

Introduce OpenStreetMap (OSM) resources

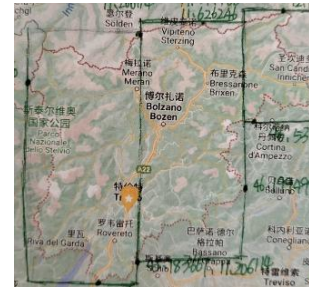
OSM is a freely available and open geographic database that is maintained through public collaboration by volunteers. OSM provides geographical information in the world, about multiple types of places: natural places, traffic places, transportation places, places of worship, points of interest, railways, roads, and more.

Two formal resources:

- Knowledge resource: [Trentino Territory Lightweight Ontology](#)
- Data resource: [Trentino OSM Data](#)

Get Trentino OSM Data

1. [nord-est-latest-free.shp.zip](#) from [Geofabrik](#), which contains the OSM data of the places in the northeastern region of Italy.
2. Extract OSM data specific to **Trentino** by limiting coordinates.
3. **Segregate** the extracted Trentino OSM data based on 'fclass' property values, into more than 700 files.



Algorithm 1 Keep Trentino places in OSM place tables

Input: OSM place tables T_1, T_2, \dots, T_{18}
Output: Updated T_1, T_2, \dots, T_{18} with only places in Trentino

```

1: for each table  $T_j$  in  $[T_1, T_2, \dots, T_{18}]$  do
2:   for each place  $p_i$  in  $T_j$  do
3:     if  $(46.671853 \leq p_i.latitude \leq 46.971215$  and  $10.381315 \leq p_i.longitude \leq 11.206114)$  or  $(45.783669 \leq p_i.latitude \leq 47.014468$  and  $11.206114 \leq p_i.longitude \leq 11.962911)$  or  $(46.531540 \leq p_i.latitude \leq 47.094276$  and  $11.962911 \leq p_i.longitude \leq 12.478587)$  then
4:       Keep  $p_i$  in  $T_j$ 
5:     else
6:       Delete  $p_i$  in  $T_j$ 
7:     end if
8:   end for
9: end for

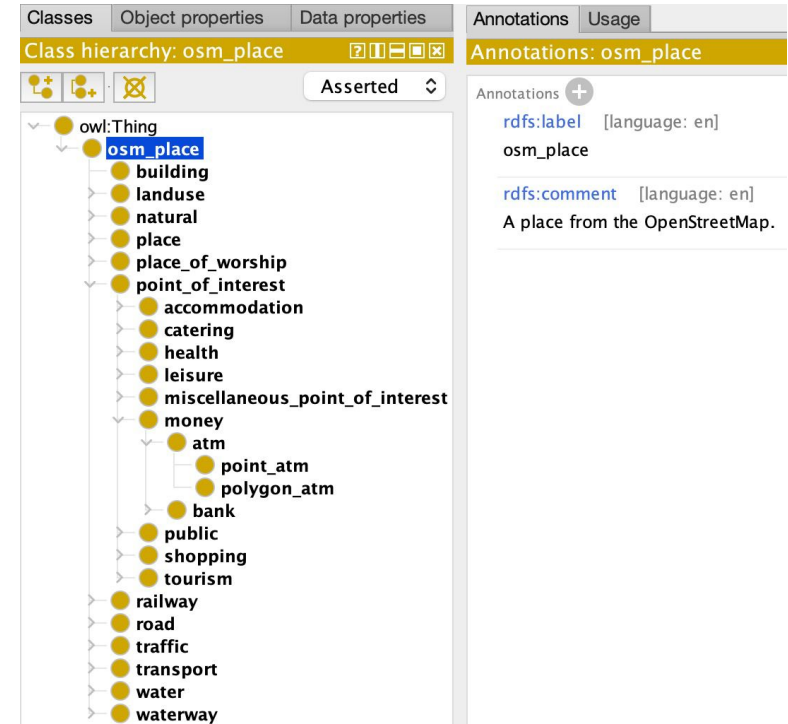
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| gid | osm_id | code | fclass | name | coordinates |
|-------|------------|------|----------|--------------------------|------------------------------|
| 36635 | 1804964023 | 2007 | library | Biblioteca comunale | POINT(10.844404 45.3535351) |
| 36636 | 1804965404 | 2601 | bank | Banca popolare di Verona | POINT(10.8451813 45.3524825) |
| 36637 | 1804966787 | 2101 | pharmacy | Farmacia Al Giglio | POINT(10.8442767 45.3520303) |

- Knowledge source: Trentino Territory Lightweight Ontology (organize these separated files)

A tree structure in Protégé, designed based on the [OpenStreetMap Data in Layered GIS Format](#) standard.

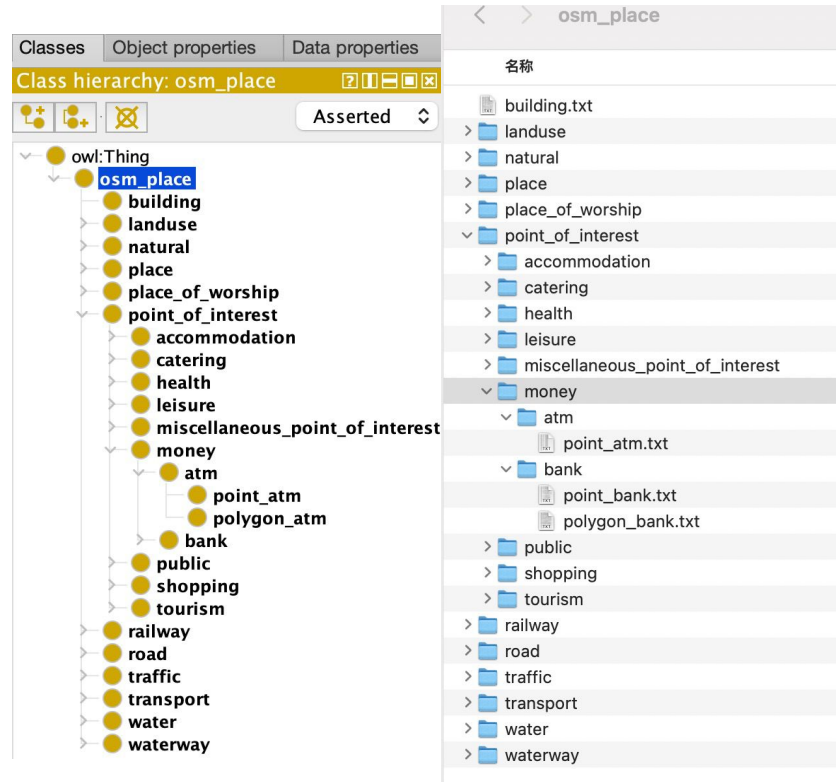
Trentino Territory Lightweight Ontology serves as a comprehensive representation of classes and hierarchical structures of OSM places.



The screenshot displays the Protégé ontology editor interface. The top navigation bar includes tabs for 'Classes', 'Object properties', 'Data properties', 'Annotations', and 'Usage'. The 'Classes' tab is active, showing a 'Class hierarchy: osm_place' view. The hierarchy is rooted at 'owl:Thing' and includes the following classes: 'osm_place', 'building', 'landuse', 'natural', 'place', 'place_of_worship', 'point_of_interest', 'accommodation', 'catering', 'health', 'leisure', 'miscellaneous_point_of_interest', 'money', 'atm', 'point_atm', 'polygon_atm', 'bank', 'public', 'shopping', 'tourism', 'railway', 'road', 'traffic', 'transport', 'water', and 'waterway'. The 'Annotations' panel on the right shows two annotations for 'osm_place': 'rdfs:label [language: en] osm_place' and 'rdfs:comment [language: en] A place from the OpenStreetMap.' The 'Usage' panel is currently empty.

Organize Trentino OSM files according to the Trentino Territory Lightweight Ontology.

Each .txt file corresponds to class in the ontology. However, not all classes have corresponding .txt files. For example, none polygon_atm or volcano was recorded in OSM Trentino data.



The screenshot displays an ontology editor interface. On the left, a class hierarchy for 'osm_place' is shown under 'owl:Thing'. The classes listed are: osm_place, building, landuse, natural, place, place_of_worship, point_of_interest, accommodation, catering, health, leisure, miscellaneous_point_of_interest, money, atm, point_atm, polygon_atm, bank, public, shopping, tourism, railway, road, traffic, transport, water, and waterway. The 'osm_place' class is highlighted in blue. On the right, a file explorer view shows the directory structure for 'osm_place'. The files listed are: building.txt, landuse, natural, place, place_of_worship, point_of_interest, accommodation, catering, health, leisure, miscellaneous_point_of_interest, money, atm, point_atm.txt, bank, point_bank.txt, polygon_bank.txt, public, shopping, tourism, railway, road, traffic, transport, water, and waterway. The 'money' directory is expanded, showing its sub-directories and files.

Trentino OSM Data contains 3 types of places

osm_place

- 名称
- lanause
- natural
- place
- place_of_worship
- ▾ point_of_interest
 - accommodation
 - catering
 - health
 - leisure
 - miscellaneous_point_of_interest
 - ▾ money
 - ▾ atm
 - point_atm.txt
 - ▾ bank
 - point_bank.txt
 - polygon_bank.txt
 - public
 - shopping
 - tourism
 - ▾ railway
 - funicular.txt
 - light_rail.txt
 - narrow_gauge.txt
 - rail.txt
 - road
 - traffic
 - transport
 - water
 - waterway

point_bank.txt

| gid | osm_id | code | fclass | name | coordinates |
|-----|-----------|------|--------|---------------------------------|------------------------------|
| 60 | 123394942 | 2601 | bank | Raiffeisenbank | POINT(11.2281773 46.783607) |
| 272 | 260574743 | 2601 | bank | Cassa Rurale di Fiemme | POINT(11.4166247 46.2728226) |
| 459 | 269195999 | 2601 | bank | Cassa Rurale Pinetana | POINT(11.2360509 46.0996773) |
| 482 | 269388604 | 2601 | bank | Cassa Rurale Alta Valsugana | POINT(11.2450236 46.130743) |
| 490 | 269608639 | 2601 | bank | Unicredit | POINT(11.2481673 46.1335919) |
| 505 | 269955387 | 2601 | bank | Unicredit | POINT(11.599287 46.3139814) |
| 717 | 277387602 | 2601 | bank | \N | POINT(11.2150509 46.0854364) |
| 785 | 279714484 | 2601 | bank | Raiffeisenkass-Cassa Raiffeisen | POINT(12.2225643 46.322045) |

rail.txt

| gid | osm_id | code | fclass | name | layer | bridge | tunnel | coordinates |
|-----|---|------|--------|---|-------|--------|--------|-------------|
| 50 | 19832379 | 6101 | rail | Pustertalbahn - Ferrovia della Val Pusteria | | | 0 | F |
| F | MULTILINESTRING((12.097182 46.7585459,12.0979286 46.7579423,12.0984832 46.757448,12.0990983 46.7568556,12.0995424 46.7564258,12.0997455 46.7562689,12.0999954 46.7561259,12.1002818 46.7559501,12.1005853 46.7558223,12.1009524 46.7556906,12.1012534 46.7555854,12.1015237 46.7554968,12.1017772 46.7554084,12.1020154 46.7552958,12.1022603 46.7551657,12.10247 46.7550372,12.1026589 46.7549057,12.1028829 46.7547221,12.1031296 46.7545156,12.1034123 46.7542671)) | | | | | | | |
| 56 | 22868840 | 6101 | rail | Brennerbahn - Ferrovia del Brennero | | | -1 | F |
| T | MULTILINESTRING((11.3932089 46.9523887,11.3931061 46.9532359,11.3931128 46.9540107,11.3932098 46.9547694,11.3933819 46.9556361,11.3936428 46.9565417,11.3942998 46.9576891,11.3951573 46.9585874,11.3961345 46.9594473,11.3976183 46.9604451,11.3992784 46.9611998,11.4015536 46.9617841,11.404264 46.962055,11.4068927 46.9618981,11.4176009 46.9608166,11.419659 46.9606117,11.420848 46.9605742,11.4217685 46.9606035,11.4244168 46.9610024,11.427034 46.9616163,11.4325736 46.9631956,11.4367873 46.9644118,11.4487328 46.9677842,11.4580923 46.9704984,11.4627583 46.9718147,11.4649264 46.9722863,11.4720559 46.9736615,11.4741692 46.9740893,11.4760229 46.9744644)) | | | | | | | |

polygon_bank.txt

| gid | osm_id | code | fclass | name | coordinates |
|------|----------|------|--------|---|--|
| 7163 | 39915038 | 2601 | bank | Banca di Trento e Bolzano | MULTIPOLYGON(((11.2418733 46.06183,11.2420377 46.0619229,11.2421451 46.0618313,11.2419807 46.0617384,11.2418733 46.06183))) |
| 7647 | 42978366 | 2601 | bank | Sudtiroler Volksbank/Banca Popolare dell'Alto Adige | MULTIPOLYGON(((11.3464154 46.4877244,11.3465114 46.4879059,11.3465796 46.4878887,11.3465759 46.4878767,11.3466084 46.4878688,11.3465389 46.4877387,11.3466093 46.4877185,11.3465932 46.4876801,11.3464154 46.4877244))) |
| 8745 | 59272536 | 2601 | bank | Banca Popolare del Trentino | MULTIPOLYGON(((11.7687287 46.477441,11.7688642 46.4774449,11.768875 46.4772658,11.7687396 46.4772619,11.7687287 46.477441))) |
| 9472 | 64551435 | 2601 | bank | Cassa Rurale di Fiemme | MULTIPOLYGON(((11.4344524 46.2798308,11.4345015 46.2799674,11.4346574 46.2799406,11.4346082 46.279804,11.4344524 46.2798308))) |
| 9911 | 69407719 | 2601 | bank | Volksbank | MULTIPOLYGON(((11.1587798 46.6725252,11.1587896 46.6726167,11.1587907 46.6726268,11.1587963 46.6726267,11.1588252 46.6726264,11.1588272 46.6726086,11.1591231 46.6726106,11.1591229 46.6726198,11.1592173 46.6726184,11.1593351 46.6726168,11.1593353 46.6726281,11.1594012 46.6726285,11.1594001 46.6726237,11.1593076 46.6725871,11.1591911 46.6725806,11.1591912 46.6725804,11.1591042 46.6725836,11.1591042 46.6725855,11.159069 46.6725853,11.1588375 46.6725804,11.1587798 46.6725252))) |

[OpenStreetMap Data in Layered GIS Format](#) provides details of most properties.

Knowdive Research Group

The selection of files should be guided by the specific research objectives. This ensures that the data used is most relevant and conducive to the study at hand.

Example: Composing Trentino Transportation Facilities and Transportation Ways.

