



GeoAlchemy2 Documentation

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Eric Lemoine

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Using SQLAlchemy with Spatial Databases.

GeoAlchemy 2 provides extensions to [SQLAlchemy](#) for working with spatial databases.

GeoAlchemy 2 focuses on [PostGIS](#). PostGIS 1.5 and PostGIS 2 are supported.

SpatiaLite is also supported, but using GeoAlchemy 2 with SpatiaLite requires some specific configuration on the application side. GeoAlchemy 2 works with SpatiaLite 4.3.0 and higher.

GeoAlchemy 2 aims to be simpler than its predecessor, [GeoAlchemy](#). Simpler to use, and simpler to maintain.

The current version of this documentation applies to the version 0.9.0 of GeoAlchemy 2.

CHAPTER 1

Requirements

GeoAlchemy 2 requires SQLAlchemy 0.8. GeoAlchemy 2 does not work with SQLAlchemy 0.7 and lower.

CHAPTER 2

Installation

GeoAlchemy 2 is available on the [Python Package Index](#). So it can be installed with the standard `pip` or `easy_install` tools.

What's New in GeoAlchemy 2

- GeoAlchemy 2 supports PostGIS' `geometry` type, as well as the `geography` and `raster` types.
- The first series had its own namespace for spatial functions. With GeoAlchemy 2, spatial functions are called like any other SQLAlchemy function, using `func`, which is SQLAlchemy's [standard way](#) of calling SQL functions.
- GeoAlchemy 2 works with SQLAlchemy's ORM, as well as with SQLAlchemy's *SQL Expression Language* (a.k.a the SQLAlchemy Core). (This is thanks to SQLAlchemy's new [type-level comparator system](#).)
- GeoAlchemy 2 supports [reflection](#) of geometry and geography columns.
- GeoAlchemy 2 adds `to_shape`, `from_shape` functions for a better integration with [Shapely](#).

3.1 Migrate to GeoAlchemy 2

This section describes how to migrate an application from the first series of GeoAlchemy to GeoAlchemy 2.

3.1.1 Defining Geometry Columns

The first series has specific types like `Point`, `LineString` and `Polygon`. These are gone, the `geoalchemy2.types.Geometry` type should be used instead, and a `geometry_type` can be passed to it.

So, for example, a `polygon` column that used to be defined like this:

```
geom = Column(Polygon)
```

is now defined like this:

```
geom = Column(Geometry('POLYGON'))
```

This change is related to GeoAlchemy 2 supporting the `geoalchemy2.types.Geography` type.

3.1.2 Calling Spatial Functions

The first series has its own namespace/object for calling spatial functions, namely `geoalchemy.functions`. With GeoAlchemy 2, SQLAlchemy's `func` object should be used.

For example, the expression

```
functions.buffer(functions.centroid(box), 10, 2)
```

would be rewritten to this with GeoAlchemy 2:

```
func.ST_Buffer(func.ST_Centroid(box), 10, 2)
```

Also, as the previous example hinted it, the names of spatial functions are now all prefixed with `ST_`. (This is to be consistent with PostGIS and the SQL-MM standard.) The `ST_` prefix should be used even when applying spatial functions to columns, `geoalchemy2.elements.WKTElement`, or `geoalchemy2.elements.WKTElement` objects:

```
Lake.geom.ST_Buffer(10, 2)
lake_table.c.geom.ST_Buffer(10, 2)
lake.geom.ST_Buffer(10, 2)
```

3.1.3 WKB and WKT Elements

The first series has classes like `PersistentSpatialElement`, `PGPersistentSpatialElement`, `WKTSpatialElement`.

They're all gone, and replaced by two classes only: `geoalchemy2.elements.WKTElement` and `geoalchemy2.elements.WKBElement`.

`geoalchemy2.elements.WKTElement` is to be used in expressions where a geometry with a specific SRID should be specified. For example:

```
Lake.geom.ST_Touches(WKTElement('POINT(1 1)', srid=4326))
```

If no SRID need be specified, a string can used directly:

```
Lake.geom.ST_Touches('POINT(1 1)')
```

- `geoalchemy2.elements.WKTElement` literally replaces the first series' `WKTSpatialElement`.
- `geoalchemy2.elements.WKBElement` is the type into which GeoAlchemy 2 converts geometry values read from the database.

For example, the `geom` attributes of `Lake` objects loaded from the database would be references to `geoalchemy2.elements.WKBElement` objects. This class replaces the first series' `PersistentSpatialElement` classes.

See the [Migrate to GeoAlchemy 2](#) page for details on how to migrate a GeoAlchemy application to GeoAlchemy 2.

GeoAlchemy 2 works with both SQLAlchemy’s *Object Relational Mapping* (ORM) and *SQL Expression Language*. This documentation provides a tutorial for each system. If you’re new to GeoAlchemy 2 start with this.

4.1 ORM Tutorial

(This tutorial is greatly inspired by the [SQLAlchemy ORM Tutorial](#), which is recommended reading, eventually.)

GeoAlchemy does not provide an Object Relational Mapper (ORM), but works well with the SQLAlchemy ORM. This tutorial shows how to use the SQLAlchemy ORM with spatial tables, using GeoAlchemy.

4.1.1 Connect to the DB

For this tutorial we will use a PostGIS 2 database. To connect we use SQLAlchemy’s `create_engine()` function:

```
>>> from sqlalchemy import create_engine
>>> engine = create_engine('postgresql://gis:gis@localhost/gis', echo=True)
```

In this example the name of the database, the database user, and the database password, is `gis`.

The `echo` flag is a shortcut to setting up SQLAlchemy logging, which is accomplished via Python’s standard logging module. With it is enabled, we’ll see all the generated SQL produced.

The return value of `create_engine` is an `Engine` object, which represents the core interface to the database.

4.1.2 Declare a Mapping

When using the ORM, the configurational process starts by describing the database tables we’ll be dealing with, and then by defining our own classes which will be mapped to those tables. In modern SQLAlchemy, these two tasks are usually performed together, using a system known as *Declarative*, which allows us to create classes that include directives to describe the actual database table they will be mapped to.

```
>>> from sqlalchemy.ext.declarative import declarative_base
>>> from sqlalchemy import Column, Integer, String
>>> from geoalchemy2 import Geometry
>>>
>>> Base = declarative_base()
>>>
>>> class Lake(Base):
...     __tablename__ = 'lake'
...     id = Column(Integer, primary_key=True)
...     name = Column(String)
...     geom = Column(Geometry('POLYGON'))
```

The Lake class establishes details about the table being mapped, including the name of the table denoted by `__tablename__`, and three columns `id`, `name`, and `geom`. The `id` column will be the primary key of the table. The `geom` column is a `geoalchemy2.types.Geometry` column whose `geometry_type` is `POLYGON`.

4.1.3 Create the Table in the Database

The Lake class has a corresponding Table object representing the database table. This Table object was created automatically by SQLAlchemy, it is referenced to by the Lake `__table__` property:

```
>>> Lake.__table__
Table('lake', MetaData(bind=None), Column('id', Integer(), table=<lake>,
primary_key=True, nullable=False), Column('name', String(), table=<lake>),
Column('geom', Polygon(srid=4326), table=<lake>), schema=None)
```

To create the lake table in the database:

```
>>> Lake.__table__.create(engine)
```

If we wanted to drop the table we'd use:

```
>>> Lake.__table__.drop(engine)
```

4.1.4 Create an Instance of the Mapped Class

With the mapping declared, we can create a Lake object:

```
>>> lake = Lake(name='Majeur', geom='POLYGON((0 0,1 0,1 1,0 1,0 0))')
>>> lake.geom
'POLYGON((0 0,1 0,1 1,0 1,0 0))'
>>> str(lake.id)
'None'
```

A WKT is passed to the Lake constructor for its geometry. This WKT represents the shape of our lake. Since we have not yet told SQLAlchemy to persist the lake object, its `id` is `None`.

The EWKT (Extended WKT) format is also supported. So, for example, if the spatial reference system for the geometry column were 4326, the string `SRID=4326;POLYGON((0 0,1 0,1 0 1,0 0))` could be used as the geometry representation.

4.1.5 Create a Session

The ORM interacts with the database through a Session. Let's create a Session class:


```
>>> for lake in query:
...     print lake.name
...
Garde
Majeur
Orta
```

Another way to execute the query and get a list of `Lake` objects involves calling `all()` on the `Query`:

```
>>> lakes = session.query(Lake).order_by(Lake.name).all()
```

The SQLAlchemy ORM Tutorial's [Querying section](#) provides more examples of queries.

4.1.8 Make Spatial Queries

Using spatial filters in SQL `SELECT` queries is very common. Such queries are performed by using spatial relationship functions, or operators, in the `WHERE` clause of the SQL query.

For example, to find the `Lake`s that contain the point `POINT(4 1)`, we can use this `Query`:

```
>>> from sqlalchemy import func
>>> query = session.query(Lake).filter(
...     func.ST_Contains(Lake.geom, 'POINT(4 1)'))
...
>>> for lake in query:
...     print lake.name
...
Orta
```

GeoAlchemy allows rewriting this `Query` more concisely:

```
>>> query = session.query(Lake).filter(Lake.geom.ST_Contains('POINT(4 1)'))
>>> for lake in query:
...     print lake.name
...
Orta
```

Here the `ST_Contains` function is applied to the `Lake.geom` column property. In that case the column property is actually passed to the function, as its first argument.

Here's another spatial filtering query, based on `ST_Intersects`:

```
>>> query = session.query(Lake).filter(
...     Lake.geom.ST_Intersects('LINESTRING(2 1,4 1)'))
...
>>> for lake in query:
...     print lake.name
...
Garde
Orta
```

We can also apply relationship functions to `geoalchemy2.elements.WKBElement`. For example:

```
>>> lake = session.query(Lake).filter_by(name='Garde').one()
>>> print session.scalar(lake.geom.ST_Intersects('LINESTRING(2 1,4 1)'))
True
```

`session.scalar` allows executing a clause and returning a scalar value (a boolean value in this case).

The GeoAlchemy functions all start with `ST_`. Operators are also called as functions, but the function names don't include the `ST_` prefix. As an example let's use PostGIS' `&&` operator, which allows testing whether the bounding boxes of geometries intersect. GeoAlchemy provides the `intersects` function for that:

```
>>> query = session.query
>>> query = session.query(Lake).filter(
...     Lake.geom.intersects('LINESTRING(2 1,4 1)'))
...
>>> for lake in query:
...     print lake.name
...
Garde
Orta
```

4.1.9 Set Spatial Relationships in the Model

Let's assume that in addition to `lake` we have another table, `treasure`, that includes treasure locations. And let's say that we are interested in discovering the treasures hidden at the bottom of lakes.

The `Treasure` class is the following:

```
>>> class Treasure(Base):
...     __tablename__ = 'treasure'
...     id = Column(Integer, primary_key=True)
...     geom = Column(Geometry('POINT'))
```

We can now add a relationship to the `Lake` table to automatically load the treasures contained by each lake:

```
>>> from sqlalchemy.orm import relationship, backref
>>> class Lake(Base):
...     __tablename__ = 'lake'
...     id = Column(Integer, primary_key=True)
...     name = Column(String)
...     geom = Column(Geometry('POLYGON'))
...     treasures = relationship(
...         'Treasure',
...         primaryjoin='func.ST_Contains(foreign(Lake.geom), Treasure.geom).as_
↳ comparison(1, 2)',
...         backref=backref('lake', uselist=False),
...         viewonly=True,
...         uselist=True,
...     )
```

Note the use of the `as_comparison` function. It is required for using an SQL function (`ST_Contains` here) in a `primaryjoin` condition. This only works with SQLAlchemy 1.3, as the `as_comparison` function did not exist before that version. See the [Custom operators based on SQL function](#) section of the SQLAlchemy documentation for more information.

Some information on the parameters used for configuring this relationship:

- `backref` is used to provide the name of property to be placed on the class that handles this relationship in the other direction, namely `Treasure`;
- `viewonly=True` specifies that the relationship is used only for loading objects, and not for persistence operations;

- `uselist=True` indicates that the property should be loaded as a list, as opposed to a scalar.

Also, note that the `treasures` property on `lake` objects (and the `lake` property on `treasure` objects) is loaded “lazily” when the property is first accessed. Another loading strategy may be configured in the `relationship`. For example you’d use `lazy='joined'` for related items to be loaded “eagerly” in the same query as that of the parent, using a `JOIN` or `LEFT OUTER JOIN`.

See the [Relationships API](#) section of the SQLAlchemy documentation for more detail on the `relationship` function, and all the parameters that can be used to configure it.

4.1.10 Use Other Spatial Functions

Here’s a Query that calculates the areas of buffers for our lakes:

```
>>> from sqlalchemy import func
>>> query = session.query(Lake.name,
...                       func.ST_Area(func.ST_Buffer(Lake.geom, 2)) \
...                               .label('bufferarea'))
>>> for row in query:
...     print '%s: %f' % (row.name, row.bufferarea)
...
Majeur: 21.485781
Garde: 32.485781
Orta: 45.485781
```

This Query applies the PostGIS `ST_Buffer` function to the geometry column of every row of the `lake` table. The return value is a list of rows, where each row is actually a tuple of two values: the lake name, and the area of a buffer of the lake. Each tuple is actually an SQLAlchemy `KeyedTuple` object, which provides property type accessors.

Again, the Query can be written more concisely:

```
>>> query = session.query(Lake.name,
...                       Lake.geom.ST_Buffer(2).ST_Area().label('bufferarea'))
>>> for row in query:
...     print '%s: %f' % (row.name, row.bufferarea)
...
Majeur: 21.485781
Garde: 32.485781
Orta: 45.485781
```

Obviously, processing and measurement functions can also be used in `WHERE` clauses. For example:

```
>>> lake = session.query(Lake).filter(
...     Lake.geom.ST_Buffer(2).ST_Area() > 33).one()
>>> print lake.name
Orta
```

And, like any other functions supported by GeoAlchemy, processing and measurement functions can be applied to `geoalchemy2.elements.WKBElement`. For example:

```
>>> lake = session.query(Lake).filter_by(name='Majeur').one()
>>> bufferarea = session.scalar(lake.geom.ST_Buffer(2).ST_Area())
>>> print '%s: %f' % (lake.name, bufferarea)
Majeur: 21.485781
Majeur: 21.485781
```

4.1.11 Use Raster functions

A few functions (like `ST_Transform()`, `ST_Union()`, `ST_SnapToGrid()`, ...) can be used on both `geoalchemy2.types.Geometry` and `geoalchemy2.types.Raster` types. In GeoAlchemy2, these functions are only defined for `Geometry` as it can not be defined for several types at the same time. Thus using these functions on `Raster` requires minor tweaking to enforce the type by passing the `type_=Raster` argument to the function:

```
>>> query = session.query(Lake.raster.ST_Transform(2154, type_=Raster))
```

4.1.12 Further Reference

- Spatial Functions Reference: *Spatial Functions*
- Spatial Operators Reference: *Spatial Operators*
- Elements Reference: *Elements*

4.2 Core Tutorial

(This tutorial is greatly inspired from the [SQLAlchemy SQL Expression Language Tutorial](#), which is recommended reading, eventually.)

This tutorial shows how to use the SQLAlchemy Expression Language (a.k.a. SQLAlchemy Core) with GeoAlchemy. As defined by the SQLAlchemy documentation itself, in contrast to the ORM's domain-centric mode of usage, the SQL Expression Language provides a schema-centric usage paradigm.

4.2.1 Connect to the DB

For this tutorial we will use a PostGIS 2 database. To connect we use SQLAlchemy's `create_engine()` function:

```
>>> from sqlalchemy import create_engine
>>> engine = create_engine('postgresql://gis:gis@localhost/gis', echo=True)
```

In this example the name of the database, the database user, and the database password, is `gis`.

The `echo` flag is a shortcut to setting up SQLAlchemy logging, which is accomplished via Python's standard logging module. With it is enabled, we'll see all the generated SQL produced.

The return value of `create_engine` is an `Engine` object, which represents the core interface to the database.

4.2.2 Define a Table

The very first object that we need to create is a `Table`. Here we create a `lake_table` object, which will correspond to the `lake` table in the database:

```
>>> from sqlalchemy import Table, Column, Integer, String, MetaData
>>> from geoalchemy2 import Geometry
>>>
>>> metadata = MetaData()
>>> lake_table = Table('lake', metadata,
...     Column('id', Integer, primary_key=True),
...     Column('name', String),
```

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```
...     Column('geom', Geometry('POLYGON'))
... )
```

This table is composed of three columns, `id`, `name` and `geom`. The `geom` column is a `geoalchemy2.types.Geometry` column whose `geometry_type` is `POLYGON`.

Any `Table` object is added to a `MetaData` object, which is a catalog of `Table` objects (and other related objects).

4.2.3 Create the Table

With our `Table` being defined we're ready (to have `SQLAlchemy`) create it in the database:

```
>>> lake_table.create(engine)
```

Calling `create_all()` on `metadata` would have worked equally well:

```
>>> metadata.create_all(engine)
```

In that case every `Table` that's referenced to by `metadata` would be created in the database. The `metadata` object includes one `Table` here, our now well-known `lake_table` object.

4.2.4 Reflecting tables

The reflection system of `SQLAlchemy` can be used on tables containing `geoalchemy2.types.Geometry` or `geoalchemy2.types.Geography` columns. In this case, the type must be imported to be registered into `SQLAlchemy`, even if it is not used explicitly.

```
>>> from geoalchemy2 import Geometry # <= not used but must be imported
>>> from sqlalchemy import create_engine, MetaData
>>> engine = create_engine("postgresql://myuser:mypass@mydb.host.tld/mydbname")
>>> meta = MetaData()
>>> meta.reflect(bind=engine)
```

4.2.5 Insertions

We want to insert records into the `lake` table. For that we need to create an `Insert` object. `SQLAlchemy` provides multiple constructs for creating an `Insert` object, here's one:

```
>>> ins = lake_table.insert()
>>> str(ins)
INSERT INTO lake (id, name, geom) VALUES (:id, :name, ST_GeomFromEWKT(:geom))
```

The `geom` column being a `Geometry` column, the `:geom` bind value is wrapped in a `ST_GeomFromEWKT` call.

To limit the columns named in the `INSERT` query the `values()` method can be used:

```
>>> ins = lake_table.insert().values(name='Majeur',
...                                  geom='POLYGON((0 0,1 0,1 1,0 1,0 0))')
...
>>> str(ins)
INSERT INTO lake (name, geom) VALUES (:name, ST_GeomFromEWKT(:geom))
```

Tip: The string representation of the SQL expression does not include the data placed in values. We got named bind parameters instead. To view the data we can get a compiled form of the expression, and ask for its params:

```
>>> ins.compile.params()
{'geom': 'POLYGON((0 0,1 0,1 1,0 1,0 0))', 'name': 'Majeur'}
```

Up to now we've created an INSERT query but we haven't sent this query to the database yet. Before being able to send it to the database we need a database Connection. We can get a Connection from the Engine object we created earlier:

```
>>> conn = engine.connect()
```

We're now ready to execute our INSERT statement:

```
>>> result = conn.execute(ins)
```

This is what the logging system should output:

```
INSERT INTO lake (name, geom) VALUES (%(name)s, ST_GeomFromEWKT(%(geom)s)) RETURNING lake.id
{'geom': 'POLYGON((0 0,1 0,1 1,0 1,0 0))', 'name': 'Majeur'}
COMMIT
```

The value returned by `conn.execute()`, stored in `result`, is a `sqlalchemy.engine.ResultProxy` object. In the case of an INSERT we can get the primary key value which was generated from our statement:

```
>>> result.inserted_primary_key
[1]
```

Instead of using `values()` to specify our INSERT data, we can send the data to the `execute()` method on Connection. So we could rewrite things as follows:

```
>>> conn.execute(lake_table.insert(),
...               name='Majeur', geom='POLYGON((0 0,1 0,1 1,0 1,0 0))')
```

Now let's use another form, allowing to insert multiple rows at once:

```
>>> conn.execute(lake_table.insert(), [
...     {'name': 'Garde', 'geom': 'POLYGON((1 0,3 0,3 2,1 2,1 0))'},
...     {'name': 'Orta', 'geom': 'POLYGON((3 0,6 0,6 3,3 3,3 0))'}
... ])
...
```

Tip: In the above examples the geometries are specified as WKT strings. Specifying them as EWKT strings is also supported.

4.2.6 Selections

Inserting involved creating an `Insert` object, so it'd come to no surprise that Selecting involves creating a `Select` object. The primary construct to generate SELECT statements is SQLAlchemy's `select()` function:

```
>>> from sqlalchemy.sql import select
>>> s = select([lake_table])
>>> str(s)
SELECT lake.id, lake.name, ST_AsEWKB(lake.geom) AS geom FROM lake
```

The geom column being a Geometry it is wrapped in a ST_AsEWKB call when specified as a column in a SELECT statement.

We can now execute the statement and look at the results:

```
>>> result = conn.execute(s)
>>> for row in result:
...     print 'name:', row['name'], '; geom:', row['geom'].desc
...
name: Majeur ; geom: 0103...
name: Garde ; geom: 0103...
name: Orta ; geom: 0103...
```

row['geom'] is a `geoalchemy2.types.WKBElement` instance. In this example we just get an hexadecimal representation of the geometry's WKB value using the `desc` property.

4.2.7 Spatial Query

As spatial database users executing spatial queries is of a great interest to us. There comes GeoAlchemy!

Spatial relationship

Using spatial filters in SQL SELECT queries is very common. Such queries are performed by using spatial relationship functions, or operators, in the WHERE clause of the SQL query.

For example, to find lakes that contain the point `POINT(4 1)`, we can use this:

```
>>> from sqlalchemy import func
>>> s = select([lake_table],
              func.ST_Contains(lake_table.c.geom, 'POINT(4 1)'))
>>> str(s)
SELECT lake.id, lake.name, ST_AsEWKB(lake.geom) AS geom FROM lake WHERE ST_
↳ Contains(lake.geom, :param_1)
>>> result = conn.execute(s)
>>> for row in result:
...     print 'name:', row['name'], '; geom:', row['geom'].desc
...
name: Orta ; geom: 0103...
```

GeoAlchemy allows rewriting this more concisely:

```
>>> s = select([lake_table], lake_table.c.geom.ST_Contains('POINT(4 1)'))
>>> str(s)
SELECT lake.id, lake.name, ST_AsEWKB(lake.geom) AS geom FROM lake WHERE ST_
↳ Contains(lake.geom, :param_1)
```

Here the `ST_Contains` function is applied to `lake.c.geom`. And the generated SQL the `lake.geom` column is actually passed to the `ST_Contains` function as the first argument.

Here's another spatial query, based on `ST_Intersects`:

```
>>> s = select([lake_table],
...             lake_table.c.geom.ST_Intersects('LINESTRING(2 1,4 1)'))
>>> result = conn.execute(s)
>>> for row in result:
...     print 'name:', row['name'], '; geom:', row['geom'].desc
...
name: Garde ; geom: 0103...
name: Orta ; geom: 0103...
```

This query selects lakes whose geometries intersect ``LINESTRING(2 1,4 1)``.

The GeoAlchemy functions all start with `ST_`. Operators are also called as functions, but the names of operator functions don't include the `ST_` prefix.

As an example let's use PostGIS' `&&` operator, which allows testing whether the bounding boxes of geometries intersect. GeoAlchemy provides the `intersects` function for that:

```
>>> s = select([lake_table],
...             lake_table.c.geom.intersects('LINESTRING(2 1,4 1)'))
>>> result = conn.execute(s)
>>> for row in result:
...     print 'name:', row['name'], '; geom:', row['geom'].desc
...
name: Garde ; geom: 0103...
name: Orta ; geom: 0103...
```

Processing and Measurement

Here's a Select that calculates the areas of buffers for our lakes:

```
>>> s = select([lake_table.c.name,
...             func.ST_Area(
...                 lake_table.c.geom.ST_Buffer(2)).label('bufferarea')])
>>> str(s)
SELECT lake.name, ST_Area(ST_Buffer(lake.geom, %(param_1)s)) AS bufferarea FROM lake
>>> result = conn.execute(s)
>>> for row in result:
...     print '%s: %f' % (row['name'], row['bufferarea'])
Majeur: 21.485781
Garde: 32.485781
Orta: 45.485781
```

Obviously, processing and measurement functions can also be used in `WHERE` clauses. For example:

```
>>> s = select([lake_table.c.name],
...             lake_table.c.geom.ST_Buffer(2).ST_Area() > 33)
>>> str(s)
SELECT lake.name FROM lake WHERE ST_Area(ST_Buffer(lake.geom, :param_1)) > :ST_Area_1
>>> result = conn.execute(s)
>>> for row in result:
...     print row['name']
Orta
```

And, like any other functions supported by GeoAlchemy, processing and measurement functions can be applied to `geoalchemy2.elements.WKBElement`. For example:

```
>>> s = select([lake_table], lake_table.c.name == 'Majeur')
>>> result = conn.execute(s)
>>> lake = result.fetchone()
>>> bufferarea = conn.scalar(lake[lake_table.c.geom].ST_Buffer(2).ST_Area())
>>> print '%s: %f' % (lake['name'], bufferarea)
Majeur: 21.485781
```

4.2.8 Use Raster functions

A few functions (like `ST_Transform()`, `ST_Union()`, `ST_SnapToGrid()`, ...) can be used on both `geoalchemy2.types.Geometry` and `geoalchemy2.types.Raster` types. In GeoAlchemy2, these functions are only defined for `Geometry` as it can not be defined for several types at the same time. Thus using these functions on `Raster` requires minor tweaking to enforce the type by passing the `type_=Raster` argument to the function:

```
>>> s = select([func.ST_Transform(
    lake_table.c.raster,
    2154,
    type_=Raster)
    .label('transformed_raster')])
```

4.2.9 Further Reference

- Spatial Functions Reference: *Spatial Functions*
- Spatial Operators Reference: *Spatial Operators*
- Elements Reference: *Elements*

4.3 Spatialite Tutorial

GeoAlchemy 2's main target is PostGIS. But GeoAlchemy 2 also supports Spatialite, the spatial extension to SQLite. This tutorial describes how to use GeoAlchemy 2 with Spatialite. It's based on the *ORM Tutorial*, which you may want to read first.

4.3.1 Connect to the DB

Just like when using PostGIS connecting to a Spatialite database requires an `Engine`. This is how you create one for Spatialite:

```
>>> from sqlalchemy import create_engine
>>> from sqlalchemy.event import listen
>>>
>>> def load_spatialite(dbapi_conn, connection_record):
...     dbapi_conn.enable_load_extension(True)
...     dbapi_conn.load_extension('/usr/lib/x86_64-linux-gnu/mod_spatialite.so')
...
>>>
>>> engine = create_engine('sqlite:///gis.db', echo=True)
>>> listen(engine, 'connect', load_spatialite)
```

The call to `create_engine` creates an engine bound to the database file `gis.db`. After that a `connect` listener is registered on the engine. The listener is responsible for loading the Spatialite extension, which is a necessary operation for using Spatialite through SQL.

At this point you can test that you are able to connect to the database:

```
>> conn = engine.connect()
2018-05-30 17:12:02,675 INFO sqlalchemy.engine.base.Engine SELECT CAST('test plain_
↳returns' AS VARCHAR(60)) AS anon_1
2018-05-30 17:12:02,676 INFO sqlalchemy.engine.base.Engine ()
2018-05-30 17:12:02,676 INFO sqlalchemy.engine.base.Engine SELECT CAST('test unicode_
↳returns' AS VARCHAR(60)) AS anon_1
2018-05-30 17:12:02,676 INFO sqlalchemy.engine.base.Engine ()
```

You can also check that the `gis.db` SQLite database file was created on the file system.

One additional step is required for using Spatialite: create the `geometry_columns` and `spatial_ref_sys` metadata tables. This is done by calling Spatialite's `InitSpatialMetadata` function:

```
>>> from sqlalchemy.sql import select, func
>>>
>>> conn.execute(select([func.InitSpatialMetadata()])))
```

Note that this operation may take some time the first time it is executed for a database. When `InitSpatialMetadata` is executed again it will report an error:

```
InitSpatialMetadata() error:"table spatial_ref_sys already exists"
```

You can safely ignore that error.

Before going further we can close the current connection:

```
>>> conn.close()
```

4.3.2 Declare a Mapping

Now that we have a working connection we can go ahead and create a mapping between a Python class and a database table.

```
>>> from sqlalchemy.ext.declarative import declarative_base
>>> from sqlalchemy import Column, Integer, String
>>> from geoalchemy2 import Geometry
>>>
>>> Base = declarative_base()
>>>
>>> class Lake(Base):
...     __tablename__ = 'lake'
...     id = Column(Integer, primary_key=True)
...     name = Column(String)
...     geom = Column(Geometry(geometry_type='POLYGON', management=True))
```

This basically works in the way as with PostGIS. The difference is the `management` argument that must be set to `True`.

Setting `management` to `True` indicates that the `AddGeometryColumn` and `DiscardGeometryColumn` management functions will be used for the creation and removal of the geometry column. This is required with Spatialite.

4.3.3 Create the Table in the Database

We can now create the `lake` table in the `gis.db` database:

```
>>> Lake.__table__.create(engine)
```

If we wanted to drop the table we'd use:

```
>>> Lake.__table__.drop(engine)
```

There's nothing specific to Spatialite here.

4.3.4 Create a Session

When using the SQLAlchemy ORM the ORM interacts with the database through a `Session`.

```
>>> from sqlalchemy.orm import sessionmaker
>>> Session = sessionmaker(bind=engine)
>>> session = Session()
```

The session is associated with our Spatialite Engine. Again, there's nothing specific to Spatialite here.

4.3.5 Add New Objects

We can now create and insert new Lake objects into the database, the same way we'd do it using GeoAlchemy 2 with PostGIS.

```
>>> lake = Lake(name='Majeur', geom='POLYGON((0 0,1 0,1 1,0 1,0 0))')
>>> session.add(lake)
>>> session.commit()
```

We can now query the database for Majeur:

```
>>> our_lake = session.query(Lake).filter_by(name='Majeur').first()
>>> our_lake.name
u'Majeur'
>>> our_lake.geom
<WKBElement at 0x9af594c;
↪ '0103000000010000000500000000000000000000000000000000000000000000f03f0000000000000000000000
↪ '>
>>> our_lake.id
1
```

Let's add more lakes:

```
>>> session.add_all([
...     Lake(name='Garde', geom='POLYGON((1 0,3 0,3 2,1 2,1 0))'),
...     Lake(name='Orta', geom='POLYGON((3 0,6 0,6 3,3 3,3 0))')
... ])
>>> session.commit()
```

4.3.6 Query

Let's make a simple, non-spatial, query:

```
>>> query = session.query(Lake).order_by(Lake.name)
>>> for lake in query:
...     print(lake.name)
...
Garde
Majeur
Orta
```

Now a spatial query:

```
>>> from geolalchemy2 import WKTElement
>>> query = session.query(Lake).filter(
...     func.ST_Contains(Lake.geom, WKTElement('POINT(4 1)'))
... )
>>> for lake in query:
...     print(lake.name)
...
Orta
```

Here's another spatial query, using `ST_Intersects` this time:

```
>>> query = session.query(Lake).filter(
...     Lake.geom.ST_Intersects(WKTElement('LINESTRING(2 1,4 1)'))
... )
>>> for lake in query:
...     print(lake.name)
...
Garde
Orta
```

We can also apply relationship functions to `geoalchemy2.elements.WKBElement`. For example:

```
>>> lake = session.query(Lake).filter_by(name='Garde').one()
>>> print(session.scalar(lake.geom.ST_Intersects(WKTElement('LINESTRING(2 1,4 1)'))))
1
```

`session.scalar` allows executing a clause and returning a scalar value (an integer value in this case).

The value 1 indicates that the lake “Garde” does intersects the `LINESTRING(2 1,4 1)` geometry. See the Spatialite SQL functions reference list for more information.

4.3.7 Further Reference

- GeoAlchemy 2 ORM Tutorial: *ORM Tutorial*
- GeoAlchemy 2 Spatial Functions Reference: *Spatial Functions*
- GeoAlchemy 2 Spatial Operators Reference: *Spatial Operators*
- GeoAlchemy 2 Elements Reference: *Elements*
- Spatialite 4.3.0 SQL functions reference list

5.1 Gallery

5.1.1 Automatically use a function at insert or select

Sometimes the application wants to apply a function in an insert or in a select. For example, the application might need the geometry with lat/lon coordinates while they are projected in the DB. To avoid having to always tweak the query with a `ST_Transform()`, it is possible to define a `TypeDecorator`

```
11 from pkg_resources import parse_version
12 import pytest
13
14 import sqlalchemy
15 from sqlalchemy import create_engine
16 from sqlalchemy import MetaData
17 from sqlalchemy import Column
18 from sqlalchemy import Integer
19 from sqlalchemy import func
20 from sqlalchemy.ext.declarative import declarative_base
21 from sqlalchemy.orm import sessionmaker
22 from sqlalchemy.types import TypeDecorator
23
24 from geoalchemy2.compat import PY3
25 from geoalchemy2 import Geometry
26 from geoalchemy2 import shape
27
28
29 engine = create_engine('postgresql://gis:gis@localhost/gis', echo=True)
30 metadata = MetaData(engine)
31
32 Base = declarative_base(metadata=metadata)
33
34
```

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```

35 class TransformedGeometry(TypeDecorator):
36     """This class is used to insert a ST_Transform() in each insert or select."""
37     impl = Geometry
38
39     def __init__(self, db_srid, app_srid, **kwargs):
40         kwargs["srid"] = db_srid
41         self.impl = self.__class__.impl(**kwargs)
42         self.app_srid = app_srid
43         self.db_srid = db_srid
44
45     def column_expression(self, col):
46         """The column_expression() method is overridden to ensure that the
47         SRID of the resulting WKBElement is correct"""
48         return getattr(func, self.impl.as_binary)(
49             func.ST_Transform(col, self.app_srid),
50             type_=self.__class__.impl(srid=self.app_srid)
51             # srid could also be -1 so that the SRID is deduced from the
52             # WKB data
53         )
54
55     def bind_expression(self, bindvalue):
56         return func.ST_Transform(
57             self.impl.bind_expression(bindvalue), self.db_srid)
58
59
60 class ThreeDGeometry(TypeDecorator):
61     """This class is used to insert a ST_Force3D() in each insert."""
62     impl = Geometry
63
64     def bind_expression(self, bindvalue):
65         return func.ST_Force3D(self.impl.bind_expression(bindvalue))
66
67
68 class Point(Base):
69     __tablename__ = "point"
70     id = Column(Integer, primary_key=True)
71     raw_geom = Column(Geometry(srid=4326, geometry_type="POINT"))
72     geom = Column(
73         TransformedGeometry(
74             db_srid=2154, app_srid=4326, geometry_type="POINT"))
75     three_d_geom = Column(
76         ThreeDGeometry(srid=4326, geometry_type="POINTZ", dimension=3))
77
78
79 session = sessionmaker(bind=engine)()
80
81
82 def check_wkb(wkb, x, y):
83     pt = shape.to_shape(wkb)
84     assert round(pt.x, 5) == x
85     assert round(pt.y, 5) == y
86
87
88 class TestTypeDecorator():
89
90     def setup(self):
91         metadata.drop_all(checkfirst=True)

```

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```

92     metadata.create_all()
93
94     def teardown(self):
95         session.rollback()
96         metadata.drop_all()
97
98     def _create_one_point(self):
99         # Create new point instance
100         p = Point()
101         p.raw_geom = "SRID=4326;POINT(5 45)"
102         p.geom = "SRID=4326;POINT(5 45)"
103         p.three_d_geom = "SRID=4326;POINT(5 45)" # Insert 2D geometry into 3D column
104
105         # Insert point
106         session.add(p)
107         session.flush()
108         session.expire(p)
109
110         return p.id
111
112     def test_transform(self):
113         self._create_one_point()
114
115         # Query the point and check the result
116         pt = session.query(Point).one()
117         assert pt.id == 1
118         assert pt.raw_geom.srid == 4326
119         check_wkb(pt.raw_geom, 5, 45)
120
121         assert pt.geom.srid == 4326
122         check_wkb(pt.geom, 5, 45)
123
124         # Check that the data is correct in DB using raw query
125         q = "SELECT id, ST_AsEWKT(geom) AS geom FROM point;"
126         res_q = session.execute(q).fetchone()
127         assert res_q.id == 1
128         assert res_q.geom == "SRID=2154;POINT(857581.899319668 6435414.7478354)"
129
130         # Compare geom, raw_geom with auto transform and explicit transform
131         pt_trans = session.query(
132             Point,
133             Point.raw_geom,
134             func.ST_Transform(Point.raw_geom, 2154).label("trans")
135         ).one()
136
137         assert pt_trans[0].id == 1
138
139         assert pt_trans[0].geom.srid == 4326
140         check_wkb(pt_trans[0].geom, 5, 45)
141
142         assert pt_trans[0].raw_geom.srid == 4326
143         check_wkb(pt_trans[0].raw_geom, 5, 45)
144
145         assert pt_trans[1].srid == 4326
146         check_wkb(pt_trans[1], 5, 45)
147
148         assert pt_trans[2].srid == 2154

```

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```

149         check_wkb(pt_trans[2], 857581.89932, 6435414.74784)
150
151     @pytest.mark.skipif(
152         not PY3 and parse_version(str(sqlalchemy.__version__)) < parse_version("1.3
→"),
153         reason="Need sqlalchemy >= 1.3")
154     def test_force_3d(self):
155         self._create_one_point()
156
157         # Query the point and check the result
158         pt = session.query(Point).one()
159
160         assert pt.id == 1
161         assert pt.three_d_geom.srid == 4326
162         assert pt.three_d_geom.desc.lower() == (
163             '01010000a0e6100000000000000000000144000000000008046400000000000000000')

```

Total running time of the script: (0 minutes 0.000 seconds)

5.1.2 Compute length on insert

It is possible to insert a geometry and ask PostgreSQL to compute its length at the same time. This example uses SQLAlchemy core queries.

```

9  from sqlalchemy import bindparam
10 from sqlalchemy import Column
11 from sqlalchemy import create_engine
12 from sqlalchemy import Float
13 from sqlalchemy import func
14 from sqlalchemy import Integer
15 from sqlalchemy import MetaData
16 from sqlalchemy import select
17 from sqlalchemy import Table
18
19 from geoalchemy2 import Geometry
20 from geoalchemy2.shape import to_shape
21
22
23 engine = create_engine('postgresql://gis:gis@localhost/gis', echo=True)
24 metadata = MetaData(engine)
25
26 table = Table(
27     "inserts",
28     metadata,
29     Column("id", Integer, primary_key=True),
30     Column("geom", Geometry("LINESTRING", 4326)),
31     Column("distance", Float),
32 )
33
34
35 class TestLengthAtInsert():
36
37     def setup(self):
38         self.conn = engine.connect()
39         metadata.drop_all(checkfirst=True)

```

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```

40     metadata.create_all()
41
42     def teardown(self):
43         self.conn.close()
44         metadata.drop_all()
45
46     def test_query(self):
47         conn = self.conn
48
49         # Define geometries to insert
50         values = [
51             {"ewkt": "SRID=4326;LINESTRING(0 0, 1 0)"},
52             {"ewkt": "SRID=4326;LINESTRING(0 0, 0 1)"}
53         ]
54
55         # Define the query to compute distance (without spheroid)
56         distance = func.ST_Length(func.ST_GeomFromText(bindparam("ewkt")), False)
57
58         i = table.insert()
59         i = i.values(geom=bindparam("ewkt"), distance=distance)
60
61         # Execute the query with values as parameters
62         conn.execute(i, values)
63
64         # Check the result
65         q = select([table])
66         res = conn.execute(q).fetchall()
67
68         # Check results
69         assert len(res) == 2
70
71         r1 = res[0]
72         assert r1[0] == 1
73         assert r1[1].srid == 4326
74         assert to_shape(r1[1]).wkt == "LINESTRING (0 0, 1 0)"
75         assert round(r1[2]) == 111195
76
77         r2 = res[1]
78         assert r2[0] == 2
79         assert r2[1].srid == 4326
80         assert to_shape(r2[1]).wkt == "LINESTRING (0 0, 0 1)"
81         assert round(r2[2]) == 111195

```

Total running time of the script: (0 minutes 0.000 seconds)

5.1.3 Decipher Raster

The *RasterElement* objects store the Raster data in WKB form. When using rasters it is usually better to convert them into TIFF, PNG, JPEG or whatever. Nevertheless, it is possible to decipher the WKB to get a 2D list of values. This example uses SQLAlchemy ORM queries.

```

10 import binascii
11 import struct
12
13 import pytest

```

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```

14 from sqlalchemy import Column
15 from sqlalchemy import create_engine
16 from sqlalchemy import Integer
17 from sqlalchemy import MetaData
18 from sqlalchemy.ext.declarative import declarative_base
19 from sqlalchemy.orm import sessionmaker
20
21 from geoalchemy2 import Raster, WKTElement
22
23
24 engine = create_engine('postgresql://gis:gis@localhost/gis', echo=False)
25 metadata = MetaData(engine)
26 Base = declarative_base(metadata=metadata)
27
28 session = sessionmaker(bind=engine)()
29
30
31 class Ocean(Base):
32     __tablename__ = 'ocean'
33     id = Column(Integer, primary_key=True)
34     rast = Column(Raster)
35
36     def __init__(self, rast):
37         self.rast = rast
38
39
40 def _format_e(endianess, struct_format):
41     return _ENDIANESS[endianess] + struct_format
42
43
44 def wkbHeader(raw):
45     # Function to decipher the WKB header
46     # See http://trac.osgeo.org/postgis/browser/trunk/raster/doc/RFC2-
47     ↪WellKnownBinaryFormat
48
49     header = {}
50
51     header['endianess'] = struct.unpack('b', raw[0:1])[0]
52
53     e = header['endianess']
54     header['version'] = struct.unpack(_format_e(e, 'H'), raw[1:3])[0]
55     header['nbands'] = struct.unpack(_format_e(e, 'H'), raw[3:5])[0]
56     header['scaleX'] = struct.unpack(_format_e(e, 'd'), raw[5:13])[0]
57     header['scaleY'] = struct.unpack(_format_e(e, 'd'), raw[13:21])[0]
58     header['ipX'] = struct.unpack(_format_e(e, 'd'), raw[21:29])[0]
59     header['ipY'] = struct.unpack(_format_e(e, 'd'), raw[29:37])[0]
60     header['skewX'] = struct.unpack(_format_e(e, 'd'), raw[37:45])[0]
61     header['skewY'] = struct.unpack(_format_e(e, 'd'), raw[45:53])[0]
62     header['srid'] = struct.unpack(_format_e(e, 'i'), raw[53:57])[0]
63     header['width'] = struct.unpack(_format_e(e, 'H'), raw[57:59])[0]
64     header['height'] = struct.unpack(_format_e(e, 'H'), raw[59:61])[0]
65
66     return header
67
68
69 def read_band(data, offset, pixtype, height, width, endianess=1):
70     ptype, _, psize = _PTYPE[pixtype]

```

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```

70     pix_data = data[offset + 1: offset + 1 + width * height * psize]
71     band = [
72         [
73             struct.unpack(_format_e(endianess, ptype), pix_data[
74                 (i * width + j) * psize: (i * width + j + 1) * psize
75             ])[0]
76             for j in range(width)
77         ]
78         for i in range(height)
79     ]
80     return band
81
82
83 def read_band_numpy(data, offset, pixtype, height, width, endianess=1):
84     import numpy as np # noqa
85     _, dtype, psize = _PTYPE[pixtype]
86     dt = np.dtype(dtype)
87     dt = dt.newbyteorder(_ENDIANESS[endianess])
88     band = np.frombuffer(data, dtype=dtype,
89                         count=height * width, offset=offset + 1)
90     band = (np.reshape(band, ((height, width))))
91     return band
92
93
94 _PTYPE = {
95     0: ['?', '?', 1],
96     1: ['B', 'B', 1],
97     2: ['B', 'B', 1],
98     3: ['b', 'b', 1],
99     4: ['B', 'B', 1],
100    5: ['h', 'i2', 2],
101    6: ['H', 'u2', 2],
102    7: ['i', 'i4', 4],
103    8: ['I', 'u4', 4],
104    10: ['f', 'f4', 4],
105    11: ['d', 'f8', 8],
106 }
107
108 _ENDIANESS = {
109     0: '>',
110     1: '<',
111 }
112
113
114 def wkbImage(raster_data, use_numpy=False):
115     """Function to decipher the WKB raster data"""
116
117     # Get binary data
118     raw = binascii.unhexlify(raster_data)
119
120     # Read header
121     h = wkbHeader(bytes(raw))
122     e = h["endianess"]
123
124     img = [] # array to store image bands
125     offset = 61 # header raw length in bytes
126     band_size = h['width'] * h['height'] # number of pixels in each band

```

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```

127
128     for i in range(h['nbands']):
129         # Determine pixtype for this band
130         pixtype = struct.unpack(_format_e(e, 'b'), raw[offset: offset + 1])[0] - 64
131
132         # Read data with either pure Python or Numpy
133         if use_numpy:
134             band = read_band_numpy(
135                 raw, offset, pixtype, h['height'], h['width'])
136         else:
137             band = read_band(
138                 raw, offset, pixtype, h['height'], h['width'])
139
140         # Store the result
141         img.append(band)
142         offset = offset + 2 + band_size
143
144     return img
145
146
147 class TestDecipherRaster():
148
149     def setup(self):
150         metadata.drop_all(checkfirst=True)
151         metadata.create_all()
152
153     def teardown(self):
154         session.rollback()
155         metadata.drop_all()
156
157     @pytest.mark.parametrize("pixel_type", [
158         '1BB',
159         '2BUI',
160         '4BUI',
161         '8BSI',
162         '8BUI',
163         '16BSI',
164         '16BUI',
165         '32BSI',
166         '32BUI',
167         '32BF',
168         '64BF'
169     ])
170     def test_decipher_raster(self, pixel_type):
171         """Create a raster and decipher it"""
172
173         # Create a new raster
174         polygon = WKTElement('POLYGON((0 0,1 1,0 1,0 0))', srid=4326)
175         o = Ocean(polygon.ST_AsRaster(5, 6, pixel_type))
176         session.add(o)
177         session.flush()
178
179         # Decipher data from each raster
180         image = wkbImage(o.rast.data)
181
182         # Define expected result
183         expected = [

```

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```

184         [0, 1, 1, 1, 1],
185         [1, 1, 1, 1, 1],
186         [0, 1, 1, 1, 0],
187         [0, 1, 1, 0, 0],
188         [0, 1, 0, 0, 0],
189         [0, 0, 0, 0, 0]
190     ]
191
192     # Check results
193     band = image[0]
194     assert band == expected

```

Total running time of the script: (0 minutes 0.000 seconds)

5.1.4 Disable wrapping in select

If the application wants to build queries with GeoAlchemy 2 and gets them as strings, the wrapping of geometry columns with a `ST_AsEWKB()` function might be annoying. In this case it is possible to disable this wrapping. This example uses SQLAlchemy ORM queries.

```

10 from sqlalchemy import Column
11 from sqlalchemy import Integer
12 from sqlalchemy import func
13 from sqlalchemy import select
14 from sqlalchemy.ext.declarative import declarative_base
15
16 from geoalchemy2 import Geometry
17
18
19 Base = declarative_base()
20
21
22 class RawGeometry(Geometry):
23     """This class is used to remove the 'ST_AsEWKB()' function from select queries"""
24     ↪
25
26     def column_expression(self, col):
27         return col
28
29 class Point(Base):
30     __tablename__ = "point"
31     id = Column(Integer, primary_key=True)
32     geom = Column(Geometry(srid=4326, geometry_type="POINT"))
33     raw_geom = Column(
34         RawGeometry(srid=4326, geometry_type="POINT"))
35
36
37 def test_no_wrapping():
38     # Select all columns
39     select_query = select([Point])
40
41     # Check that the 'geom' column is wrapped by 'ST_AsEWKB()' and that the column
42     # 'raw_geom' is not.
43     assert str(select_query) == (

```

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```

44         "SELECT point.id, ST_AsEWKB(point.geom) AS geom, point.raw_geom \n"
45         "FROM point"
46     )
47
48
49 def test_func_no_wrapping():
50     # Select query with function
51     select_query = select([
52         func.ST_Buffer(Point.geom), # with wrapping (default behavior)
53         func.ST_Buffer(Point.geom, type_=Geometry), # with wrapping
54         func.ST_Buffer(Point.geom, type_=RawGeometry) # without wrapping
55     ])
56
57     # Check the query
58     assert str(select_query) == (
59         "SELECT "
60         "ST_AsEWKB(ST_Buffer(point.geom)) AS \"ST_Buffer_1\", "
61         "ST_AsEWKB(ST_Buffer(point.geom)) AS \"ST_Buffer_2\", "
62         "ST_Buffer(point.geom) AS \"ST_Buffer_3\" \n"
63         "FROM point"
64     )

```

Total running time of the script: (0 minutes 0.000 seconds)

5.1.5 Reproject a Raster using ST_Transform

The *ST_Transform()* function (and a few others like *ST_SnapToGrid()*) can be used on both *Geometry* and *Raster* types. In *GeoAlchemy2*, this function is only defined for *Geometry* as it can not be defined for several types at the same time. Thus using this function on *Raster* requires minor tweaking.

This example uses both SQLAlchemy core and ORM queries.

```

12 from sqlalchemy import Column
13 from sqlalchemy import func
14 from sqlalchemy import Integer
15 from sqlalchemy import MetaData
16 from sqlalchemy import select
17 from sqlalchemy import Table
18 from sqlalchemy.orm import Query
19 from sqlalchemy.ext.declarative import declarative_base
20
21 from geoalchemy2 import Geometry
22 from geoalchemy2 import Raster
23
24
25 metadata = MetaData()
26 Base = declarative_base(metadata=metadata)
27
28 table = Table(
29     "raster_table",
30     metadata,
31     Column("id", Integer, primary_key=True),
32     Column("geom", Geometry("POLYGON", 4326)),
33     Column("rast", Raster(srid=4326)),
34 )

```

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```

35
36
37 class RasterTable(Base):
38     __tablename__ = 'raster_table_orm'
39     id = Column(Integer, primary_key=True)
40     geom = Column(Geometry("POLYGON", 4326))
41     rast = Column(Raster(srid=4326))
42
43     def __init__(self, rast):
44         self.rast = rast
45
46
47 def test_transform_core():
48     # Define the transform query for both the geometry and the raster in a naive way
49     wrong_query = select([
50         func.ST_Transform(table.c.geom, 2154),
51         func.ST_Transform(table.c.rast, 2154)
52     ])
53
54     # Check the query
55     assert str(wrong_query) == (
56         "SELECT "
57         "ST_AsEWKB("
58         "ST_Transform(raster_table.geom, :ST_Transform_2)) AS \"ST_Transform_1\", "
59         "ST_AsEWKB(" # <= Note that the raster is processed as a Geometry here
60         "ST_Transform(raster_table.rast, :ST_Transform_4)) AS \"ST_Transform_3\" \"n"
61         "FROM raster_table"
62     )
63
64     # Define the transform query for both the geometry and the raster in the correct_
↪ way
65     correct_query = select([
66         func.ST_Transform(table.c.geom, 2154),
67         func.ST_Transform(table.c.rast, 2154, type_=Raster)
68     ])
69
70     # Check the query
71     assert str(correct_query) == (
72         "SELECT "
73         "ST_AsEWKB("
74         "ST_Transform(raster_table.geom, :ST_Transform_2)) AS \"ST_Transform_1\", "
75         "raster(" # <= This time the raster is correctly processed as a Raster
76         "ST_Transform(raster_table.rast, :ST_Transform_4)) AS \"ST_Transform_3\" \"n"
77         "FROM raster_table"
78     )
79
80
81 def test_transform ORM():
82     # Define the transform query for both the geometry and the raster in a naive way
83     wrong_query = Query([
84         RasterTable.geom.ST_Transform(2154),
85         RasterTable.rast.ST_Transform(2154)
86     ])
87
88     # Check the query
89     assert str(wrong_query) == (
90         "SELECT "

```

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```

91         "ST_AsEWKB("
92         "ST_Transform(raster_table_orm.geom, :ST_Transform_2)) AS \"ST_Transform_1\",
↪ "
93         "ST_AsEWKB(" # <= Note that the raster is processed as a Geometry here
94         "ST_Transform(raster_table_orm.rast, :ST_Transform_4)) AS \"ST_Transform_3\"_
↪ \n"
95         "FROM raster_table_orm"
96     )
97
98     # Define the transform query for both the geometry and the raster in the correct_
↪ way
99     correct_query = Query([
100         RasterTable.geom.ST_Transform(2154),
101         RasterTable.rast.ST_Transform(2154, type_=Raster)
102     ])
103
104     # Check the query
105     assert str(correct_query) == (
106         "SELECT "
107         "ST_AsEWKB("
108         "ST_Transform(raster_table_orm.geom, :ST_Transform_2)) AS \"ST_Transform_1\",
↪ "
109         "raster(" # <= This time the raster is correctly processed as a Raster
110         "ST_Transform(raster_table_orm.rast, :ST_Transform_4)) AS \"ST_Transform_3\"_
↪ \n"
111         "FROM raster_table_orm"
112     )

```

Total running time of the script: (0 minutes 0.000 seconds)

5.1.6 Use CompositeType

Some functions return composite types. This example shows how to deal with this kind of functions.

```

8  from sqlalchemy import Column
9  from sqlalchemy import create_engine
10 from sqlalchemy import Float
11 from sqlalchemy import func
12 from sqlalchemy import Integer
13 from sqlalchemy import MetaData
14 from sqlalchemy import select
15 from sqlalchemy.ext.declarative import declarative_base
16 from sqlalchemy.orm import sessionmaker
17
18 from geoalchemy2 import Raster, WKTElement
19 from geoalchemy2.functions import GenericFunction
20 from geoalchemy2.types import CompositeType
21
22
23 class SummaryStats(CompositeType):
24     """Define the composite type returned by the function ST_SummaryStatsAgg"""
25     typemap = {
26         'count': Integer,
27         'sum': Float,
28         'mean': Float,

```

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```

29         'stddev': Float,
30         'min': Float,
31         'max': Float,
32     }
33
34
35     class ST_SummaryStatsAgg(GenericFunction):
36         type = SummaryStats
37
38
39     engine = create_engine('postgresql://gis:gis@localhost/gis', echo=True)
40     metadata = MetaData(engine)
41     Base = declarative_base(metadata=metadata)
42     session = sessionmaker(bind=engine)()
43
44
45     class Ocean(Base):
46         __tablename__ = 'ocean'
47         __table_args__ = {'schema': 'public'}
48         id = Column(Integer, primary_key=True)
49         rast = Column(Raster)
50
51         def __init__(self, rast):
52             self.rast = rast
53
54
55     class TestSTSummaryStatsAgg():
56
57         def setup(self):
58             metadata.drop_all(checkfirst=True)
59             metadata.create_all()
60
61         def teardown(self):
62             session.rollback()
63             metadata.drop_all()
64
65         def test_st_summary_stats_agg(self):
66
67             # Create a new raster
68             polygon = WKTElement('POLYGON((0 0,1 0,1 0,0 0))', srid=4326)
69             o = Ocean(polygon.ST_AsRaster(5, 6))
70             session.add(o)
71             session.flush()
72
73             # Define the query to compute stats
74             stats_agg = select([
75                 func.ST_SummaryStatsAgg(Ocean.__table__.c.rast, 1, True, 1).label("stats
↪ ")
76             ])
77             stats_agg_alias = stats_agg.alias("stats_agg")
78
79             # Use these stats
80             query = select([
81                 stats_agg_alias.c.stats.count.label("count"),
82                 stats_agg_alias.c.stats.sum.label("sum"),
83                 stats_agg_alias.c.stats.stddev.label("stddev"),
84                 stats_agg_alias.c.stats.min.label("min"),

```

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```

85         stats_agg_alias.c.stats.max.label("max")
86     ])
87
88     # Check the query
89     assert str(query) == (
90         "SELECT "
91         "(stats_agg.stats).count AS count, "
92         "(stats_agg.stats).sum AS sum, "
93         "(stats_agg.stats).stddev AS stddev, "
94         "(stats_agg.stats).min AS min, "
95         "(stats_agg.stats).max AS max \n"
96         "FROM ("
97         "SELECT "
98         "ST_SummaryStatsAgg("
99         "public.ocean.rast, "
100         "%(ST_SummaryStatsAgg_1)s, %(ST_SummaryStatsAgg_2)s, %(ST_
↪SummaryStatsAgg_3)s"
101         ") AS stats \n"
102         "FROM public.ocean) AS stats_agg"
103     )
104
105     # Execute the query
106     res = session.execute(query).fetchall()
107
108     # Check the result
109     assert res == [(15, 15.0, 0.0, 1.0, 1.0)]

```

Total running time of the script: (0 minutes 0.000 seconds)

The *Gallery* page shows examples of the GeoAlchemy 2's functionalities.

6.1 Types

This module defines the `geoalchemy2.types.Geometry`, `geoalchemy2.types.Geography`, and `geoalchemy2.types.Raster` classes, that are used when defining geometry, geography and raster columns/properties in models.

6.1.1 Reference

class `geoalchemy2.types.CompositeType`

Bases: `sqlalchemy.sql.type_api.UserDefinedType`

A wrapper for `geoalchemy2.elements.CompositeElement`, that can be used as the return type in PostgreSQL functions that return composite values.

This is used as the base class of `geoalchemy2.types.GeometryDump`.

class `comparator_factory(expr)`

Bases: `sqlalchemy.sql.type_api.Comparator`

typemap = {}

Dictionary used for defining the content types and their corresponding keys. Set in subclasses.

class `geoalchemy2.types.Geography(geometry_type='GEOMETRY', srid=-1, dimension=2, spatial_index=True, use_N_D_index=False, management=False, use_typedmod=None, from_text=None, name=None)`

Bases: `geoalchemy2.types._GISType`

The Geography type.

Creating a geography column is done like this:

```
Column(Geography(geometry_type='POINT', srid=4326))
```

See `geoalchemy2.types._GISType` for the list of arguments that can be passed to the constructor.

ElementType

alias of `geoalchemy2.elements.WKBElement`

as_binary = 'ST_AsBinary'

The “as binary” function to use. Used by the parent class’ `column_expression` method.

from_text = 'ST_GeogFromText'

The FromText geography constructor. Used by the parent class’ `bind_expression` method.

name = 'geography'

Type name used for defining geography columns in CREATE TABLE.

```
class geoalchemy2.types.Geometry(geometry_type='GEOMETRY', srid=-1, dimension=2,
                                spatial_index=True, use_N_D_index=False, man-
                                agement=False, use_typedmod=None, from_text=None,
                                name=None)
```

Bases: `geoalchemy2.types._GISType`

The Geometry type.

Creating a geometry column is done like this:

```
Column(Geometry(geometry_type='POINT', srid=4326))
```

See `geoalchemy2.types._GISType` for the list of arguments that can be passed to the constructor.

If `srid` is set then the `WKBElement` objects resulting from queries will have that SRID, and, when constructing the `WKBElement` objects, the SRID won’t be read from the data returned by the database. If `srid` is not set (meaning it’s -1) then the SRID set in `WKBElement` objects will be read from the data returned by the database.

ElementType

alias of `geoalchemy2.elements.WKBElement`

as_binary = 'ST_AsEWKB'

The “as binary” function to use. Used by the parent class’ `column_expression` method.

from_text = 'ST_GeomFromEWKT'

The “from text” geometry constructor. Used by the parent class’ `bind_expression` method.

name = 'geometry'

Type name used for defining geometry columns in CREATE TABLE.

```
class geoalchemy2.types.GeometryDump
```

Bases: `geoalchemy2.types.CompositeType`

The return type for functions like `ST_Dump`, consisting of a path and a geom field. You should normally never use this class directly.

```
typemap = {'geom': <class 'geoalchemy2.types.Geometry'>, 'path': ARRAY(Integer())}
```

Dictionary defining the contents of a `geometry_dump`.

```
class geoalchemy2.types.Raster(*args, **kwargs)
```

Bases: `geoalchemy2.types._GISType`

The Raster column type.

Creating a raster column is done like this:

```
Column(Raster)
```

This class defines the `result_processor` method, so that raster values received from the database are converted to `geoalchemy2.elements.RasterElement` objects.

Constructor arguments:

`spatial_index`

Indicate if a spatial index should be created. Default is `True`.

ElementType

alias of `geoalchemy2.elements.RasterElement`

as_binary = 'raster'

The “as binary” function to use. Used by the parent class’ `column_expression` method.

comparator_factory

alias of `geoalchemy2.comparator.BaseComparator`

from_text = 'raster'

The “from text” raster constructor. Used by the parent class’ `bind_expression` method.

name = 'raster'

Type name used for defining raster columns in `CREATE TABLE`.

```
class geoalchemy2.types._GISType(geometry_type='GEOMETRY', srid=-1, dimension=2,
                                spatial_index=True, use_N_D_index=False, man-
                                agement=False, use_typed=None, from_text=None,
                                name=None)
```

Bases: `sqlalchemy.sql.type_api.UserDefinedType`

The base class for `geoalchemy2.types.Geometry` and `geoalchemy2.types.Geography`.

This class defines `bind_expression` and `column_expression` methods that wrap column expressions in `ST_GeomFromEWKT`, `ST_GeogFromText`, or `ST_AsEWKB` calls.

This class also defines `result_processor` and `bind_processor` methods. The function returned by `result_processor` converts WKB values received from the database to `geoalchemy2.elements.WKBElement` objects. The function returned by `bind_processor` converts `geoalchemy2.elements.WKTElement` objects to EWKT strings.

Constructor arguments:

`geometry_type`

The geometry type.

Possible values are:

- "GEOMETRY",
- "POINT",
- "LINESTRING",
- "POLYGON",
- "MULTIPOINT",
- "MULTILINESTRING",
- "MULTIPOLYGON",
- "GEOMETRYCOLLECTION",
- "CURVE",
- None.

The latter is actually not supported with `geoalchemy2.types.Geography`.

When set to `None` then no “geometry type” constraints will be attached to the geometry type declaration. Using `None` here is not compatible with setting management to `True`.

Default is `"GEOMETRY"`.

`srid`

The SRID for this column. E.g. 4326. Default is `-1`.

`dimension`

The dimension of the geometry. Default is `2`.

With management set to `True`, that is when `AddGeometryColumn` is used to add the geometry column, there are two constraints:

- The `geometry_type` must not end with `"ZM"`. This is due to PostGIS' `AddGeometryColumn` failing with ZM geometry types. Instead the “simple” geometry type (e.g. `POINT` rather `POINTZM`) should be used with `dimension` set to `4`.
- When the `geometry_type` ends with `"Z"` or `"M"` then `dimension` must be set to `3`.

With management set to `False` (the default) `dimension` is not taken into account, and the actual dimension is fully defined with the `geometry_type`.

`spatial_index`

Indicate if a spatial index should be created. Default is `True`.

`use_N_D_index` Use the N-D index instead of the standard 2-D index.

`management`

Indicate if the `AddGeometryColumn` and `DropGeometryColumn` managements functions should be called when adding and dropping the geometry column. Should be set to `True` for PostGIS 1.x. Default is `False`. Note that this option has no effect for `geoalchemy2.types.Geography`.

`use_typedmod`

By default PostgreSQL type modifiers are used to create the geometry column. To use check constraints instead set `use_typedmod` to `False`. By default this option is not included in the call to `AddGeometryColumn`. Note that this option is only taken into account if management is set to `True` and is only available for PostGIS 2.x.

`as_binary = None`

The name of the “as binary” function for this type. Set in subclasses.

`bind_expression` (*bindvalue*)

Specific `bind_expression` that automatically adds a conversion function

`bind_processor` (*dialect*)

Return a conversion function for processing bind values.

Returns a callable which will receive a bind parameter value as the sole positional argument and will return a value to send to the DB-API.

If processing is not necessary, the method should return `None`.

Parameters `dialect` – Dialect instance in use.

`column_expression` (*col*)

Specific `column_expression` that automatically adds a conversion function

comparator_factory

alias of `geoalchemy2.comparator.Comparator`

from_text = None

The name of “from text” function for this type. Set in subclasses.

name = None

Name used for defining the main geo type (geometry or geography) in CREATE TABLE statements. Set in subclasses.

result_processor (*dialect, coltype*)

Return a conversion function for processing result row values.

Returns a callable which will receive a result row column value as the sole positional argument and will return a value to return to the user.

If processing is not necessary, the method should return `None`.

Parameters

- **dialect** – Dialect instance in use.
- **coltype** – DBAPI coltype argument received in `cursor.description`.

6.2 Elements

class `geoalchemy2.elements.WKTElement` (*data, srid=-1, extended=False*)

Bases: `geoalchemy2.elements._SpatialElement`

Instances of this class wrap a WKT or EWKT value.

Usage examples:

```
wkt_element_1 = WKTElement('POINT(5 45)')
wkt_element_2 = WKTElement('POINT(5 45)', srid=4326)
wkt_element_3 = WKTElement('SRID=4326;POINT(5 45)', extended=True)
```

desc

This element’s description string.

geom_from = 'ST_GeomFromText'

geom_from_extended_version = 'ST_GeomFromEWKT'

class `geoalchemy2.elements.WKBElement` (*data, srid=-1, extended=False*)

Bases: `geoalchemy2.elements._SpatialElement`

Instances of this class wrap a WKB or EWKB value.

Geometry values read from the database are converted to instances of this type. In most cases you won’t need to create `WKBElement` instances yourself.

If `extended` is `True` and `srid` is `-1` at construction time then the SRID will be read from the EWKB data.

Note: you can create `WKBElement` objects from Shapely geometries using the `geoalchemy2.shape.from_shape()` function.

desc

This element’s description string.

geom_from = 'ST_GeomFromWKB'

geom_from_extended_version = 'ST_GeomFromEWKB'

```
class geoalchemy2.elements.RasterElement (data)
    Bases: geoalchemy2.elements._SpatialElement
```

Instances of this class wrap a raster value. Raster values read from the database are converted to instances of this type. In most cases you won't need to create `RasterElement` instances yourself.

```
desc
    This element's description string.
```

6.3 Spatial Functions

This module defines the *GenericFunction* class, which is the base for the implementation of spatial functions in GeoAlchemy. This module is also where actual spatial functions are defined. Spatial functions supported by GeoAlchemy are defined in this module. See *GenericFunction* to know how to create new spatial functions.

Note: By convention the names of spatial functions are prefixed by `ST_`. This is to be consistent with PostGIS', which itself is based on the SQL-MM standard.

Functions created by subclassing *GenericFunction* can be called in several ways:

- By using the `func` object, which is the SQLAlchemy standard way of calling a function. For example, without the ORM:

```
select ([func.ST_Area (lake_table.c.geom)])
```

and with the ORM:

```
Session.query (func.ST_Area (Lake.geom))
```

- By applying the function to a geometry column. For example, without the ORM:

```
select ([lake_table.c.geom.ST_Area()])
```

and with the ORM:

```
Session.query (Lake.geom.ST_Area())
```

- By applying the function to a *geoalchemy2.elements.WKBElement* object (*geoalchemy2.elements.WKBElement* is the type into which GeoAlchemy converts geometry values read from the database), or to a *geoalchemy2.elements.WKTElement* object. For example, without the ORM:

```
conn.scalar (lake['geom'].ST_Area())
```

and with the ORM:

```
session.scalar (lake.geom.ST_Area())
```

6.3.1 Reference

```
class geoalchemy2.functions.AddAuth (*args, **kwargs)
    Adds an authorization token to be used in the current transaction.
```

see <http://postgis.net/docs/AddAuth.html>

class `geoalchemy2.functions.AddGeometryColumn(*args, **kwargs)`
 Adds a geometry column to an existing table.
 see <http://postgis.net/docs/AddGeometryColumn.html>

class `geoalchemy2.functions.Box2D(*args, **kwargs)`
 Returns a BOX2D representing the 2D extent of the geometry.
 see http://postgis.net/docs/Box2D_type.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.Box3D(*args, **kwargs)`
 [geometry] Returns a BOX3D representing the 3D extent of the geometry. OR [raster] Returns the box 3d representation of the enclosing box of the raster.
 see http://postgis.net/docs/Box3D_type.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.CheckAuth(*args, **kwargs)`
 Creates a trigger on a table to prevent/allow updates and deletes of rows based on authorization token.
 see <http://postgis.net/docs/CheckAuth.html>

class `geoalchemy2.functions.DisableLongTransactions(*args, **kwargs)`
 Disables long transaction support.
 see <http://postgis.net/docs/DisableLongTransactions.html>

class `geoalchemy2.functions.DropGeometryColumn(*args, **kwargs)`
 Removes a geometry column from a spatial table.
 see <http://postgis.net/docs/DropGeometryColumn.html>

class `geoalchemy2.functions.DropGeometryTable(*args, **kwargs)`
 Drops a table and all its references in geometry_columns.
 see <http://postgis.net/docs/DropGeometryTable.html>

class `geoalchemy2.functions.EnableLongTransactions(*args, **kwargs)`
 Enables long transaction support.
 see <http://postgis.net/docs/EnableLongTransactions.html>

class `geoalchemy2.functions.Find_SRID(*args, **kwargs)`
 Returns the SRID defined for a geometry column.
 see http://postgis.net/docs/Find_SRID.html

class `geoalchemy2.functions.GenericFunction(*args, **kwargs)`
 The base class for GeoAlchemy functions.

This class inherits from `sqlalchemy.sql.functions.GenericFunction`, so functions defined by subclassing this class can be given a fixed return type. For example, functions like `ST_Buffer` and `ST_Envelope` have their type attributes set to `geoalchemy2.types.Geometry`.

This class allows constructs like `Lake.geom.ST_Buffer(2)`. In that case the `Function` instance is bound to an expression (`Lake.geom` here), and that expression is passed to the function when the function is actually called.

If you need to use a function that GeoAlchemy does not provide you will certainly want to subclass this class. For example, if you need the `ST_TransScale` spatial function, which isn't (currently) natively supported by GeoAlchemy, you will write this:

```
from geoalchemy2 import Geometry
from geoalchemy2.functions import GenericFunction

class ST_TransScale(GenericFunction):
    name = 'ST_TransScale'
    type = Geometry
```

class `geoalchemy2.functions.GeometryType(*args, **kwargs)`

Returns the type of a geometry as text.

see <http://postgis.net/docs/GeometryType.html>

class `geoalchemy2.functions.LockRow(*args, **kwargs)`

Sets lock/authorization for a row in a table.

see <http://postgis.net/docs/LockRow.html>

class `geoalchemy2.functions.Populate_Geometry_Columns(*args, **kwargs)`

Ensures geometry columns are defined with type modifiers or have appropriate spatial constraints.

see http://postgis.net/docs/Populate_Geometry_Columns.html

class `geoalchemy2.functions.PostGIS_AddBBBox(*args, **kwargs)`

Add bounding box to the geometry.

see http://postgis.net/docs/PostGIS_AddBBBox.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.PostGIS_DropBBBox(*args, **kwargs)`

Drop the bounding box cache from the geometry.

see http://postgis.net/docs/PostGIS_DropBBBox.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.PostGIS_Extensions_Upgrade(*args, **kwargs)`

Packages and upgrades postgis extensions (e.g. `postgis_raster`, `postgis_topology`, `postgis_sfcgal`) to latest available version.

see http://postgis.net/docs/PostGIS_Extensions_Upgrade.html

class `geoalchemy2.functions.PostGIS_Full_Version(*args, **kwargs)`

Reports full postgis version and build configuration infos.

see http://postgis.net/docs/PostGIS_Full_Version.html

class `geoalchemy2.functions.PostGIS_GEOS_Version(*args, **kwargs)`

Returns the version number of the GEOS library.

see http://postgis.net/docs/PostGIS_GEOS_Version.html

class `geoalchemy2.functions.PostGIS_HasBBBox(*args, **kwargs)`

Returns TRUE if the bbox of this geometry is cached, FALSE otherwise.

see http://postgis.net/docs/PostGIS_HasBBBox.html

class `geoalchemy2.functions.PostGIS_LibXML_Version(*args, **kwargs)`
Returns the version number of the libxml2 library.

see http://postgis.net/docs/PostGIS_LibXML_Version.html

class `geoalchemy2.functions.PostGIS_Lib_Build_Date(*args, **kwargs)`
Returns build date of the PostGIS library.

see http://postgis.net/docs/PostGIS_Lib_Build_Date.html

class `geoalchemy2.functions.PostGIS_Lib_Version(*args, **kwargs)`
Returns the version number of the PostGIS library.

see http://postgis.net/docs/PostGIS_Lib_Version.html

class `geoalchemy2.functions.PostGIS_Liblwgeom_Version(*args, **kwargs)`
Returns the version number of the liblwgeom library. This should match the version of PostGIS.

see http://postgis.net/docs/PostGIS_Liblwgeom_Version.html

class `geoalchemy2.functions.PostGIS_PROJ_Version(*args, **kwargs)`
Returns the version number of the PROJ4 library.

see http://postgis.net/docs/PostGIS_PROJ_Version.html

class `geoalchemy2.functions.PostGIS_Scripts_Build_Date(*args, **kwargs)`
Returns build date of the PostGIS scripts.

see http://postgis.net/docs/PostGIS_Scripts_Build_Date.html

class `geoalchemy2.functions.PostGIS_Scripts_Installed(*args, **kwargs)`
Returns version of the postgis scripts installed in this database.

see http://postgis.net/docs/PostGIS_Scripts_Installed.html

class `geoalchemy2.functions.PostGIS_Scripts_Released(*args, **kwargs)`
Returns the version number of the postgis.sql script released with the installed postgis lib.

see http://postgis.net/docs/PostGIS_Scripts_Released.html

class `geoalchemy2.functions.PostGIS_Version(*args, **kwargs)`
Returns PostGIS version number and compile-time options.

see http://postgis.net/docs/PostGIS_Version.html

class `geoalchemy2.functions.PostGIS_Wagyu_Version(*args, **kwargs)`
Returns the version number of the internal Wagyu library.

see http://postgis.net/docs/PostGIS_Wagyu_Version.html

class `geoalchemy2.functions.ST_3DArea(*args, **kwargs)`
Computes area of 3D surface geometries. Will return 0 for solids.

see http://postgis.net/docs/ST_3DArea.html

class `geoalchemy2.functions.ST_3DClosestPoint(*args, **kwargs)`
Returns the 3D point on g1 that is closest to g2. This is the first point of the 3D shortest line.

see http://postgis.net/docs/ST_3DClosestPoint.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_3DDFullyWithin(*args, **kwargs)`
Returns true if all of the 3D geometries are within the specified distance of one another.
see http://postgis.net/docs/ST_3DDFullyWithin.html

class `geoalchemy2.functions.ST_3DDWithin(*args, **kwargs)`
For 3d (z) geometry type Returns true if two geometries 3d distance is within number of units.
see http://postgis.net/docs/ST_3DDWithin.html

class `geoalchemy2.functions.ST_3DDifference(*args, **kwargs)`
Perform 3D difference
see http://postgis.net/docs/ST_3DDifference.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_3DDistance(*args, **kwargs)`
Returns the 3D cartesian minimum distance (based on spatial ref) between two geometries in projected units.
see http://postgis.net/docs/ST_3DDistance.html

class `geoalchemy2.functions.ST_3DExtent(*args, **kwargs)`
an aggregate function that returns the 3D bounding box that bounds rows of geometries.
see http://postgis.net/docs/ST_3DExtent.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_3DIntersection(*args, **kwargs)`
Perform 3D intersection
see http://postgis.net/docs/ST_3DIntersection.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_3DIntersects(*args, **kwargs)`
Returns TRUE if the Geometries “spatially intersect” in 3D - only for points, linestrings, polygons, polyhedral surface (area).
see http://postgis.net/docs/ST_3DIntersects.html

class `geoalchemy2.functions.ST_3DLength(*args, **kwargs)`
Returns the 3D length of a linear geometry.
see http://postgis.net/docs/ST_3DLength.html

class `geoalchemy2.functions.ST_3DLineInterpolatePoint(*args, **kwargs)`
Returns a point interpolated along a line in 3D. Second argument is a float8 between 0 and 1 representing fraction of total length of linestring the point has to be located.
see http://postgis.net/docs/ST_3DLineInterpolatePoint.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_3DLongestLine(*args, **kwargs)`
 Returns the 3D longest line between two geometries
 see http://postgis.net/docs/ST_3DLongestLine.html
 Return type: *geoalchemy2.types.Geometry*.

type
 alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_3DMakeBox(*args, **kwargs)`
 Creates a BOX3D defined by two 3D point geometries.
 see http://postgis.net/docs/ST_3DMakeBox.html
 Return type: *geoalchemy2.types.Geometry*.

type
 alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_3DMaxDistance(*args, **kwargs)`
 Returns the 3D cartesian maximum distance (based on spatial ref) between two geometries in projected units.
 see http://postgis.net/docs/ST_3DMaxDistance.html

class `geoalchemy2.functions.ST_3DPerimeter(*args, **kwargs)`
 Returns the 3D perimeter of a polygonal geometry.
 see http://postgis.net/docs/ST_3DPerimeter.html

class `geoalchemy2.functions.ST_3DShortestLine(*args, **kwargs)`
 Returns the 3D shortest line between two geometries
 see http://postgis.net/docs/ST_3DShortestLine.html
 Return type: *geoalchemy2.types.Geometry*.

type
 alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_3DUnion(*args, **kwargs)`
 Perform 3D union
 see http://postgis.net/docs/ST_3DUnion.html
 Return type: *geoalchemy2.types.Geometry*.

type
 alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_AddBand(*args, **kwargs)`
 Returns a raster with the new band(s) of given type added with given initial value in the given index location. If no index is specified, the band is added to the end.
 see http://postgis.net/docs/RT_ST_AddBand.html
 Return type: *geoalchemy2.types.Raster*.

type
 alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_AddMeasure(*args, **kwargs)`
 Return a derived geometry with measure elements linearly interpolated between the start and end points.
 see http://postgis.net/docs/ST_AddMeasure.html
 Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_AddPoint* (*args, **kwargs)
Add a point to a LineString.

see http://postgis.net/docs/ST_AddPoint.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Affine* (*args, **kwargs)
Apply a 3D affine transformation to a geometry.

see http://postgis.net/docs/ST_Affine.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Angle* (*args, **kwargs)
Returns the angle between 3 points, or between 2 vectors (4 points or 2 lines).

see http://postgis.net/docs/ST_Angle.html

class *geoalchemy2.functions.ST_ApproximateMedialAxis* (*args, **kwargs)
Compute the approximate medial axis of an areal geometry.

see http://postgis.net/docs/ST_ApproximateMedialAxis.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Area* (*args, **kwargs)
Returns the area of a polygonal geometry.

see http://postgis.net/docs/ST_Area.html

class *geoalchemy2.functions.ST_AsBinary* (*args, **kwargs)
Return the Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data.

see http://postgis.net/docs/ST_AsBinary.html

class *geoalchemy2.functions.ST_AsEWKB* (*args, **kwargs)
Return the Well-Known Binary (WKB) representation of the geometry with SRID meta data.

see http://postgis.net/docs/ST_AsEWKB.html

class *geoalchemy2.functions.ST_AsEWKT* (*args, **kwargs)
Return the Well-Known Text (WKT) representation of the geometry with SRID meta data.

see http://postgis.net/docs/ST_AsEWKT.html

class *geoalchemy2.functions.ST_AsEncodedPolyline* (*args, **kwargs)
Returns an Encoded Polyline from a LineString geometry.

see http://postgis.net/docs/ST_AsEncodedPolyline.html

class *geoalchemy2.functions.ST_AsGDALRaster* (*args, **kwargs)
Return the raster tile in the designated GDAL Raster format. Raster formats are one of those supported by your compiled library. Use *ST_GDALDrivers()* to get a list of formats supported by your library.

see http://postgis.net/docs/RT_ST_AsGDALRaster.html

class `geoalchemy2.functions.ST_AsGML(*args, **kwargs)`
Return the geometry as a GML version 2 or 3 element.

see http://postgis.net/docs/ST_AsGML.html

class `geoalchemy2.functions.ST_AsGeoJSON(*args, **kwargs)`
Return the geometry as a GeoJSON “geometry” object, or the row as a GeoJSON feature” object (PostGIS 3 only). (Cf GeoJSON specifications RFC 7946). 2D and 3D Geometries are both supported. GeoJSON only support SFS 1.1 geometry types (no curve support for example). See https://postgis.net/docs/ST_AsGeoJSON.html

class `geoalchemy2.functions.ST_AsGeobuf(*args, **kwargs)`
Return a Geobuf representation of a set of rows.

see http://postgis.net/docs/ST_AsGeobuf.html

class `geoalchemy2.functions.ST_AsHEXEWKB(*args, **kwargs)`
Returns a Geometry in HEXEWKB format (as text) using either little-endian (NDR) or big-endian (XDR) encoding.

see http://postgis.net/docs/ST_AsHEXEWKB.html

class `geoalchemy2.functions.ST_AsHexWKB(*args, **kwargs)`
Return the Well-Known Binary (WKB) in Hex representation of the raster.

see http://postgis.net/docs/RT_ST_AsHexWKB.html

class `geoalchemy2.functions.ST_AsJPEG(*args, **kwargs)`
Return the raster tile selected bands as a single Joint Photographic Exports Group (JPEG) image (byte array). If no band is specified and 1 or more than 3 bands, then only the first band is used. If only 3 bands then all 3 bands are used and mapped to RGB.

see http://postgis.net/docs/RT_ST_AsJPEG.html

class `geoalchemy2.functions.ST_AsKML(*args, **kwargs)`
Return the geometry as a KML element. Several variants. Default version=2, default maxdecimaldigits=15

see http://postgis.net/docs/ST_AsKML.html

class `geoalchemy2.functions.ST_AsLatLonText(*args, **kwargs)`
Return the Degrees, Minutes, Seconds representation of the given point.

see http://postgis.net/docs/ST_AsLatLonText.html

class `geoalchemy2.functions.ST_AsMVT(*args, **kwargs)`
Aggregate function returning a Mapbox Vector Tile representation of a set of rows.

see http://postgis.net/docs/ST_AsMVT.html

class `geoalchemy2.functions.ST_AsMVTGeom(*args, **kwargs)`
Transform a geometry into the coordinate space of a Mapbox Vector Tile.

see http://postgis.net/docs/ST_AsMVTGeom.html

Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_AsPNG(*args, **kwargs)`
Return the raster tile selected bands as a single portable network graphics (PNG) image (byte array). If 1, 3, or 4 bands in raster and no bands are specified, then all bands are used. If more 2 or more than 4 bands and no bands specified, then only band 1 is used. Bands are mapped to RGB or RGBA space.

see http://postgis.net/docs/RT_ST_AsPNG.html

class `geoalchemy2.functions.ST_AsRaster(*args, **kwargs)`

Converts a PostGIS geometry to a PostGIS raster.

see http://postgis.net/docs/RT_ST_AsRaster.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_AsSVG(*args, **kwargs)`

Returns SVG path data for a geometry.

see http://postgis.net/docs/ST_AsSVG.html

class `geoalchemy2.functions.ST_AsTIFF(*args, **kwargs)`

Return the raster selected bands as a single TIFF image (byte array). If no band is specified or any of specified bands does not exist in the raster, then will try to use all bands.

see http://postgis.net/docs/RT_ST_AsTIFF.html

class `geoalchemy2.functions.ST_AsTWKB(*args, **kwargs)`

Returns the geometry as TWKB, aka “Tiny Well-Known Binary”

see http://postgis.net/docs/ST_AsTWKB.html

class `geoalchemy2.functions.ST_AsText(*args, **kwargs)`

Return the Well-Known Text (WKT) representation of the geometry/geography without SRID metadata.

see http://postgis.net/docs/ST_AsText.html

class `geoalchemy2.functions.ST_AsX3D(*args, **kwargs)`

Returns a Geometry in X3D xml node element format: ISO-IEC-19776-1.2-X3DEncodings-XML

see http://postgis.net/docs/ST_AsX3D.html

class `geoalchemy2.functions.ST_Aspect(*args, **kwargs)`

Returns the aspect (in degrees by default) of an elevation raster band. Useful for analyzing terrain.

see http://postgis.net/docs/RT_ST_Aspect.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_Azimuth(*args, **kwargs)`

Returns the north-based azimuth as the angle in radians measured clockwise from the vertical on pointA to pointB.

see http://postgis.net/docs/ST_Azimuth.html

class `geoalchemy2.functions.ST_Band(*args, **kwargs)`

Returns one or more bands of an existing raster as a new raster. Useful for building new rasters from existing rasters.

see http://postgis.net/docs/RT_ST_Band.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_BandFileSize(*args, **kwargs)`
 Returns the file size of a band stored in file system. If no bandnum specified, 1 is assumed.
 see http://postgis.net/docs/RT_ST_BandFileSize.html

class `geoalchemy2.functions.ST_BandFileTimestamp(*args, **kwargs)`
 Returns the file timestamp of a band stored in file system. If no bandnum specified, 1 is assumed.
 see http://postgis.net/docs/RT_ST_BandFileTimestamp.html

class `geoalchemy2.functions.ST_BandIsNoData(*args, **kwargs)`
 Returns true if the band is filled with only nodata values.
 see http://postgis.net/docs/RT_ST_BandIsNoData.html

class `geoalchemy2.functions.ST_BandMetaData(*args, **kwargs)`
 Returns basic meta data for a specific raster band. band num 1 is assumed if none-specified.
 see http://postgis.net/docs/RT_ST_BandMetaData.html

class `geoalchemy2.functions.ST_BandNoDataValue(*args, **kwargs)`
 Returns the value in a given band that represents no data. If no band num 1 is assumed.
 see http://postgis.net/docs/RT_ST_BandNoDataValue.html

class `geoalchemy2.functions.ST_BandPath(*args, **kwargs)`
 Returns system file path to a band stored in file system. If no bandnum specified, 1 is assumed.
 see http://postgis.net/docs/RT_ST_BandPath.html

class `geoalchemy2.functions.ST_BandPixelType(*args, **kwargs)`
 Returns the type of pixel for given band. If no bandnum specified, 1 is assumed.
 see http://postgis.net/docs/RT_ST_BandPixelType.html

class `geoalchemy2.functions.ST_BdMPolyFromText(*args, **kwargs)`
 Construct a MultiPolygon given an arbitrary collection of closed linestrings as a MultiLineString text representation Well-Known text representation.
 see http://postgis.net/docs/ST_BdMPolyFromText.html
 Return type: *geoalchemy2.types.Geometry*.

type
 alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_BdPolyFromText(*args, **kwargs)`
 Construct a Polygon given an arbitrary collection of closed linestrings as a MultiLineString Well-Known text representation.
 see http://postgis.net/docs/ST_BdPolyFromText.html
 Return type: *geoalchemy2.types.Geometry*.

type
 alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_Boundary(*args, **kwargs)`
 Returns the boundary of a geometry.
 see http://postgis.net/docs/ST_Boundary.html
 Return type: *geoalchemy2.types.Geometry*.

type
 alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_BoundingDiagonal(*args, **kwargs)`
Returns the diagonal of a geometry's bounding box.
see http://postgis.net/docs/ST_BoundingDiagonal.html
Return type: `geoalchemy2.types.Geometry`.
type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Box2dFromGeoHash(*args, **kwargs)`
Return a BOX2D from a GeoHash string.
see http://postgis.net/docs/ST_Box2dFromGeoHash.html
Return type: `geoalchemy2.types.Geometry`.
type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Buffer(*args, **kwargs)`
(T) Returns a geometry covering all points within a given distance from the input geometry.
see http://postgis.net/docs/ST_Buffer.html
Return type: `geoalchemy2.types.Geometry`.
type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_BuildArea(*args, **kwargs)`
Creates an areal geometry formed by the constituent linework of given geometry
see http://postgis.net/docs/ST_BuildArea.html
Return type: `geoalchemy2.types.Geometry`.
type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_CPAWithin(*args, **kwargs)`
Returns true if the closest point of approach of two trajectories is within the specified distance.
see http://postgis.net/docs/ST_CPAWithin.html

class `geoalchemy2.functions.ST_Centroid(*args, **kwargs)`
Returns the geometric center of a geometry.
see http://postgis.net/docs/ST_Centroid.html
Return type: `geoalchemy2.types.Geometry`.
type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_ChaikinSmoothing(*args, **kwargs)`
Returns a "smoothed" version of the given geometry using the Chaikin algorithm
see http://postgis.net/docs/ST_ChaikinSmoothing.html
Return type: `geoalchemy2.types.Geometry`.
type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Clip(*args, **kwargs)`
 Returns the raster clipped by the input geometry. If band number not is specified, all bands are processed. If crop is not specified or TRUE, the output raster is cropped.
 see http://postgis.net/docs/RT_ST_Clip.html
 Return type: `geoalchemy2.types.Raster`.

type
 alias of `geoalchemy2.types.Raster`

class `geoalchemy2.functions.ST_ClipByBox2D(*args, **kwargs)`
 Returns the portion of a geometry falling within a rectangle.
 see http://postgis.net/docs/ST_ClipByBox2D.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_ClosestPoint(*args, **kwargs)`
 Returns the 2D point on g1 that is closest to g2. This is the first point of the shortest line.
 see http://postgis.net/docs/ST_ClosestPoint.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_ClosestPointOfApproach(*args, **kwargs)`
 Returns the measure at which points interpolated along two trajectories are closest.
 see http://postgis.net/docs/ST_ClosestPointOfApproach.html

class `geoalchemy2.functions.ST_ClusterDBSCAN(*args, **kwargs)`
 Window function that returns a cluster id for each input geometry using the DBSCAN algorithm.
 see http://postgis.net/docs/ST_ClusterDBSCAN.html

class `geoalchemy2.functions.ST_ClusterIntersecting(*args, **kwargs)`
 Aggregate function that clusters the input geometries into connected sets.
 see http://postgis.net/docs/ST_ClusterIntersecting.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_ClusterKMeans(*args, **kwargs)`
 Window function that returns a cluster id for each input geometry using the K-means algorithm.
 see http://postgis.net/docs/ST_ClusterKMeans.html

class `geoalchemy2.functions.ST_ClusterWithin(*args, **kwargs)`
 Aggregate function that clusters the input geometries by separation distance.
 see http://postgis.net/docs/ST_ClusterWithin.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Collect (*args, **kwargs)`

Creates a GeometryCollection or Multi* geometry from a set of geometries.

see http://postgis.net/docs/ST_Collect.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_CollectionExtract (*args, **kwargs)`

Given a (multi)geometry, return a (multi)geometry consisting only of elements of the specified type.

see http://postgis.net/docs/ST_CollectionExtract.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_CollectionHomogenize (*args, **kwargs)`

Given a geometry collection, return the “simplest” representation of the contents.

see http://postgis.net/docs/ST_CollectionHomogenize.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_ColorMap (*args, **kwargs)`

Creates a new raster of up to four 8BUI bands (grayscale, RGB, RGBA) from the source raster and a specified band. Band 1 is assumed if not specified.

see http://postgis.net/docs/RT_ST_ColorMap.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_ConcaveHull (*args, **kwargs)`

The concave hull of a geometry represents a possibly concave geometry that encloses all geometries within the set. You can think of it as shrink wrapping.

see http://postgis.net/docs/ST_ConcaveHull.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_ConstrainedDelaunayTriangles (*args, **kwargs)`

Return a constrained Delaunay triangulation around the given input geometry.

see http://postgis.net/docs/ST_ConstrainedDelaunayTriangles.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_Contains (*args, **kwargs)`

[geometry] Returns true if and only if no points of B lie in the exterior of A, and at least one point of the interior of B lies in the interior of A. OR [raster] Return true if no points of raster rastB lie in the exterior of raster rastA and at least one point of the interior of rastB lies in the interior of rastA.

see http://postgis.net/docs/ST_Contains.html

class `geoalchemy2.functions.ST_ContainsProperly` (*args, **kwargs)
 [geometry] Returns true if B intersects the interior of A but not the boundary (or exterior). A does not contain properly itself, but does contain itself. OR [raster] Return true if rastB intersects the interior of rastA but not the boundary or exterior of rastA.

see http://postgis.net/docs/ST_ContainsProperly.html

class `geoalchemy2.functions.ST_ConvexHull` (*args, **kwargs)
 [geometry] Computes the convex hull of a geometry. OR [raster] Return the convex hull geometry of the raster including pixel values equal to BandNoDataValue. For regular shaped and non-skewed rasters, this gives the same result as ST_Envelope so only useful for irregularly shaped or skewed rasters.

see http://postgis.net/docs/ST_ConvexHull.html

Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_CoordDim` (*args, **kwargs)
 Return the coordinate dimension of a geometry.

see http://postgis.net/docs/ST_CoordDim.html

class `geoalchemy2.functions.ST_Count` (*args, **kwargs)
 Returns the number of pixels in a given band of a raster or raster coverage. If no band is specified defaults to band 1. If exclude_nodata_value is set to true, will only count pixels that are not equal to the nodata value.

see http://postgis.net/docs/RT_ST_Count.html

class `geoalchemy2.functions.ST_CountAgg` (*args, **kwargs)
 Aggregate. Returns the number of pixels in a given band of a set of rasters. If no band is specified defaults to band 1. If exclude_nodata_value is set to true, will only count pixels that are not equal to the NODATA value.

see http://postgis.net/docs/RT_ST_CountAgg.html

class `geoalchemy2.functions.ST_CoveredBy` (*args, **kwargs)
 [geometry] Returns 1 (TRUE) if no point in Geometry/Geography A is outside Geometry/Geography B OR [raster] Return true if no points of raster rastA lie outside raster rastB.

see http://postgis.net/docs/ST_CoveredBy.html

class `geoalchemy2.functions.ST_Covers` (*args, **kwargs)
 [geometry] Returns 1 (TRUE) if no point in Geometry B is outside Geometry A OR [raster] Return true if no points of raster rastB lie outside raster rastA.

see http://postgis.net/docs/ST_Covers.html

class `geoalchemy2.functions.ST_Crosses` (*args, **kwargs)
 Returns TRUE if the supplied geometries have some, but not all, interior points in common.

see http://postgis.net/docs/ST_Crosses.html

class `geoalchemy2.functions.ST_CurveToLine` (*args, **kwargs)
 Converts a CIRCULARSTRING/CURVEPOLYGON/MULTISURFACE to a LINestring/POLYGON/MULTIPOLYGON

see http://postgis.net/docs/ST_CurveToLine.html

Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_DFullyWithin(*args, **kwargs)`
[geometry] Returns true if all of the geometries are within the specified distance of one another OR [raster] Return true if rasters `rastA` and `rastB` are fully within the specified distance of each other.
see http://postgis.net/docs/ST_DFullyWithin.html

class `geoalchemy2.functions.ST_DWithin(*args, **kwargs)`
[geometry] Returns true if the geometries are within the specified distance of one another. For geometry units are in those of spatial reference and for geography units are in meters and measurement is defaulted to `use_spheroid=True` (measure around spheroid), for faster check, `use_spheroid=False` to measure along sphere. OR [raster] Return true if rasters `rastA` and `rastB` are within the specified distance of each other.
see http://postgis.net/docs/ST_DWithin.html

class `geoalchemy2.functions.ST_DelaunayTriangles(*args, **kwargs)`
Return a Delaunay triangulation around the given input points.
see http://postgis.net/docs/ST_DelaunayTriangles.html
Return type: `geoalchemy2.types.Geometry`.
type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Difference(*args, **kwargs)`
Returns a geometry that represents that part of geometry A that does not intersect with geometry B.
see http://postgis.net/docs/ST_Difference.html
Return type: `geoalchemy2.types.Geometry`.
type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Dimension(*args, **kwargs)`
Returns the topological dimension of a geometry.
see http://postgis.net/docs/ST_Dimension.html

class `geoalchemy2.functions.ST_Disjoint(*args, **kwargs)`
[geometry] Returns TRUE if the Geometries do not “spatially intersect” - if they do not share any space together. OR [raster] Return true if raster `rastA` does not spatially intersect `rastB`.
see http://postgis.net/docs/ST_Disjoint.html

class `geoalchemy2.functions.ST_Distance(*args, **kwargs)`
Returns the distance between two geometry or geography values.
see http://postgis.net/docs/ST_Distance.html

class `geoalchemy2.functions.ST_DistanceCPA(*args, **kwargs)`
Returns the distance between the closest point of approach of two trajectories.
see http://postgis.net/docs/ST_DistanceCPA.html

class `geoalchemy2.functions.ST_DistanceSphere(*args, **kwargs)`
Returns minimum distance in meters between two lon/lat geometries using a spherical earth model.
see http://postgis.net/docs/ST_DistanceSphere.html

class `geoalchemy2.functions.ST_DistanceSpheroid(*args, **kwargs)`
Returns the minimum distance between two lon/lat geometries using a spheroidal earth model.
see http://postgis.net/docs/ST_DistanceSpheroid.html

class `geoalchemy2.functions.ST_Distance_Sphere(*args, **kwargs)`
 Returns minimum distance in meters between two lon/lat geometries. Uses a spherical earth and radius of 6370986 meters. Faster than `ST_Distance_Spheroid`, but less accurate. PostGIS versions prior to 1.5 only implemented for points.
 see http://postgis.net/docs/ST_Distance_Sphere.html

class `geoalchemy2.functions.ST_Distinct4ma(*args, **kwargs)`
 Raster processing function that calculates the number of unique pixel values in a neighborhood.
 see http://postgis.net/docs/RT_ST_Distinct4ma.html

class `geoalchemy2.functions.ST_Dump(*args, **kwargs)`
 Returns a set of geometry_dump rows for the components of a geometry.
 see http://postgis.net/docs/ST_Dump.html
 Return type: `geoalchemy2.types.GeometryDump`.

type
 alias of `geoalchemy2.types.GeometryDump`

class `geoalchemy2.functions.ST_DumpAsPolygons(*args, **kwargs)`
 Returns a set of geomval (geom,val) rows, from a given raster band. If no band number is specified, band num defaults to 1.
 see http://postgis.net/docs/RT_ST_DumpAsPolygons.html

class `geoalchemy2.functions.ST_DumpPoints(*args, **kwargs)`
 Returns a set of geometry_dump rows for the points in a geometry.
 see http://postgis.net/docs/ST_DumpPoints.html
 Return type: `geoalchemy2.types.GeometryDump`.

type
 alias of `geoalchemy2.types.GeometryDump`

class `geoalchemy2.functions.ST_DumpRings(*args, **kwargs)`
 Returns a set of geometry_dump rows for the exterior and interior rings of a Polygon.
 see http://postgis.net/docs/ST_DumpRings.html
 Return type: `geoalchemy2.types.GeometryDump`.

type
 alias of `geoalchemy2.types.GeometryDump`

class `geoalchemy2.functions.ST_DumpValues(*args, **kwargs)`
 Get the values of the specified band as a 2-dimension array.
 see http://postgis.net/docs/RT_ST_DumpValues.html

class `geoalchemy2.functions.ST_EndPoint(*args, **kwargs)`
 Returns the last point of a LineString or CircularLineString.
 see http://postgis.net/docs/ST_EndPoint.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Envelope(*args, **kwargs)`
 [geometry] Returns a geometry representing the bounding box of a geometry. OR [raster] Returns the polygon representation of the extent of the raster.

see http://postgis.net/docs/ST_Envelope.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Equals* (*args, **kwargs)

Returns true if the given geometries represent the same geometry. Directionality is ignored.

see http://postgis.net/docs/ST_Equals.html

class *geoalchemy2.functions.ST_EstimatedExtent* (*args, **kwargs)

Return the ‘estimated’ extent of a spatial table.

see http://postgis.net/docs/ST_EstimatedExtent.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Expand* (*args, **kwargs)

Returns a bounding box expanded from another bounding box or a geometry.

see http://postgis.net/docs/ST_Expand.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Extent* (*args, **kwargs)

an aggregate function that returns the bounding box that bounds rows of geometries.

see http://postgis.net/docs/ST_Extent.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_ExteriorRing* (*args, **kwargs)

Returns a LineString representing the exterior ring of a Polygon.

see http://postgis.net/docs/ST_ExteriorRing.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Extrude* (*args, **kwargs)

Extrude a surface to a related volume

see http://postgis.net/docs/ST_Extrude.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_FilterByM* (*args, **kwargs)

Filters vertex points based on their m-value

see http://postgis.net/docs/ST_FilterByM.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_FlipCoordinates* (*args, **kwargs)

Returns a version of the given geometry with X and Y axis flipped. Useful for people who have built latitude/longitude features and need to fix them.

see http://postgis.net/docs/ST_FlipCoordinates.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Force2D* (*args, **kwargs)

Force the geometries into a “2-dimensional mode”.

see http://postgis.net/docs/ST_Force2D.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Force3D* (*args, **kwargs)

Force the geometries into XYZ mode. This is an alias for *ST_Force3DZ*.

see http://postgis.net/docs/ST_Force_3D.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Force3DM* (*args, **kwargs)

Force the geometries into XYM mode.

see http://postgis.net/docs/ST_Force_3DZ.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Force3DZ* (*args, **kwargs)

Force the geometries into XYZ mode.

see http://postgis.net/docs/ST_Force_3DZ.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Force4D* (*args, **kwargs)

Force the geometries into XYZM mode.

see http://postgis.net/docs/ST_Force_4D.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_ForceCollection(*args, **kwargs)`
Convert the geometry into a GEOMETRYCOLLECTION.

see http://postgis.net/docs/ST_Force_Collection.html

Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_ForceCurve(*args, **kwargs)`
Upcast a geometry into its curved type, if applicable.

see http://postgis.net/docs/ST_ForceCurve.html

Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_ForceLHR(*args, **kwargs)`
Force LHR orientation

see http://postgis.net/docs/ST_ForceLHR.html

Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_ForcePolygonCCW(*args, **kwargs)`
Orients all exterior rings counter-clockwise and all interior rings clockwise.

see http://postgis.net/docs/ST_ForcePolygonCCW.html

Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_ForcePolygonCW(*args, **kwargs)`
Orients all exterior rings clockwise and all interior rings counter-clockwise.

see http://postgis.net/docs/ST_ForcePolygonCW.html

Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_ForceRHR(*args, **kwargs)`
Force the orientation of the vertices in a polygon to follow the Right-Hand-Rule.

see http://postgis.net/docs/ST_ForceRHR.html

Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_ForceSFS(*args, **kwargs)`
Force the geometries to use SFS 1.1 geometry types only.

see http://postgis.net/docs/ST_ForceSFS.html

Return type: `geoalchemy2.types.Geometry`.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_FrechetDistance* (*args, **kwargs)
Returns the Fréchet distance between two geometries.
see http://postgis.net/docs/ST_FrechetDistance.html

class *geoalchemy2.functions.ST_FromGDALRaster* (*args, **kwargs)
Returns a raster from a supported GDAL raster file.
see http://postgis.net/docs/RT_ST_FromGDALRaster.html
Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_GMLToSQL* (*args, **kwargs)
Return a specified ST_Geometry value from GML representation. This is an alias name for ST_GeomFromGML
see http://postgis.net/docs/ST_GMLToSQL.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_GeneratePoints* (*args, **kwargs)
Converts a polygon or multi-polygon into a multi-point composed of randomly location points within the original areas.
see http://postgis.net/docs/ST_GeneratePoints.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_GeoHash* (*args, **kwargs)
Return a GeoHash representation of the geometry.
see http://postgis.net/docs/ST_GeoHash.html

class *geoalchemy2.functions.ST_GeoReference* (*args, **kwargs)
Returns the georeference meta data in GDAL or ESRI format as commonly seen in a world file. Default is GDAL.
see http://postgis.net/docs/RT_ST_GeoReference.html

class *geoalchemy2.functions.ST_GeogFromText* (*args, **kwargs)
Return a specified geography value from Well-Known Text representation or extended (WKT).
see http://postgis.net/docs/ST_GeogFromText.html
Return type: *geoalchemy2.types.Geography*.

type
alias of *geoalchemy2.types.Geography*

class *geoalchemy2.functions.ST_GeogFromWKB* (*args, **kwargs)
Creates a geography instance from a Well-Known Binary geometry representation (WKB) or extended Well Known Binary (EWKB).
see http://postgis.net/docs/ST_GeogFromWKB.html

Return type: *geoalchemy2.types.Geography*.

type

alias of *geoalchemy2.types.Geography*

class *geoalchemy2.functions.ST_GeographyFromText* (*args, **kwargs)

Return a specified geography value from Well-Known Text representation or extended (WKT).

see http://postgis.net/docs/ST_GeographyFromText.html

Return type: *geoalchemy2.types.Geography*.

type

alias of *geoalchemy2.types.Geography*

class *geoalchemy2.functions.ST_GeomCollFromText* (*args, **kwargs)

Makes a collection Geometry from collection WKT with the given SRID. If SRID is not given, it defaults to 0.

see http://postgis.net/docs/ST_GeomCollFromText.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_GeomFromEWKB* (*args, **kwargs)

Return a specified ST_Geometry value from Extended Well-Known Binary representation (EWKB).

see http://postgis.net/docs/ST_GeomFromEWKB.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_GeomFromEWKT* (*args, **kwargs)

Return a specified ST_Geometry value from Extended Well-Known Text representation (EWKT).

see http://postgis.net/docs/ST_GeomFromEWKT.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_GeomFromGML* (*args, **kwargs)

Takes as input GML representation of geometry and outputs a PostGIS geometry object

see http://postgis.net/docs/ST_GeomFromGML.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_GeomFromGeoHash* (*args, **kwargs)

Return a geometry from a GeoHash string.

see http://postgis.net/docs/ST_GeomFromGeoHash.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_GeomFromGeoJSON(*args, **kwargs)`
 Takes as input a geojson representation of a geometry and outputs a PostGIS geometry object
 see http://postgis.net/docs/ST_GeomFromGeoJSON.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_GeomFromKML(*args, **kwargs)`
 Takes as input KML representation of geometry and outputs a PostGIS geometry object
 see http://postgis.net/docs/ST_GeomFromKML.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_GeomFromTWKB(*args, **kwargs)`
 Creates a geometry instance from a TWKB (“Tiny Well-Known Binary”) geometry representation.
 see http://postgis.net/docs/ST_GeomFromTWKB.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_GeomFromText(*args, **kwargs)`
 Return a specified ST_Geometry value from Well-Known Text representation (WKT).
 see http://postgis.net/docs/ST_GeomFromText.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_GeomFromWKB(*args, **kwargs)`
 Creates a geometry instance from a Well-Known Binary geometry representation (WKB) and optional SRID.
 see http://postgis.net/docs/ST_GeomFromWKB.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_GeometricMedian(*args, **kwargs)`
 Returns the geometric median of a MultiPoint.
 see http://postgis.net/docs/ST_GeometricMedian.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_GeometryFromText(*args, **kwargs)`
 Return a specified ST_Geometry value from Well-Known Text representation (WKT). This is an alias name for ST_GeomFromText
 see http://postgis.net/docs/ST_GeometryFromText.html
 Return type: `geoalchemy2.types.Geometry`.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_GeometryN*(*args, **kwargs)
Return the Nth geometry element of a geometry collection.

see http://postgis.net/docs/ST_GeometryN.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_GeometryType*(*args, **kwargs)
Returns the SQL-MM type of a geometry as text.

see http://postgis.net/docs/ST_GeometryType.html

class *geoalchemy2.functions.ST_Grayscale*(*args, **kwargs)
Creates a new one-8BUI band raster from the source raster and specified bands representing Red, Green and Blue

see http://postgis.net/docs/RT_ST_Grayscale.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_HasArc*(*args, **kwargs)
Tests if a geometry contains a circular arc

see http://postgis.net/docs/ST_HasArc.html

class *geoalchemy2.functions.ST_HasNoBand*(*args, **kwargs)
Returns true if there is no band with given band number. If no band number is specified, then band number 1 is assumed.

see http://postgis.net/docs/RT_ST_HasNoBand.html

class *geoalchemy2.functions.ST_HausdorffDistance*(*args, **kwargs)
Returns the Hausdorff distance between two geometries.

see http://postgis.net/docs/ST_HausdorffDistance.html

class *geoalchemy2.functions.ST_Height*(*args, **kwargs)
Returns the height of the raster in pixels.

see http://postgis.net/docs/RT_ST_Height.html

class *geoalchemy2.functions.ST_HillShade*(*args, **kwargs)
Returns the hypothetical illumination of an elevation raster band using provided azimuth, altitude, brightness and scale inputs.

see http://postgis.net/docs/RT_ST_HillShade.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_Histogram*(*args, **kwargs)
Returns a set of record summarizing a raster or raster coverage data distribution separate bin ranges. Number of bins are autocomputed if not specified.

see http://postgis.net/docs/RT_ST_Histogram.html

class `geoalchemy2.functions.ST_InteriorRingN(*args, **kwargs)`

Returns the Nth interior ring (hole) of a Polygon.

see http://postgis.net/docs/ST_InteriorRingN.html

Return type: `geoalchemy2.types.Geometry`.

type

alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_InterpolatePoint(*args, **kwargs)`

Return the value of the measure dimension of a geometry at the point closed to the provided point.

see http://postgis.net/docs/ST_InterpolatePoint.html

class `geoalchemy2.functions.ST_Intersection(*args, **kwargs)`

[geometry] (T) Returns a geometry that represents the shared portion of geomA and geomB. OR [raster] Returns a raster or a set of geometry-pixelvalue pairs representing the shared portion of two rasters or the geometrical intersection of a vectorization of the raster and a geometry.

see http://postgis.net/docs/ST_Intersection.html

Return type: `geoalchemy2.types.Geometry`.

type

alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Intersects(*args, **kwargs)`

[geometry] Returns TRUE if the Geometries/Geography “spatially intersect in 2D” - (share any portion of space) and FALSE if they don’t (they are Disjoint). For geography tolerance is 0.00001 meters (so any points that close are considered to intersect) OR [raster] Return true if raster rastA spatially intersects raster rastB.

see http://postgis.net/docs/ST_Intersects.html

class `geoalchemy2.functions.ST_InvDistWeight4ma(*args, **kwargs)`

Raster processing function that interpolates a pixel’s value from the pixel’s neighborhood.

see http://postgis.net/docs/RT_ST_InvDistWeight4ma.html

class `geoalchemy2.functions.ST_IsClosed(*args, **kwargs)`

Tests if a LineStrings’s start and end points are coincident. For a PolyhedralSurface tests if it is closed (volumetric).

see http://postgis.net/docs/ST_IsClosed.html

class `geoalchemy2.functions.ST_IsCollection(*args, **kwargs)`

Tests if a geometry is a geometry collection type.

see http://postgis.net/docs/ST_IsCollection.html

class `geoalchemy2.functions.ST_IsEmpty(*args, **kwargs)`

[geometry] Tests if a geometry is empty. OR [raster] Returns true if the raster is empty (width = 0 and height = 0). Otherwise, returns false.

see http://postgis.net/docs/ST_IsEmpty.html

class `geoalchemy2.functions.ST_IsPlanar(*args, **kwargs)`

Check if a surface is or not planar

see http://postgis.net/docs/ST_IsPlanar.html

class `geoalchemy2.functions.ST_IsPolygonCCW(*args, **kwargs)`

Tests if Polygons have exterior rings oriented counter-clockwise and interior rings oriented clockwise.

see http://postgis.net/docs/ST_IsPolygonCCW.html

class `geoalchemy2.functions.ST_IsPolygonCW(*args, **kwargs)`
Tests if Polygons have exterior rings oriented clockwise and interior rings oriented counter-clockwise.
see http://postgis.net/docs/ST_IsPolygonCW.html

class `geoalchemy2.functions.ST_IsRing(*args, **kwargs)`
Tests if a LineString is closed and simple.
see http://postgis.net/docs/ST_IsRing.html

class `geoalchemy2.functions.ST_IsSimple(*args, **kwargs)`
Tests if a geometry has no points of self-intersection or self-tangency.
see http://postgis.net/docs/ST_IsSimple.html

class `geoalchemy2.functions.ST_IsSolid(*args, **kwargs)`
Test if the geometry is a solid. No validity check is performed.
see http://postgis.net/docs/ST_IsSolid.html

class `geoalchemy2.functions.ST_IsValid(*args, **kwargs)`
Tests if a geometry is well-formed in 2D.
see http://postgis.net/docs/ST_IsValid.html

class `geoalchemy2.functions.ST_IsValidDetail(*args, **kwargs)`
Returns a valid_detail row stating if a geometry is valid, and if not a reason why and a location.
see http://postgis.net/docs/ST_IsValidDetail.html

class `geoalchemy2.functions.ST_IsValidReason(*args, **kwargs)`
Returns text stating if a geometry is valid, or a reason for invalidity.
see http://postgis.net/docs/ST_IsValidReason.html

class `geoalchemy2.functions.ST_IsValidTrajectory(*args, **kwargs)`
Returns true if the geometry is a valid trajectory.
see http://postgis.net/docs/ST_IsValidTrajectory.html

class `geoalchemy2.functions.ST_Length(*args, **kwargs)`
Returns the 2D length of a linear geometry.
see http://postgis.net/docs/ST_Length.html

class `geoalchemy2.functions.ST_Length2D(*args, **kwargs)`
Returns the 2D length of a linear geometry. Alias for ST_Length
see http://postgis.net/docs/ST_Length2D.html

class `geoalchemy2.functions.ST_LengthSpheroid(*args, **kwargs)`
Returns the 2D or 3D length/perimeter of a lon/lat geometry on a spheroid.
see http://postgis.net/docs/ST_LengthSpheroid.html

class `geoalchemy2.functions.ST_LineCrossingDirection(*args, **kwargs)`
Given 2 linestrings, returns a number between -3 and 3 denoting what kind of crossing behavior. 0 is no crossing.
see http://postgis.net/docs/ST_LineCrossingDirection.html

class `geoalchemy2.functions.ST_LineFromEncodedPolyline(*args, **kwargs)`
Creates a LineString from an Encoded Polyline.
see http://postgis.net/docs/ST_LineFromEncodedPolyline.html
Return type: `geoalchemy2.types.Geometry`.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LineFromMultiPoint* (*args, **kwargs)

Creates a LineString from a MultiPoint geometry.

see http://postgis.net/docs/ST_LineFromMultiPoint.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LineFromText* (*args, **kwargs)

Makes a Geometry from WKT representation with the given SRID. If SRID is not given, it defaults to 0.

see http://postgis.net/docs/ST_LineFromText.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LineFromWKB* (*args, **kwargs)

Makes a LINESTRING from WKB with the given SRID

see http://postgis.net/docs/ST_LineFromWKB.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LineInterpolatePoint* (*args, **kwargs)

Returns a point interpolated along a line. Second argument is a float8 between 0 and 1 representing fraction of total length of linestring the point has to be located.

see http://postgis.net/docs/ST_LineInterpolatePoint.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LineInterpolatePoints* (*args, **kwargs)

Returns one or more points interpolated along a line.

see http://postgis.net/docs/ST_LineInterpolatePoints.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LineLocatePoint* (*args, **kwargs)

Returns a float between 0 and 1 representing the location of the closest point on LineString to the given Point, as a fraction of total 2d line length.

see http://postgis.net/docs/ST_LineLocatePoint.html

class *geoalchemy2.functions.ST_LineMerge* (*args, **kwargs)

Return a (set of) LineString(s) formed by sewing together a MULTILINESTRING.

see http://postgis.net/docs/ST_LineMerge.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LineSubstring* (*args, **kwargs)
Return a linestring being a substring of the input one starting and ending at the given fractions of total 2d length. Second and third arguments are float8 values between 0 and 1.

see http://postgis.net/docs/ST_LineSubstring.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LineToCurve* (*args, **kwargs)
Converts a LINESTRING/POLYGON to a CIRCULARSTRING, CURVEPOLYGON

see http://postgis.net/docs/ST_LineToCurve.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LinestringFromWKB* (*args, **kwargs)
Makes a geometry from WKB with the given SRID.

see http://postgis.net/docs/ST_LinestringFromWKB.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LocateAlong* (*args, **kwargs)
Return a derived geometry collection value with elements that match the specified measure. Polygonal elements are not supported.

see http://postgis.net/docs/ST_LocateAlong.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LocateBetween* (*args, **kwargs)
Return a derived geometry collection value with elements that match the specified range of measures inclusively.

see http://postgis.net/docs/ST_LocateBetween.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_LocateBetweenElevations* (*args, **kwargs)
Return a derived geometry (collection) value with elements that intersect the specified range of elevations inclusively.

see http://postgis.net/docs/ST_LocateBetweenElevations.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_LongestLine(*args, **kwargs)`
 Returns the 2D longest line between two geometries.
 see http://postgis.net/docs/ST_LongestLine.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_M(*args, **kwargs)`
 Returns the M coordinate of a Point.
 see http://postgis.net/docs/ST_M.html

class `geoalchemy2.functions.ST_MLineFromText(*args, **kwargs)`
 Return a specified ST_MultiLineString value from WKT representation.
 see http://postgis.net/docs/ST_MLineFromText.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_MPointFromText(*args, **kwargs)`
 Makes a Geometry from WKT with the given SRID. If SRID is not given, it defaults to 0.
 see http://postgis.net/docs/ST_MPointFromText.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_MPolyFromText(*args, **kwargs)`
 Makes a MultiPolygon Geometry from WKT with the given SRID. If SRID is not given, it defaults to 0.
 see http://postgis.net/docs/ST_MPolyFromText.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_MakeBox2D(*args, **kwargs)`
 Creates a BOX2D defined by two 2D point geometries.
 see http://postgis.net/docs/ST_MakeBox2D.html
 Return type: `geoalchemy2.types.Geometry`.

type
 alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_MakeEmptyCoverage(*args, **kwargs)`
 Cover georeferenced area with a grid of empty raster tiles.
 see http://postgis.net/docs/RT_ST_MakeEmptyCoverage.html
 Return type: `geoalchemy2.types.Raster`.

type
 alias of `geoalchemy2.types.Raster`

class `geoalchemy2.functions.ST_MakeEmptyRaster(*args, **kwargs)`

Returns an empty raster (having no bands) of given dimensions (width & height), upperleft X and Y, pixel size and rotation (scalex, scaley, skewx & skewy) and reference system (srid). If a raster is passed in, returns a new raster with the same size, alignment and SRID. If srid is left out, the spatial ref is set to unknown (0).

see http://postgis.net/docs/RT_ST_MakeEmptyRaster.html

Return type: `geoalchemy2.types.Raster`.

type

alias of `geoalchemy2.types.Raster`

class `geoalchemy2.functions.ST_MakeEnvelope(*args, **kwargs)`

Creates a rectangular Polygon from minimum and maximum coordinates.

see http://postgis.net/docs/ST_MakeEnvelope.html

Return type: `geoalchemy2.types.Geometry`.

type

alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_MakeLine(*args, **kwargs)`

Creates a Linestring from Point, MultiPoint, or LineString geometries.

see http://postgis.net/docs/ST_MakeLine.html

Return type: `geoalchemy2.types.Geometry`.

type

alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_MakePoint(*args, **kwargs)`

Creates a 2D, 3DZ or 4D Point.

see http://postgis.net/docs/ST_MakePoint.html

Return type: `geoalchemy2.types.Geometry`.

type

alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_MakePointM(*args, **kwargs)`

Creates a Point from X, Y and M values.

see http://postgis.net/docs/ST_MakePointM.html

Return type: `geoalchemy2.types.Geometry`.

type

alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_MakePolygon(*args, **kwargs)`

Creates a Polygon from a shell and optional list of holes.

see http://postgis.net/docs/ST_MakePolygon.html

Return type: `geoalchemy2.types.Geometry`.

type

alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_MakeSolid(*args, **kwargs)`

Cast the geometry into a solid. No check is performed. To obtain a valid solid, the input geometry must be a closed Polyhedral Surface or a closed TIN.

see http://postgis.net/docs/ST_MakeSolid.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_MakeValid*(*args, **kwargs)

Attempts to make an invalid geometry valid without losing vertices.

see http://postgis.net/docs/ST_MakeValid.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_MapAlgebra*(*args, **kwargs)

[raster] Callback function version - Returns a one-band raster given one or more input rasters, band indexes and one user-specified callback function. OR [raster] Expression version - Returns a one-band raster given one or two input rasters, band indexes and one or more user-specified SQL expressions.

see http://postgis.net/docs/RT_ST_MapAlgebra.html

class *geoalchemy2.functions.ST_MapAlgebraExpr*(*args, **kwargs)

[raster] 1 raster band version: Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation on the input raster band and of pixeltype provided. Band 1 is assumed if no band is specified. OR [raster] 2 raster band version: Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation on the two input raster bands and of pixeltype provided. band 1 of each raster is assumed if no band numbers are specified. The resulting raster will be aligned (scale, skew and pixel corners) on the grid defined by the first raster and have its extent defined by the “extenttype” parameter. Values for “extenttype” can be: INTERSECTION, UNION, FIRST, SECOND.

see http://postgis.net/docs/RT_ST_MapAlgebraExpr.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_MapAlgebraFct*(*args, **kwargs)

[raster] 1 band version - Creates a new one band raster formed by applying a valid PostgreSQL function on the input raster band and of pixeltype provided. Band 1 is assumed if no band is specified. OR [raster] 2 band version - Creates a new one band raster formed by applying a valid PostgreSQL function on the 2 input raster bands and of pixeltype provided. Band 1 is assumed if no band is specified. Extent type defaults to INTERSECTION if not specified.

see http://postgis.net/docs/RT_ST_MapAlgebraFct.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_MapAlgebraFctNgb*(*args, **kwargs)

1-band version: Map Algebra Nearest Neighbor using user-defined PostgreSQL function. Return a raster which values are the result of a PLPGSQL user function involving a neighborhood of values from the input raster band.

see http://postgis.net/docs/RT_ST_MapAlgebraFctNgb.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_Max4ma(*args, **kwargs)`
Raster processing function that calculates the maximum pixel value in a neighborhood.
see http://postgis.net/docs/RT_ST_Max4ma.html

class `geoalchemy2.functions.ST_MaxDistance(*args, **kwargs)`
Returns the 2D largest distance between two geometries in projected units.
see http://postgis.net/docs/ST_MaxDistance.html

class `geoalchemy2.functions.ST_Mean4ma(*args, **kwargs)`
Raster processing function that calculates the mean pixel value in a neighborhood.
see http://postgis.net/docs/RT_ST_Mean4ma.html

class `geoalchemy2.functions.ST_MemSize(*args, **kwargs)`
[geometry] Returns the amount of memory space a geometry takes. OR [raster] Returns the amount of space (in bytes) the raster takes.
see http://postgis.net/docs/ST_MemSize.html

class `geoalchemy2.functions.ST_MemUnion(*args, **kwargs)`
Same as `ST_Union`, only memory-friendly (uses less memory and more processor time).
see http://postgis.net/docs/ST_MemUnion.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_MetaData(*args, **kwargs)`
Returns basic meta data about a raster object such as pixel size, rotation (skew), upper, lower left, etc.
see http://postgis.net/docs/RT_ST_MetaData.html

class `geoalchemy2.functions.ST_Min4ma(*args, **kwargs)`
Raster processing function that calculates the minimum pixel value in a neighborhood.
see http://postgis.net/docs/RT_ST_Min4ma.html

class `geoalchemy2.functions.ST_MinConvexHull(*args, **kwargs)`
Return the convex hull geometry of the raster excluding NODATA pixels.
see http://postgis.net/docs/RT_ST_MinConvexHull.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_MinDist4ma(*args, **kwargs)`
Raster processing function that returns the minimum distance (in number of pixels) between the pixel of interest and a neighboring pixel with value.
see http://postgis.net/docs/RT_ST_MinDist4ma.html

class `geoalchemy2.functions.ST_MinPossibleValue(*args, **kwargs)`
Returns the minimum value this pixeltype can store.
see http://postgis.net/docs/ST_MinPossibleValue.html

class `geoalchemy2.functions.ST_MinimumBoundingCircle(*args, **kwargs)`
Returns the smallest circle polygon that can fully contain a geometry. Default uses 48 segments per quarter circle.

see http://postgis.net/docs/ST_MinimumBoundingCircle.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_MinimumBoundingRadius* (*args, **kwargs)

Returns the center point and radius of the smallest circle that can fully contain a geometry.

see http://postgis.net/docs/ST_MinimumBoundingRadius.html

class *geoalchemy2.functions.ST_MinimumClearance* (*args, **kwargs)

Returns the minimum clearance of a geometry, a measure of a geometry's robustness.

see http://postgis.net/docs/ST_MinimumClearance.html

class *geoalchemy2.functions.ST_MinimumClearanceLine* (*args, **kwargs)

Returns the two-point LineString spanning a geometry's minimum clearance.

see http://postgis.net/docs/ST_MinimumClearanceLine.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_MinkowskiSum* (*args, **kwargs)

Performs Minkowski sum

see http://postgis.net/docs/ST_MinkowskiSum.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Multi* (*args, **kwargs)

Return the geometry as a MULTI* geometry.

see http://postgis.net/docs/ST_Multi.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_NDims* (*args, **kwargs)

Returns the coordinate dimension of a geometry.

see http://postgis.net/docs/ST_NDims.html

class *geoalchemy2.functions.ST_NPoints* (*args, **kwargs)

Returns the number of points (vertices) in a geometry.

see http://postgis.net/docs/ST_NPoints.html

class *geoalchemy2.functions.ST_NRings* (*args, **kwargs)

Returns the number of rings in a polygonal geometry.

see http://postgis.net/docs/ST_NRings.html

class *geoalchemy2.functions.ST_NearestValue* (*args, **kwargs)

Returns the nearest non-NODATA value of a given band's pixel specified by a columnx and rowy or a geometric point expressed in the same spatial reference coordinate system as the raster.

see http://postgis.net/docs/RT_ST_NearestValue.html

class `geoalchemy2.functions.ST_Neighborhood(*args, **kwargs)`

Returns a 2-D double precision array of the non-NODATA values around a given band's pixel specified by either a columnX and rowY or a geometric point expressed in the same spatial reference coordinate system as the raster.

see http://postgis.net/docs/RT_ST_Neighborhood.html

class `geoalchemy2.functions.ST_Node(*args, **kwargs)`

Node a set of linestrings.

see http://postgis.net/docs/ST_Node.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_Normalize(*args, **kwargs)`

Return the geometry in its canonical form.

see http://postgis.net/docs/ST_Normalize.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_NotSameAlignmentReason(*args, **kwargs)`

Returns text stating if rasters are aligned and if not aligned, a reason why.

see http://postgis.net/docs/RT_ST_NotSameAlignmentReason.html

class `geoalchemy2.functions.ST_NumBands(*args, **kwargs)`

Returns the number of bands in the raster object.

see http://postgis.net/docs/RT_ST_NumBands.html

class `geoalchemy2.functions.ST_NumGeometries(*args, **kwargs)`

Returns the number of elements in a geometry collection.

see http://postgis.net/docs/ST_NumGeometries.html

class `geoalchemy2.functions.ST_NumInteriorRing(*args, **kwargs)`

Returns the number of interior rings (holes) of a Polygon. Alias for ST_NumInteriorRings

see http://postgis.net/docs/ST_NumInteriorRing.html

class `geoalchemy2.functions.ST_NumInteriorRings(*args, **kwargs)`

Returns the number of interior rings (holes) of a Polygon.

see http://postgis.net/docs/ST_NumInteriorRings.html

class `geoalchemy2.functions.ST_NumPatches(*args, **kwargs)`

Return the number of faces on a Polyhedral Surface. Will return null for non-polyhedral geometries.

see http://postgis.net/docs/ST_NumPatches.html

class `geoalchemy2.functions.ST_NumPoints(*args, **kwargs)`

Returns the number of points in a LineString or CircularString.

see http://postgis.net/docs/ST_NumPoints.html

class `geoalchemy2.functions.ST_OffsetCurve(*args, **kwargs)`

Return an offset line at a given distance and side from an input line. Useful for computing parallel lines about a center line

see http://postgis.net/docs/ST_OffsetCurve.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_OrderingEquals* (*args, **kwargs)

Returns true if the given geometries represent the same geometry and points are in the same directional order.

see http://postgis.net/docs/ST_OrderingEquals.html

class *geoalchemy2.functions.ST_Orientation* (*args, **kwargs)

Determine surface orientation

see http://postgis.net/docs/ST_Orientation.html

class *geoalchemy2.functions.ST_OrientedEnvelope* (*args, **kwargs)

Returns a minimum rotated rectangle enclosing a geometry.

see http://postgis.net/docs/ST_OrientedEnvelope.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Overlaps* (*args, **kwargs)

[geometry] Returns TRUE if the Geometries share space, are of the same dimension, but are not completely contained by each other. OR [raster] Return true if raster rastA and rastB intersect but one does not completely contain the other.

see http://postgis.net/docs/ST_Overlaps.html

class *geoalchemy2.functions.ST_PatchN* (*args, **kwargs)

Returns the Nth geometry (face) of a PolyhedralSurface.

see http://postgis.net/docs/ST_PatchN.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Perimeter* (*args, **kwargs)

Returns the length of the boundary of a polygonal geometry or geography.

see http://postgis.net/docs/ST_Perimeter.html

class *geoalchemy2.functions.ST_Perimeter2D* (*args, **kwargs)

Returns the 2D perimeter of a polygonal geometry. Alias for ST_Perimeter.

see http://postgis.net/docs/ST_Perimeter2D.html

class *geoalchemy2.functions.ST_PixelAsCentroid* (*args, **kwargs)

Returns the centroid (point geometry) of the area represented by a pixel.

see http://postgis.net/docs/RT_ST_PixelAsCentroid.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_PixelAsCentroids(*args, **kwargs)`
Returns the centroid (point geometry) for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The point geometry is the centroid of the area represented by a pixel.
see http://postgis.net/docs/RT_ST_PixelAsCentroids.html

class `geoalchemy2.functions.ST_PixelAsPoint(*args, **kwargs)`
Returns a point geometry of the pixel's upper-left corner.
see http://postgis.net/docs/RT_ST_PixelAsPoint.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_PixelAsPoints(*args, **kwargs)`
Returns a point geometry for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The coordinates of the point geometry are of the pixel's upper-left corner.
see http://postgis.net/docs/RT_ST_PixelAsPoints.html

class `geoalchemy2.functions.ST_PixelAsPolygon(*args, **kwargs)`
Returns the polygon geometry that bounds the pixel for a particular row and column.
see http://postgis.net/docs/RT_ST_PixelAsPolygon.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_PixelAsPolygons(*args, **kwargs)`
Returns the polygon geometry that bounds every pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel.
see http://postgis.net/docs/RT_ST_PixelAsPolygons.html

class `geoalchemy2.functions.ST_PixelHeight(*args, **kwargs)`
Returns the pixel height in geometric units of the spatial reference system.
see http://postgis.net/docs/RT_ST_PixelHeight.html

class `geoalchemy2.functions.ST_PixelOfValue(*args, **kwargs)`
Get the columnx, rowy coordinates of the pixel whose value equals the search value.
see http://postgis.net/docs/RT_ST_PixelOfValue.html

class `geoalchemy2.functions.ST_PixelWidth(*args, **kwargs)`
Returns the pixel width in geometric units of the spatial reference system.
see http://postgis.net/docs/RT_ST_PixelWidth.html

class `geoalchemy2.functions.ST_Point(*args, **kwargs)`
Creates a Point with the given coordinate values. Alias for `ST_MakePoint`.
see http://postgis.net/docs/ST_Point.html
Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_PointFromGeoHash(*args, **kwargs)`
Return a point from a GeoHash string.

see http://postgis.net/docs/ST_PointFromGeoHash.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_PointFromText* (*args, **kwargs)

Makes a point Geometry from WKT with the given SRID. If SRID is not given, it defaults to unknown.

see http://postgis.net/docs/ST_PointFromText.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_PointFromWKB* (*args, **kwargs)

Makes a geometry from WKB with the given SRID

see http://postgis.net/docs/ST_PointFromWKB.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_PointInsideCircle* (*args, **kwargs)

Is the point geometry inside the circle defined by center_x, center_y, radius

see http://postgis.net/docs/ST_PointInsideCircle.html

class *geoalchemy2.functions.ST_PointN* (*args, **kwargs)

Returns the Nth point in the first LineString or circular LineString in a geometry.

see http://postgis.net/docs/ST_PointN.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_PointOnSurface* (*args, **kwargs)

Returns a POINT guaranteed to lie on the surface.

see http://postgis.net/docs/ST_PointOnSurface.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Points* (*args, **kwargs)

Returns a MultiPoint containing all the coordinates of a geometry.

see http://postgis.net/docs/ST_Points.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Polygon* (*args, **kwargs)

[geometry] Creates a Polygon from a LineString with a specified SRID. OR [raster] Returns a multipolygon geometry formed by the union of pixels that have a pixel value that is not no data value. If no band number is specified, band num defaults to 1.

see http://postgis.net/docs/ST_Polygon.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_PolygonFromText* (*args, **kwargs)

Makes a Geometry from WKT with the given SRID. If SRID is not given, it defaults to 0.

see http://postgis.net/docs/ST_PolygonFromText.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Polygonize* (*args, **kwargs)

Aggregate. Creates a GeometryCollection containing possible polygons formed from the constituent linework of a set of geometries.

see http://postgis.net/docs/ST_Polygonize.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Project* (*args, **kwargs)

Returns a point projected from a start point by a distance and bearing (azimuth).

see http://postgis.net/docs/ST_Project.html

Return type: *geoalchemy2.types.Geography*.

type

alias of *geoalchemy2.types.Geography*

class *geoalchemy2.functions.ST_Quantile* (*args, **kwargs)

Compute quantiles for a raster or raster table coverage in the context of the sample or population. Thus, a value could be examined to be at the raster's 25%, 50%, 75% percentile.

see http://postgis.net/docs/RT_ST_Quantile.html

class *geoalchemy2.functions.ST_QuantizeCoordinates* (*args, **kwargs)

Sets least significant bits of coordinates to zero

see http://postgis.net/docs/ST_QuantizeCoordinates.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Range4ma* (*args, **kwargs)

Raster processing function that calculates the range of pixel values in a neighborhood.

see http://postgis.net/docs/RT_ST_Range4ma.html

class *geoalchemy2.functions.ST_RastFromHexWKB* (*args, **kwargs)

Return a raster value from a Hex representation of Well-Known Binary (WKB) raster.

see http://postgis.net/docs/RT_ST_RastFromHexWKB.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_RastFromWKB* (*args, **kwargs)

Return a raster value from a Well-Known Binary (WKB) raster.

see http://postgis.net/docs/RT_ST_RastFromWKB.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_RasterToWorldCoord* (*args, **kwargs)

Returns the raster's upper left corner as geometric X and Y (longitude and latitude) given a column and row. Column and row starts at 1.

see http://postgis.net/docs/RT_ST_RasterToWorldCoord.html

class *geoalchemy2.functions.ST_RasterToWorldCoordX* (*args, **kwargs)

Returns the geometric X coordinate upper left of a raster, column and row. Numbering of columns and rows starts at 1.

see http://postgis.net/docs/RT_ST_RasterToWorldCoordX.html

class *geoalchemy2.functions.ST_RasterToWorldCoordY* (*args, **kwargs)

Returns the geometric Y coordinate upper left corner of a raster, column and row. Numbering of columns and rows starts at 1.

see http://postgis.net/docs/RT_ST_RasterToWorldCoordY.html

class *geoalchemy2.functions.ST_Reclass* (*args, **kwargs)

Creates a new raster composed of band types reclassified from original. The nband is the band to be changed. If nband is not specified assumed to be 1. All other bands are returned unchanged. Use case: convert a 16BUI band to a 8BUI and so forth for simpler rendering as viewable formats.

see http://postgis.net/docs/RT_ST_Reclass.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_Relate* (*args, **kwargs)

Returns true if this Geometry is spatially related to anotherGeometry, by testing for intersections between the Interior, Boundary and Exterior of the two geometries as specified by the values in the intersectionMatrixPattern. If no intersectionMatrixPattern is passed in, then returns the maximum intersectionMatrixPattern that relates the 2 geometries.

see http://postgis.net/docs/ST_Relate.html

class *geoalchemy2.functions.ST_RelateMatch* (*args, **kwargs)

Returns true if intersectionMatrixPattern1 implies intersectionMatrixPattern2

see http://postgis.net/docs/ST_RelateMatch.html

class *geoalchemy2.functions.ST_RemovePoint* (*args, **kwargs)

Remove point from a linestring.

see http://postgis.net/docs/ST_RemovePoint.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_RemoveRepeatedPoints(*args, **kwargs)`

Returns a version of the given geometry with duplicated points removed.

see http://postgis.net/docs/ST_RemoveRepeatedPoints.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_Resample(*args, **kwargs)`

Resample a raster using a specified resampling algorithm, new dimensions, an arbitrary grid corner and a set of raster georeferencing attributes defined or borrowed from another raster.

see http://postgis.net/docs/RT_ST_Resample.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_Rescale(*args, **kwargs)`

Resample a raster by adjusting only its scale (or pixel size). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.

see http://postgis.net/docs/RT_ST_Rescale.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_Resize(*args, **kwargs)`

Resize a raster to a new width/height

see http://postgis.net/docs/RT_ST_Resize.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_Reskew(*args, **kwargs)`

Resample a raster by adjusting only its skew (or rotation parameters). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.

see http://postgis.net/docs/RT_ST_Reskew.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_Retile(*args, **kwargs)`

Return a set of configured tiles from an arbitrarily tiled raster coverage.

see http://postgis.net/docs/RT_ST_Retile.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

```

class geoalchemy2.functions.ST_Reverse(*args, **kwargs)
    Return the geometry with vertex order reversed.

    see http://postgis.net/docs/ST\_Reverse.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_Rotate(*args, **kwargs)
    Rotates a geometry about an origin point.

    see http://postgis.net/docs/ST\_Rotate.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_RotateX(*args, **kwargs)
    Rotates a geometry about the X axis.

    see http://postgis.net/docs/ST\_RotateX.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_RotateY(*args, **kwargs)
    Rotates a geometry about the Y axis.

    see http://postgis.net/docs/ST\_RotateY.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_RotateZ(*args, **kwargs)
    Rotates a geometry about the Z axis.

    see http://postgis.net/docs/ST\_RotateZ.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_Rotation(*args, **kwargs)
    Returns the rotation of the raster in radian.

    see http://postgis.net/docs/RT\_ST\_Rotation.html

class geoalchemy2.functions.ST_Roughness(*args, **kwargs)
    Returns a raster with the calculated “roughness” of a DEM.

    see http://postgis.net/docs/RT\_ST\_Roughness.html

    Return type: geoalchemy2.types.Raster.

    type
        alias of geoalchemy2.types.Raster

```

class `geoalchemy2.functions.ST_SRID(*args, **kwargs)`
[geometry] Returns the spatial reference identifier for the ST_Geometry as defined in spatial_ref_sys table. OR
[raster] Returns the spatial reference identifier of the raster as defined in spatial_ref_sys table.

see http://postgis.net/docs/ST_SRID.html

class `geoalchemy2.functions.ST_SameAlignment(*args, **kwargs)`
Returns true if rasters have same skew, scale, spatial ref, and offset (pixels can be put on same grid without cutting into pixels) and false if they don't with notice detailing issue.

see http://postgis.net/docs/RT_ST_SameAlignment.html

class `geoalchemy2.functions.ST_Scale(*args, **kwargs)`
Scales a geometry by given factors.

see http://postgis.net/docs/ST_Scale.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_ScaleX(*args, **kwargs)`
Returns the X component of the pixel width in units of coordinate reference system.

see http://postgis.net/docs/RT_ST_ScaleX.html

class `geoalchemy2.functions.ST_ScaleY(*args, **kwargs)`
Returns the Y component of the pixel height in units of coordinate reference system.

see http://postgis.net/docs/RT_ST_ScaleY.html

class `geoalchemy2.functions.ST_Segmentize(*args, **kwargs)`
Return a modified geometry/geography having no segment longer than the given distance.

see http://postgis.net/docs/ST_Segmentize.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class `geoalchemy2.functions.ST_SetBandIndex(*args, **kwargs)`
Update the external band number of an out-db band

see http://postgis.net/docs/RT_ST_SetBandIndex.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_SetBandIsNoData(*args, **kwargs)`
Sets the isnodata flag of the band to TRUE.

see http://postgis.net/docs/RT_ST_SetBandIsNoData.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_SetBandNoDataValue(*args, **kwargs)`
Sets the value for the given band that represents no data. Band 1 is assumed if no band is specified. To mark a band as having no nodata value, set the nodata value = NULL.

see http://postgis.net/docs/RT_ST_SetBandNoDataValue.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_SetBandPath* (*args, **kwargs)

Update the external path and band number of an out-db band

see http://postgis.net/docs/RT_ST_SetBandPath.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_SetEffectiveArea* (*args, **kwargs)

Sets the effective area for each vertex, storing the value in the M ordinate. A simplified geometry can then be generated by filtering on the M ordinate.

see http://postgis.net/docs/ST_SetEffectiveArea.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_SetGeoReference* (*args, **kwargs)

Set Georeference 6 georeference parameters in a single call. Numbers should be separated by white space. Accepts inputs in GDAL or ESRI format. Default is GDAL.

see http://postgis.net/docs/RT_ST_SetGeoReference.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_SetPoint* (*args, **kwargs)

Replace point of a linestring with a given point.

see http://postgis.net/docs/ST_SetPoint.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_SetRotation* (*args, **kwargs)

Set the rotation of the raster in radian.

see http://postgis.net/docs/RT_ST_SetRotation.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_SetSRID* (*args, **kwargs)

[geometry] Set the SRID on a geometry to a particular integer value. OR [raster] Sets the SRID of a raster to a particular integer srid defined in the spatial_ref_sys table.

see http://postgis.net/docs/ST_SetSRID.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_SetScale* (*args, **kwargs)
Sets the X and Y size of pixels in units of coordinate reference system. Number units/pixel width/height.

see http://postgis.net/docs/RT_ST_SetScale.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_SetSkew* (*args, **kwargs)
Sets the georeference X and Y skew (or rotation parameter). If only one is passed in, sets X and Y to the same value.

see http://postgis.net/docs/RT_ST_SetSkew.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_SetUpperLeft* (*args, **kwargs)
Sets the value of the upper left corner of the pixel of the raster to projected X and Y coordinates.

see http://postgis.net/docs/RT_ST_SetUpperLeft.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_SetValue* (*args, **kwargs)
Returns modified raster resulting from setting the value of a given band in a given columnx, rowy pixel or the pixels that intersect a particular geometry. Band numbers start at 1 and assumed to be 1 if not specified.

see http://postgis.net/docs/RT_ST_SetValue.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_SetValues* (*args, **kwargs)
Returns modified raster resulting from setting the values of a given band.

see http://postgis.net/docs/RT_ST_SetValues.html

Return type: *geoalchemy2.types.Raster*.

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_SharedPaths* (*args, **kwargs)
Returns a collection containing paths shared by the two input linestrings/multilinestrings.

see http://postgis.net/docs/ST_SharedPaths.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

```

class geoalchemy2.functions.ST_ShiftLongitude (*args, **kwargs)
    Toggle geometry coordinates between -180..180 and 0..360 ranges.

    see http://postgis.net/docs/ST\_Shift\_Longitude.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_ShortestLine (*args, **kwargs)
    Returns the 2D shortest line between two geometries

    see http://postgis.net/docs/ST\_ShortestLine.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_Simplify (*args, **kwargs)
    Returns a “simplified” version of the given geometry using the Douglas-Peucker algorithm.

    see http://postgis.net/docs/ST\_Simplify.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_SimplifyPreserveTopology (*args, **kwargs)
    Returns a “simplified” version of the given geometry using the Douglas-Peucker algorithm. Will avoid creating
    derived geometries (polygons in particular) that are invalid.

    see http://postgis.net/docs/ST\_SimplifyPreserveTopology.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_SimplifyVW (*args, **kwargs)
    Returns a “simplified” version of the given geometry using the Visvalingam-Whyatt algorithm

    see http://postgis.net/docs/ST\_SimplifyVW.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_SkewX (*args, **kwargs)
    Returns the georeference X skew (or rotation parameter).

    see http://postgis.net/docs/RT\_ST\_SkewX.html

class geoalchemy2.functions.ST_SkewY (*args, **kwargs)
    Returns the georeference Y skew (or rotation parameter).

    see http://postgis.net/docs/RT\_ST\_SkewY.html

class geoalchemy2.functions.ST_Slope (*args, **kwargs)
    Returns the slope (in degrees by default) of an elevation raster band. Useful for analyzing terrain.

    see http://postgis.net/docs/RT\_ST\_Slope.html

    Return type: geoalchemy2.types.Raster.

```

type
alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_Snap* (*args, **kwargs)
Snap segments and vertices of input geometry to vertices of a reference geometry.

see http://postgis.net/docs/ST_Snap.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_SnapToGrid* (*args, **kwargs)
[geometry] Snap all points of the input geometry to a regular grid. OR [raster] Resample a raster by snapping it to a grid. New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.

see http://postgis.net/docs/ST_SnapToGrid.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Split* (*args, **kwargs)
Returns a collection of geometries resulting by splitting a geometry.

see http://postgis.net/docs/ST_Split.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_StartPoint* (*args, **kwargs)
Returns the first point of a LineString.

see http://postgis.net/docs/ST_StartPoint.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_StdDev4ma* (*args, **kwargs)
Raster processing function that calculates the standard deviation of pixel values in a neighborhood.

see http://postgis.net/docs/RT_ST_StdDev4ma.html

class *geoalchemy2.functions.ST_StraightSkeleton* (*args, **kwargs)
Compute a straight skeleton from a geometry

see http://postgis.net/docs/ST_StraightSkeleton.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Subdivide* (*args, **kwargs)
Returns a set of geometry where no geometry in the set has more than the specified number of vertices.

see http://postgis.net/docs/ST_Subdivide.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Sum4ma* (*args, **kwargs)

Raster processing function that calculates the sum of all pixel values in a neighborhood.

see http://postgis.net/docs/RT_ST_Sum4ma.html

class *geoalchemy2.functions.ST_Summary* (*args, **kwargs)

[geometry] Returns a text summary of the contents of a geometry. OR [raster] Returns a text summary of the contents of the raster.

see http://postgis.net/docs/ST_Summary.html

class *geoalchemy2.functions.ST_SummaryStats* (*args, **kwargs)

Returns summarystats consisting of count, sum, mean, stddev, min, max for a given raster band of a raster or raster coverage. Band 1 is assumed is no band is specified.

see http://postgis.net/docs/RT_ST_SummaryStats.html

class *geoalchemy2.functions.ST_SummaryStatsAgg* (*args, **kwargs)

Aggregate. Returns summarystats consisting of count, sum, mean, stddev, min, max for a given raster band of a set of raster. Band 1 is assumed is no band is specified.

see http://postgis.net/docs/RT_ST_SummaryStatsAgg.html

class *geoalchemy2.functions.ST_SwapOrdinates* (*args, **kwargs)

Returns a version of the given geometry with given ordinate values swapped.

see http://postgis.net/docs/ST_SwapOrdinates.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_SymDifference* (*args, **kwargs)

Returns a geometry that represents the portions of A and B that do not intersect. It is called a symmetric difference because $ST_SymDifference(A,B) = ST_SymDifference(B,A)$.

see http://postgis.net/docs/ST_SymDifference.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_TPI* (*args, **kwargs)

Returns a raster with the calculated Topographic Position Index.

see http://postgis.net/docs/RT_ST_TPI.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class *geoalchemy2.functions.ST_TRI* (*args, **kwargs)

Returns a raster with the calculated Terrain Ruggedness Index.

see http://postgis.net/docs/RT_ST_TRI.html

Return type: *geoalchemy2.types.Raster*.

type

alias of *geoalchemy2.types.Raster*

class `geoalchemy2.functions.ST_Tessellate(*args, **kwargs)`
Perform surface Tessellation of a polygon or polyhedralsurface and returns as a TIN or collection of TINS
see http://postgis.net/docs/ST_Tessellate.html
Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Tile(*args, **kwargs)`
Returns a set of rasters resulting from the split of the input raster based upon the desired dimensions of the output rasters.
see http://postgis.net/docs/RT_ST_Tile.html
Return type: `geoalchemy2.types.Raster`.

type
alias of `geoalchemy2.types.Raster`

class `geoalchemy2.functions.ST_TileEnvelope(*args, **kwargs)`
Creates a rectangular Polygon in Web Mercator (SRID:3857) using the XYZ tile system.
see http://postgis.net/docs/ST_TileEnvelope.html
Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Touches(*args, **kwargs)`
[geometry] Returns TRUE if the geometries have at least one point in common, but their interiors do not intersect. OR [raster] Return true if raster rastA and rastB have at least one point in common but their interiors do not intersect.
see http://postgis.net/docs/ST_Touches.html

class `geoalchemy2.functions.ST_TransScale(*args, **kwargs)`
Translates and scales a geometry by given offsets and factors.
see http://postgis.net/docs/ST_TransScale.html
Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Transform(*args, **kwargs)`
[geometry] Return a new geometry with its coordinates transformed to a different spatial reference system. OR [raster] Reprojects a raster in a known spatial reference system to another known spatial reference system using specified resampling algorithm. Options are NearestNeighbor, Bilinear, Cubic, CubicSpline, Lanczos defaulting to NearestNeighbor.
see http://postgis.net/docs/ST_Transform.html
Return type: `geoalchemy2.types.Geometry`.

type
alias of `geoalchemy2.types.Geometry`

class `geoalchemy2.functions.ST_Translate(*args, **kwargs)`
Translates a geometry by given offsets.
see http://postgis.net/docs/ST_Translate.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_UnaryUnion* (*args, **kwargs)

Like ST_Union, but working at the geometry component level.

see http://postgis.net/docs/ST_UnaryUnion.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Union* (*args, **kwargs)

[geometry] Returns a geometry that represents the point set union of the Geometries. OR [raster] Returns the union of a set of raster tiles into a single raster composed of 1 or more bands.

see http://postgis.net/docs/ST_Union.html

Return type: *geoalchemy2.types.Geometry*.

type

alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_UpperLeftX* (*args, **kwargs)

Returns the upper left X coordinate of raster in projected spatial ref.

see http://postgis.net/docs/RT_ST_UpperLeftX.html

class *geoalchemy2.functions.ST_UpperLeftY* (*args, **kwargs)

Returns the upper left Y coordinate of raster in projected spatial ref.

see http://postgis.net/docs/RT_ST_UpperLeftY.html

class *geoalchemy2.functions.ST_Value* (*args, **kwargs)

Returns the value of a given band in a given columnx, rowy pixel or at a particular geometric point. Band numbers start at 1 and assumed to be 1 if not specified. If `exclude_nodata_value` is set to false, then all pixels include nodata pixels are considered to intersect and return value. If `exclude_nodata_value` is not passed in then reads it from metadata of raster.

see http://postgis.net/docs/RT_ST_Value.html

class *geoalchemy2.functions.ST_ValueCount* (*args, **kwargs)

Returns a set of records containing a pixel band value and count of the number of pixels in a given band of a raster (or a raster coverage) that have a given set of values. If no band is specified defaults to band 1. By default nodata value pixels are not counted. and all other values in the pixel are output and pixel band values are rounded to the nearest integer.

see http://postgis.net/docs/RT_ST_ValueCount.html

class *geoalchemy2.functions.ST_Volume* (*args, **kwargs)

Computes the volume of a 3D solid. If applied to surface (even closed) geometries will return 0.

see http://postgis.net/docs/ST_Volume.html

class *geoalchemy2.functions.ST_VoronoiLines* (*args, **kwargs)

Returns the boundaries between the cells of the Voronoi diagram constructed from the vertices of a geometry.

see http://postgis.net/docs/ST_VoronoiLines.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_VoronoiPolygons* (*args, **kwargs)
Returns the cells of the Voronoi diagram constructed from the vertices of a geometry.

see http://postgis.net/docs/ST_VoronoiPolygons.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_WKBToSQL* (*args, **kwargs)
Return a specified ST_Geometry value from Well-Known Binary representation (WKB). This is an alias name for ST_GeomFromWKB that takes no srid

see http://postgis.net/docs/ST_WKBToSQL.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_WKTToSQL* (*args, **kwargs)
Return a specified ST_Geometry value from Well-Known Text representation (WKT). This is an alias name for ST_GeomFromText

see http://postgis.net/docs/ST_WKTToSQL.html

Return type: *geoalchemy2.types.Geometry*.

type
alias of *geoalchemy2.types.Geometry*

class *geoalchemy2.functions.ST_Width* (*args, **kwargs)
Returns the width of the raster in pixels.

see http://postgis.net/docs/RT_ST_Width.html

class *geoalchemy2.functions.ST_Within* (*args, **kwargs)
[geometry] Returns true if the geometry A is completely inside geometry B OR [raster] Return true if no points of raster rastA lie in the exterior of raster rastB and at least one point of the interior of rastA lies in the interior of rastB.

see http://postgis.net/docs/ST_Within.html

class *geoalchemy2.functions.ST_WorldToRasterCoord* (*args, **kwargs)
Returns the upper left corner as column and row given geometric X and Y (longitude and latitude) or a point geometry expressed in the spatial reference coordinate system of the raster.

see http://postgis.net/docs/RT_ST_WorldToRasterCoord.html

class *geoalchemy2.functions.ST_WorldToRasterCoordX* (*args, **kwargs)
Returns the column in the raster of the point geometry (pt) or a X and Y world coordinate (xw, yw) represented in world spatial reference system of raster.

see http://postgis.net/docs/RT_ST_WorldToRasterCoordX.html

class *geoalchemy2.functions.ST_WorldToRasterCoordY* (*args, **kwargs)
Returns the row in the raster of the point geometry (pt) or a X and Y world coordinate (xw, yw) represented in world spatial reference system of raster.

see http://postgis.net/docs/RT_ST_WorldToRasterCoordY.html

```

class geoalchemy2.functions.ST_WrapX(*args, **kwargs)
    Wrap a geometry around an X value.

    see http://postgis.net/docs/ST\_WrapX.html

    Return type: geoalchemy2.types.Geometry.

    type
        alias of geoalchemy2.types.Geometry

class geoalchemy2.functions.ST_X(*args, **kwargs)
    Returns the X coordinate of a Point.

    see http://postgis.net/docs/ST\_X.html

class geoalchemy2.functions.ST_XMax(*args, **kwargs)
    Returns the X maxima of a 2D or 3D bounding box or a geometry.

    see http://postgis.net/docs/ST\_XMax.html

class geoalchemy2.functions.ST_XMin(*args, **kwargs)
    Returns the X minima of a 2D or 3D bounding box or a geometry.

    see http://postgis.net/docs/ST\_XMin.html

class geoalchemy2.functions.ST_Y(*args, **kwargs)
    Returns the Y coordinate of a Point.

    see http://postgis.net/docs/ST\_Y.html

class geoalchemy2.functions.ST_YMax(*args, **kwargs)
    Returns the Y maxima of a 2D or 3D bounding box or a geometry.

    see http://postgis.net/docs/ST\_YMax.html

class geoalchemy2.functions.ST_YMin(*args, **kwargs)
    Returns the Y minima of a 2D or 3D bounding box or a geometry.

    see http://postgis.net/docs/ST\_YMin.html

class geoalchemy2.functions.ST_Z(*args, **kwargs)
    Returns the Z coordinate of a Point.

    see http://postgis.net/docs/ST\_Z.html

class geoalchemy2.functions.ST_ZMax(*args, **kwargs)
    Returns the Z maxima of a 2D or 3D bounding box or a geometry.

    see http://postgis.net/docs/ST\_ZMax.html

class geoalchemy2.functions.ST_ZMin(*args, **kwargs)
    Returns the Z minima of a 2D or 3D bounding box or a geometry.

    see http://postgis.net/docs/ST\_ZMin.html

class geoalchemy2.functions.ST_Zmflag(*args, **kwargs)
    Returns a code indicating the ZM coordinate dimension of a geometry.

    see http://postgis.net/docs/ST\_Zmflag.html

class geoalchemy2.functions.TableRowElement(selectable)

class geoalchemy2.functions.UnlockRows(*args, **kwargs)
    Removes all locks held by an authorization token.

    see http://postgis.net/docs/UnlockRows.html

```

class `geoalchemy2.functions.UpdateGeometrySRID(*args, **kwargs)`

Updates the SRID of all features in a geometry column, and the table metadata.

see <http://postgis.net/docs/UpdateGeometrySRID.html>

class `geoalchemy2.functions.postgis_sfcgal_version(*args, **kwargs)`

Returns the version of SFCGAL in use

see http://postgis.net/docs/postgis_sfcgal_version.html

6.4 Spatial Operators

This module defines a `Comparator` class for use with geometry and geography objects. This is where spatial operators, like `&&`, `&<`, are defined. Spatial operators very often apply to the bounding boxes of geometries. For example, `geom1 && geom2` indicates if `geom1`'s bounding box intersects `geom2`'s.

6.4.1 Examples

Select the objects whose bounding boxes are to the left of the bounding box of `POLYGON((-5 45,5 45,5 -45,-5 -45,-5 45))`:

```
select([table]).where(table.c.geom.to_left(
    'POLYGON((-5 45,5 45,5 -45,-5 -45,-5 45))')
```

The `<<` and `>>` operators are a bit specific, because they have corresponding Python operator (`__lshift__` and `__rshift__`). The above `SELECT` expression can thus be rewritten like this:

```
select([table]).where(
    table.c.geom << 'POLYGON((-5 45,5 45,5 -45,-5 -45,-5 45))')
```

Operators can also be used when using the ORM. For example:

```
Session.query(Cls).filter(
    Cls.geom << 'POLYGON((-5 45,5 45,5 -45,-5 -45,-5 45))')
```

Now some other examples with the `<#>` operator.

Select the ten objects that are the closest to `POINT(0 0)` (typical closed neighbors problem):

```
select([table]).order_by(table.c.geom.distance_box('POINT(0 0)')).limit(10)
```

Using the ORM:

```
Session.query(Cls).order_by(Cls.geom.distance_box('POINT(0 0)')).limit(10)
```

6.4.2 Reference

class `geoalchemy2.comparator.BaseComparator(expr)`

Bases: `sqlalchemy.sql.type_api.Comparator`

A custom comparator base class. It adds the ability to call spatial functions on columns that use this kind of comparator. It also defines functions that map to operators supported by Geometry, Geography and Raster columns.

This comparator is used by the `geoalchemy2.types.Raster`.

__weakref__

list of weak references to the object (if defined)

intersects (*other*)

The && operator. A's BBOX intersects B's.

overlaps_or_to_left (*other*)

The &< operator. A's BBOX overlaps or is to the left of B's.

overlaps_or_to_right (*other*)

The &> operator. A's BBOX overlaps or is to the right of B's.

class geoalchemy2.comparator.**Comparator** (*expr*)

Bases: *geoalchemy2.comparator.BaseComparator*

A custom comparator class. Used in *geoalchemy2.types.Geometry* and *geoalchemy2.types.Geography*.

This is where spatial operators like << and <-> are defined.

__lshift__ (*other*)

The << operator. A's BBOX is strictly to the left of B's. Same as `to_left`, so:

```
table.c.geom << 'POINT(1 2)'
```

is the same as:

```
table.c.geom.to_left('POINT(1 2)')
```

__rshift__ (*other*)

The >> operator. A's BBOX is strictly to the right of B's. Same as `to_right`, so:

```
table.c.geom >> 'POINT(1 2)'
```

is the same as:

```
table.c.geom.to_right('POINT(1 2)')
```

above (*other*)

The |>> operator. A's BBOX is strictly above B's.

below (*other*)

The <<| operator. A's BBOX is strictly below B's.

contained (*other*)

The @ operator. A's BBOX is contained by B's.

contains (*other*, ***kw*)

The ~ operator. A's BBOX contains B's.

distance_box (*other*)

The <#> operator. The distance between bounding box of two geometries.

distance_centroid (*other*)

The <-> operator. The distance between two points.

overlaps_or_above (*other*)

The |&> operator. A's BBOX overlaps or is above B's.

overlaps_or_below (*other*)

The &<| operator. A's BBOX overlaps or is below B's.

same (*other*)

The `~=` operator. A's BBOX is the same as B's.

to_left (*other*)

The `<<` operator. A's BBOX is strictly to the left of B's.

to_right (*other*)

The `>>` operator. A's BBOX is strictly to the right of B's.

6.5 Shapely Integration

CHAPTER 7

Development

The code is available on GitHub: <https://github.com/geoalchemy/geoalchemy2>.

Contributors:

- Adrien Berchet (<https://github.com/adrien-berchet>)
- Éric Lemoine (<https://github.com/elemoine>)
- Dolf Andringa (<https://github.com/dolfandringa>)
- Frédéric Junod, Camptocamp SA (<https://github.com/fredj>)
- ijl (<https://github.com/ijl>)
- Loïc Gasser (<https://github.com/loicgasser>)
- Marcel Radischat (<https://github.com/quiqua>)
- rapto (<https://github.com/rapto>)
- Serge Bouchut (<https://github.com/SergeBouchut>)
- Tobias Bieniek (<https://github.com/Turbo87>)
- Tom Payne (<https://github.com/twpayne>)

Many thanks to Mike Bayer for his guidance and support! He also [fostered](#) the birth of GeoAlchemy 2.

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