

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

```

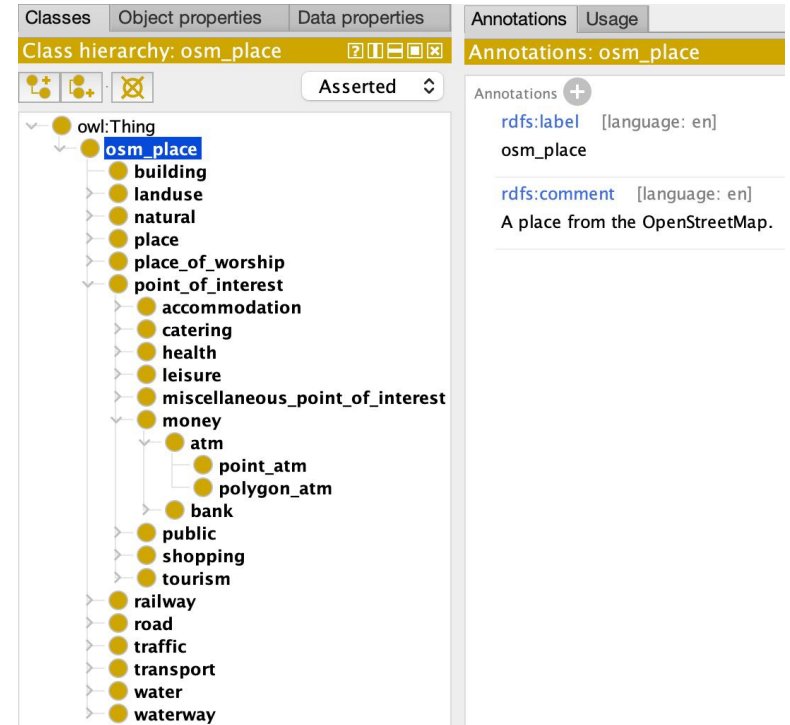
1: for each table  $T_j$  in  $[T_1, T_2, \dots, T_{18}]$  do
2:   for each place  $p_i$  in  $T_j$  do
3:     if  $(46.671853 \leq p_i.latitude \leq 46.971215 \text{ and } 10.381315 \leq p_i.longitude \leq 11.206114)$  or  $(45.783669 \leq p_i.latitude \leq 47.014468 \text{ and } 11.206114 \leq p_i.longitude \leq 11.962911)$  or  $(46.531540 \leq p_i.latitude \leq 47.094276 \text{ and } 11.962911 \leq p_i.longitude \leq 12.478587)$  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
  
```

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.

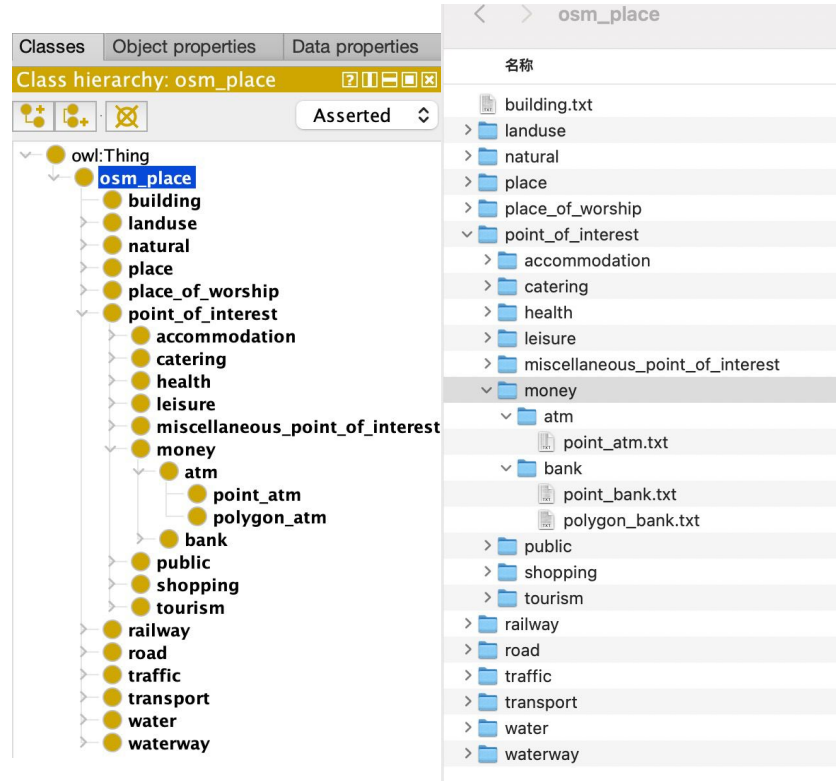
Trentino Territory Lightweight Ontology serves as a comprehensive representation of classes and hierarchical structures of OSM places.



The screenshot displays the Protégé ontology editor interface. The top tabs include 'Classes', 'Object properties', 'Data properties', 'Annotations', and 'Usage'. The 'Classes' tab is active, showing a 'Class hierarchy: osm_place'. The hierarchy is a tree structure starting from 'owl:Thing' and branching into 'osm_place'. Under 'osm_place', there are several subclasses: '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' tab is also visible, showing 'Annotations: osm_place' with two annotations: 'rdfs:label [language: en] osm_place' and 'rdfs:comment [language: en] A place from the OpenStreetMap.'.

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.



Trentino OSM Data contains 3 types of places

osm_place		point_bank.txt	
名称		gid	osm_id code fclass name coordinates
> lanouse		60	123394942 2601 bank Raiffeisenbank POINT(11.2281773 46.783607)
> natural		272	260574743 2601 bank Cassa Rurale di Fiemme POINT(11.4166247 46.2728226)
> place		459	269195999 2601 bank Cassa Rurale Pinetana POINT(11.2360509 46.0996773)
> place_of_worship		482	269388604 2601 bank Cassa Rurale Alta Valsugana POINT(11.2450236 46.130743)
> point_of_interest		490	269608639 2601 bank Unicredit POINT(11.2481673 46.1335919)
> accommodation		505	269955387 2601 bank Unicredit POINT(11.599287 46.3139814)
> catering		717	277387602 2601 bank \N POINT(11.2150509 46.0854364)
> health		785	279714484 2601 bank Raiffeisenkass-Cassa Raiffeisen POINT(12.2225643 46.733045)
> leisure		gid	osm_id code fclass name layer bridge tunnel coordinates
> miscellaneous_point_of_interest		50	19832379 6101 rail Pustertalbahn - Ferrovia della Val Pusteria 0 F
> money		F	MULTILINESTRING((12.097182 46.7585459,12.0979286 46.7579423,12.0984832 46.757448,12.0990903 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))
> atm		56	22868840 6101 rail Brennerbahn - Ferrovia del Brennero -1 F
> point_atm.txt		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))
> bank		gid	osm_id code fclass name coordinates
> point_bank.txt		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)))
> polygon_bank.txt		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)))
> public		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)))
> shopping		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)))
> tourism		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 46.6726285,11.159401 46.6726237,11.1593976 46.6725871,11.1591911 46.672506,11.1591912 46.6725042,11.1591042 46.6725036,11.1591042 46.6725855,11.159069 46.6725853,11.1588375 46.672504,11.1587798 46.6725252)))
> road		11554	81637553 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)))
> traffic		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 46.6726285,11.159401 46.6726237,11.1593976 46.6725871,11.1591911 46.672506,11.1591912 46.6725042,11.1591042 46.6725036,11.1591042 46.6725855,11.159069 46.6725853,11.1588375 46.672504,11.1587798 46.6725252)))
> transport		11554	81637553 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)))
> water		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 46.6726285,11.159401 46.6726237,11.1593976 46.6725871,11.1591911 46.672506,11.1591912 46.6725042,11.1591042 46.6725036,11.1591042 46.6725855,11.159069 46.6725853,11.1588375 46.672504,11.1587798 46.6725252)))
> waterway		11554	81637553 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)))

[OpenStreetMap Data in Layered GIS Format](#)

provides details of most properties.

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.

