DeepTags: Integration of Various VGI Sources Towards Enhanced Data Quality

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Outline

- Volunteered Geographic Information (VGI)
- Deep Learning
- Tagging-Matching-Enhancement (TME)
- Scenarios
- Future Work

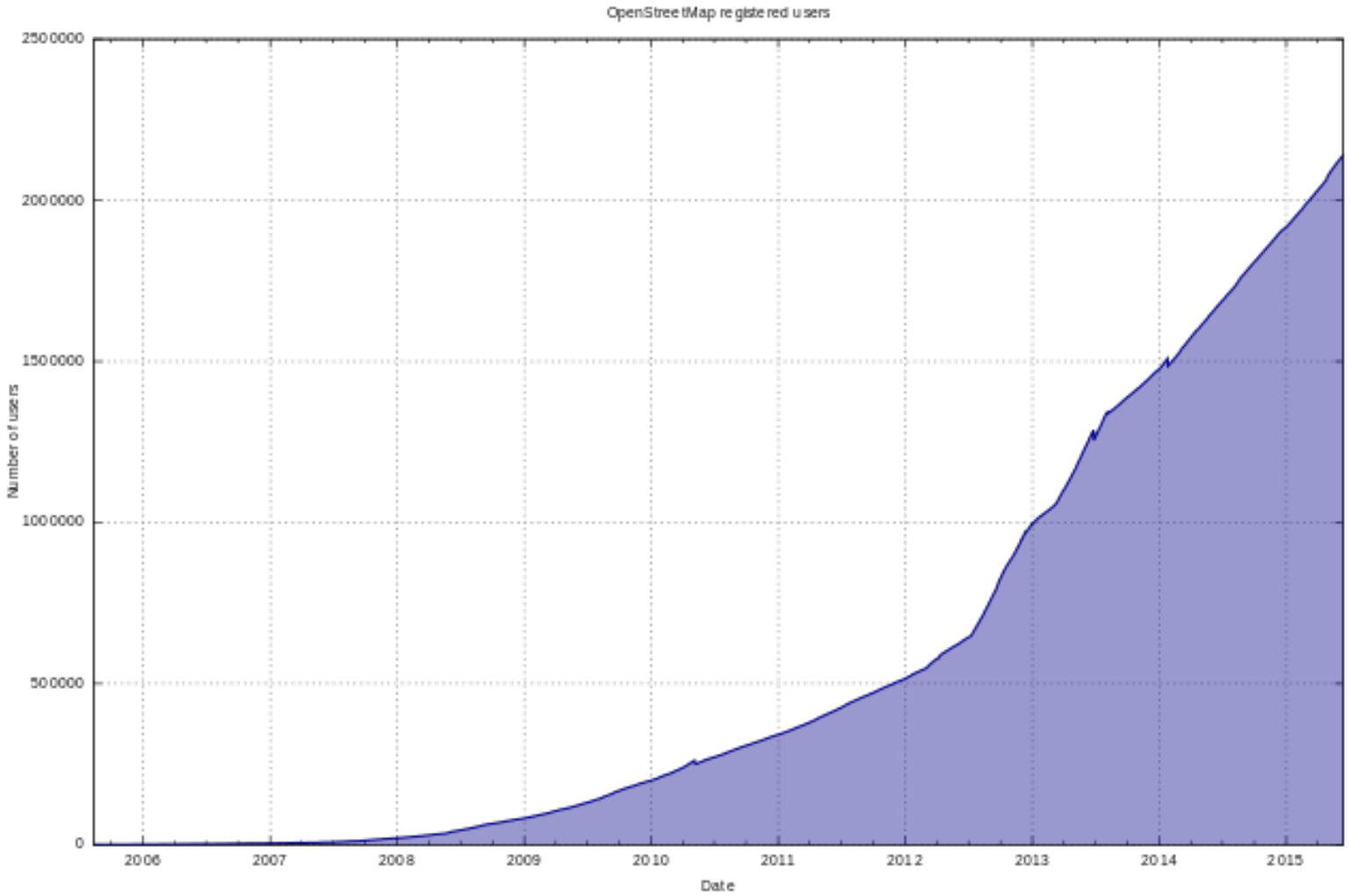
Volunteered Geographic Information (VGI)

flickr™

OpenStreetMap

Mapillary

OpenStreetMap(OSM)



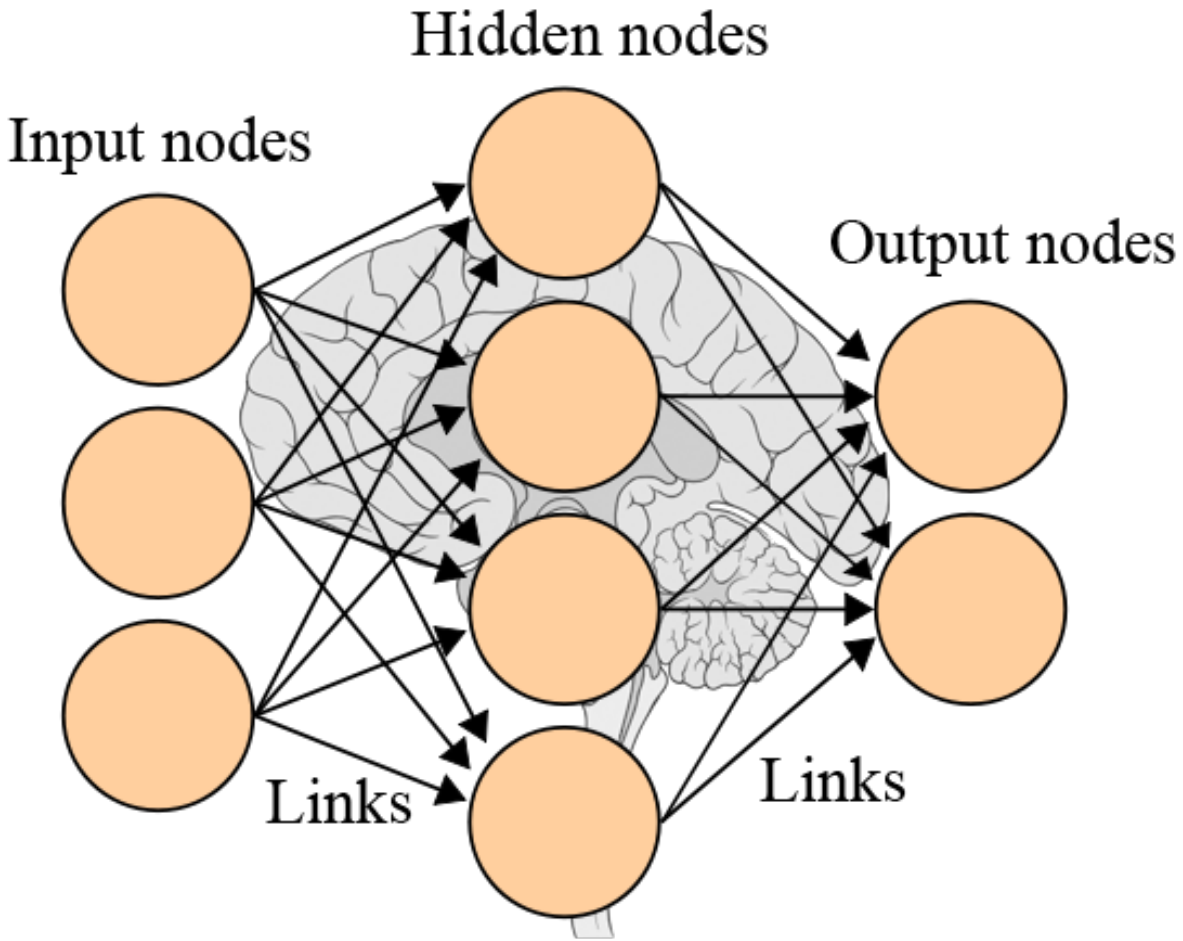
https://en.wikipedia.org/wiki/OpenStreetMap

Deep Learning

- What is deep learning?

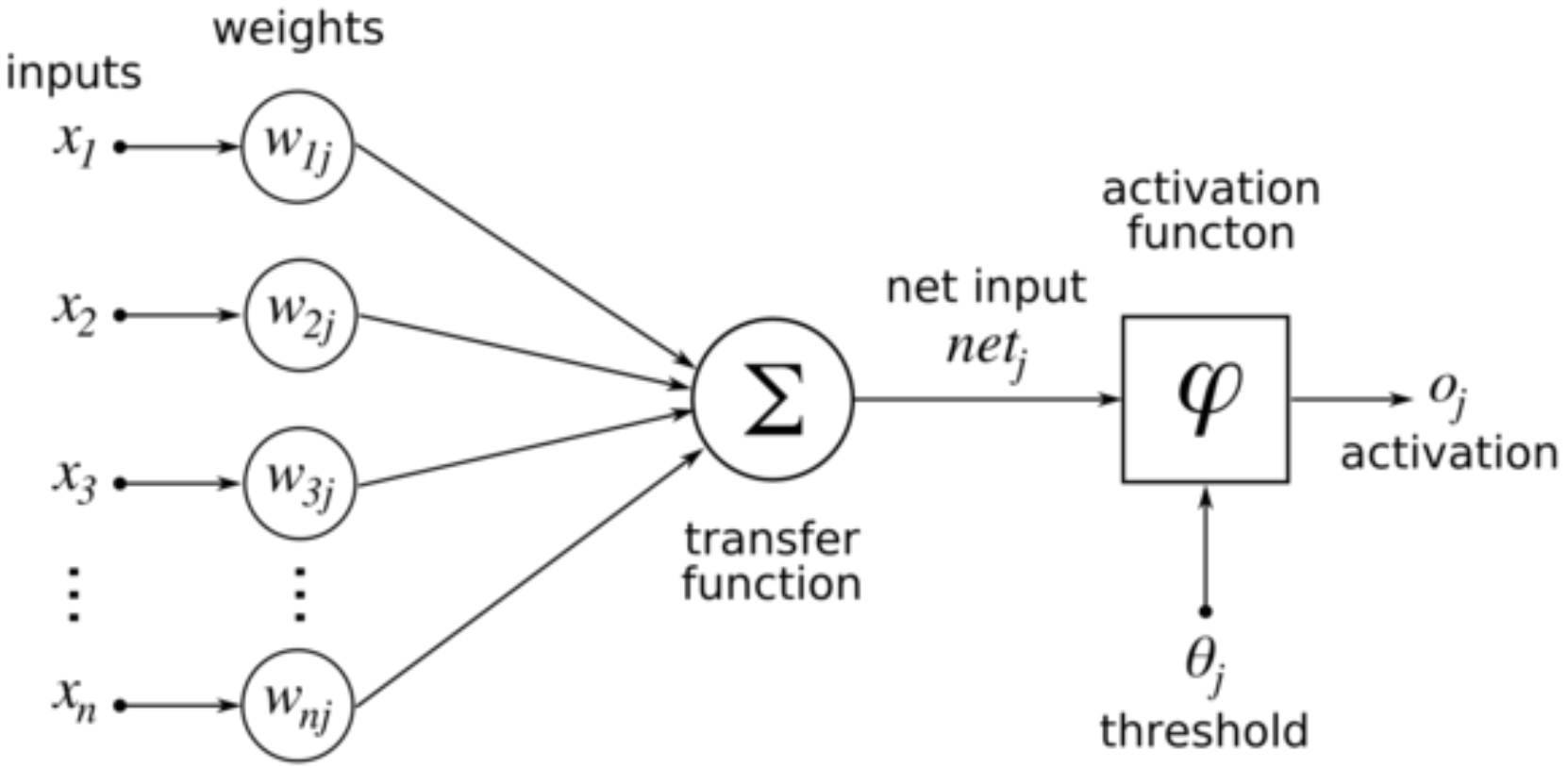
A rebranding of Artificial Neural Networks (ANN)

Artificial Neural Networks (ANN)



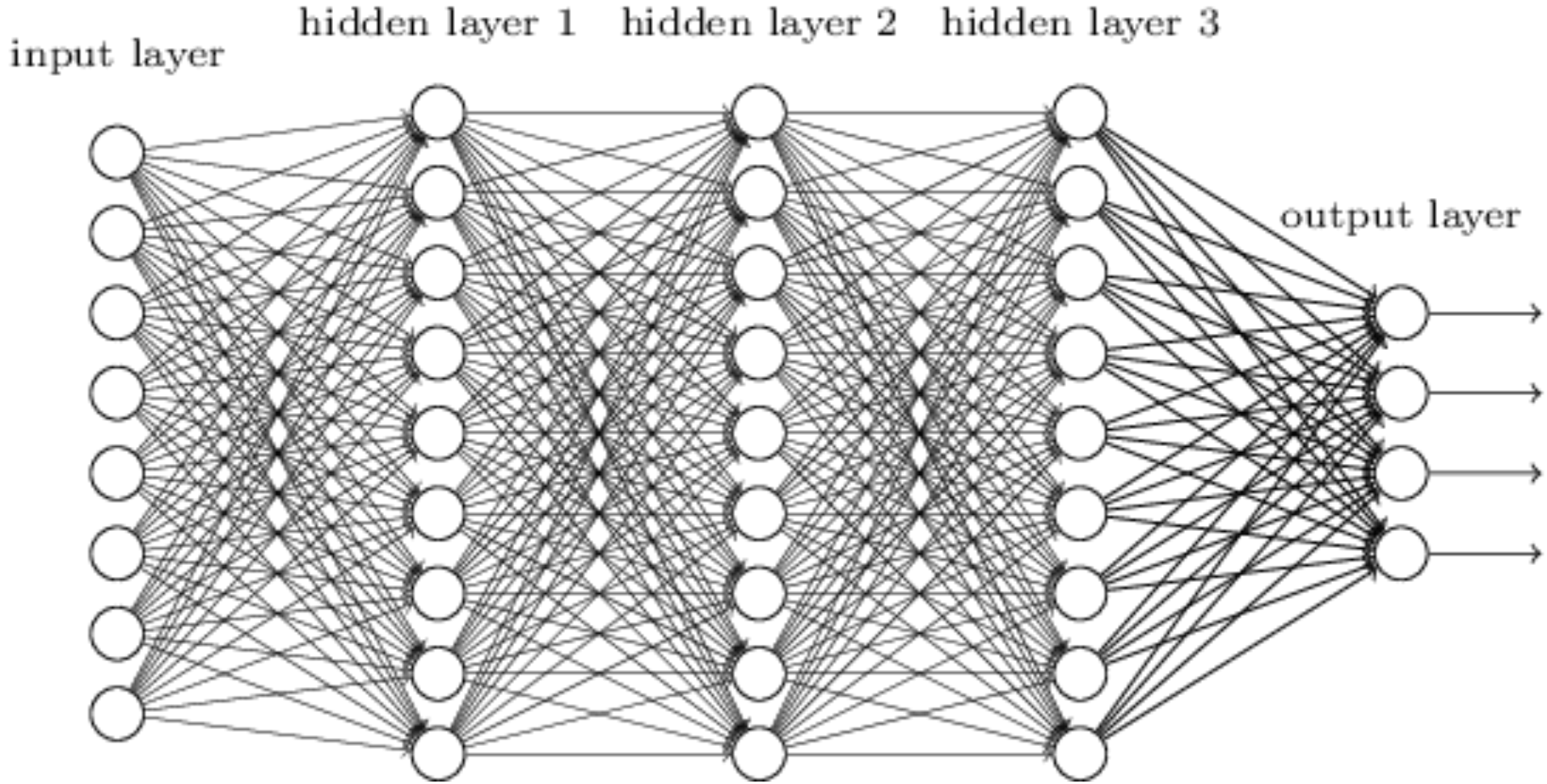
http://futurehumanevolution.com/artificial-intelligence-future-human-evolution/introduction-to-artificial-intelligence

Artificial Neural Networks (ANN)



https://upload.wikimedia.org/wikipedia/commons/thumb/6/60/ArtificialNeuronModel_english.png/600px-ArtificialNeuronModel_english.png

Deep Artificial Neural Networks (ANN) == **Deep** Learning

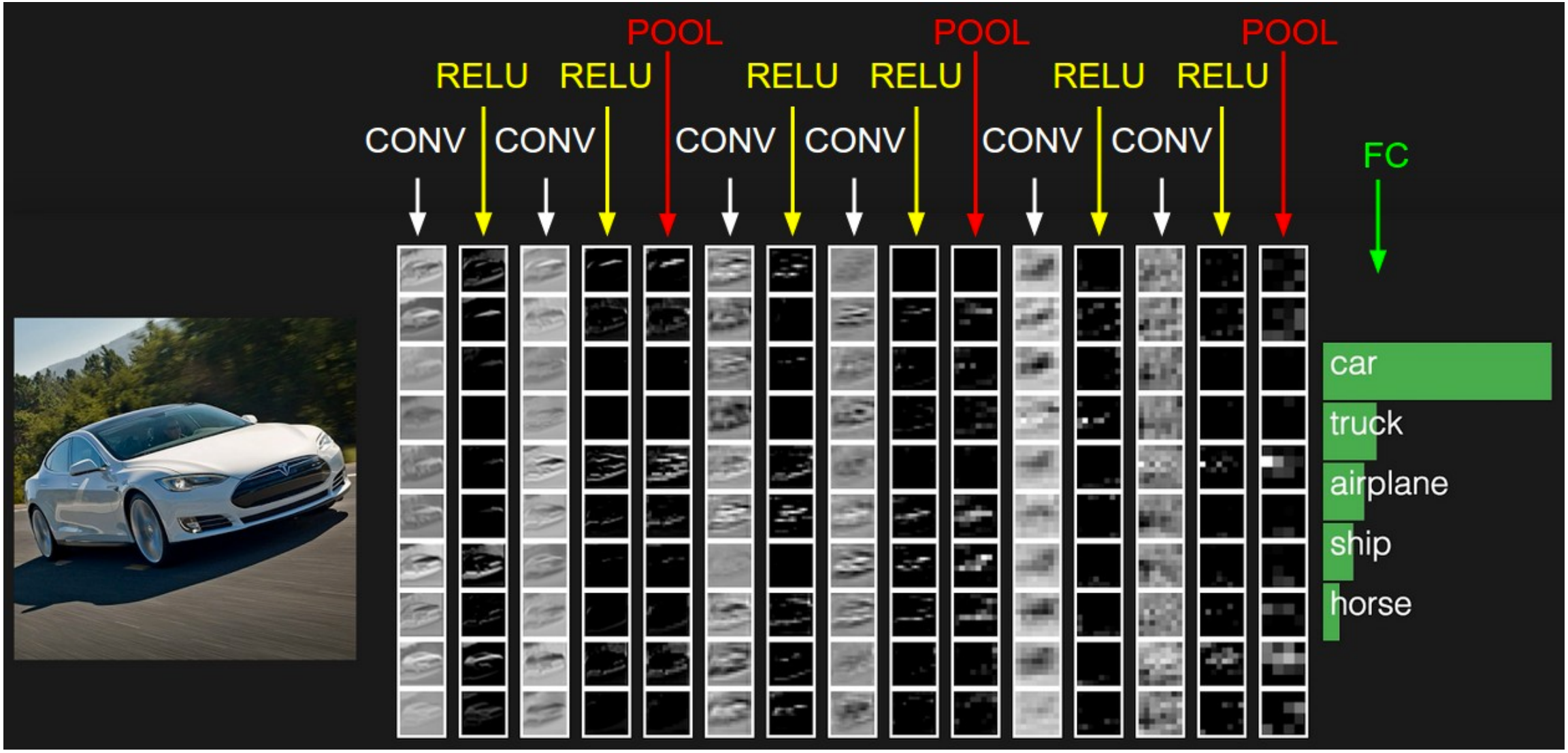


From http://neuralnetworksanddeeplearning.com/images/tikz41.png

Deep Learning Applications

- Computer Vision:
  - Autonomous Driving
  - **Images Classification**
- Natural Language Processing:
  - Text classification
  - Word2Vec
  - Text Translation
- Etc …

Example: Convolutional Neural Networks



From http://cs231n.github.io/convolutional-networks/

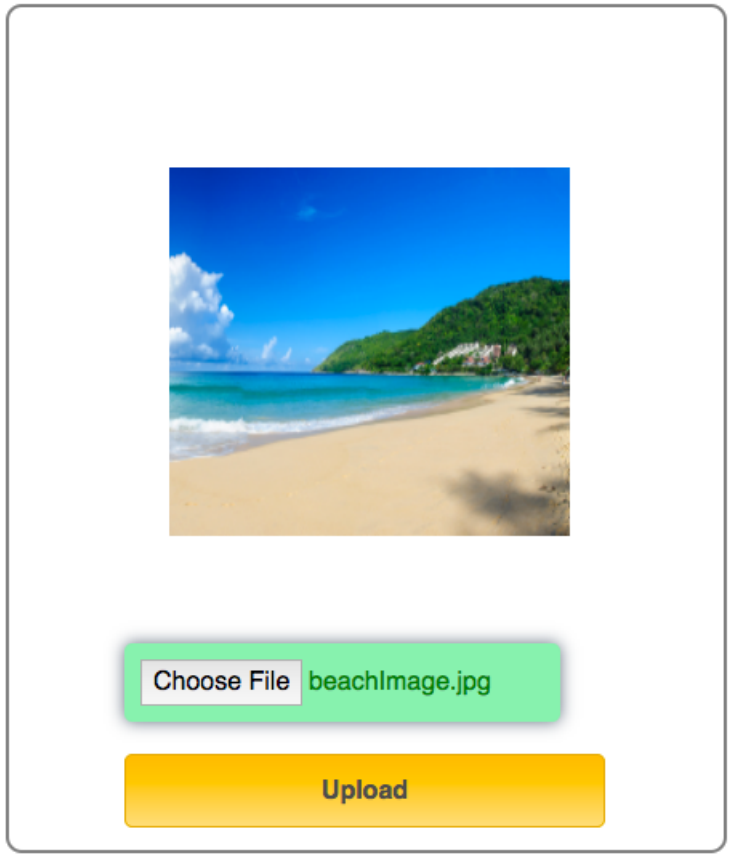
The pre-trained Inception v3 classifier

- Using **~9 million** annotated images with labels spanning over **6000 categories**.
- Can be used directly based on the learning transfer concept

Inception v3 classifier

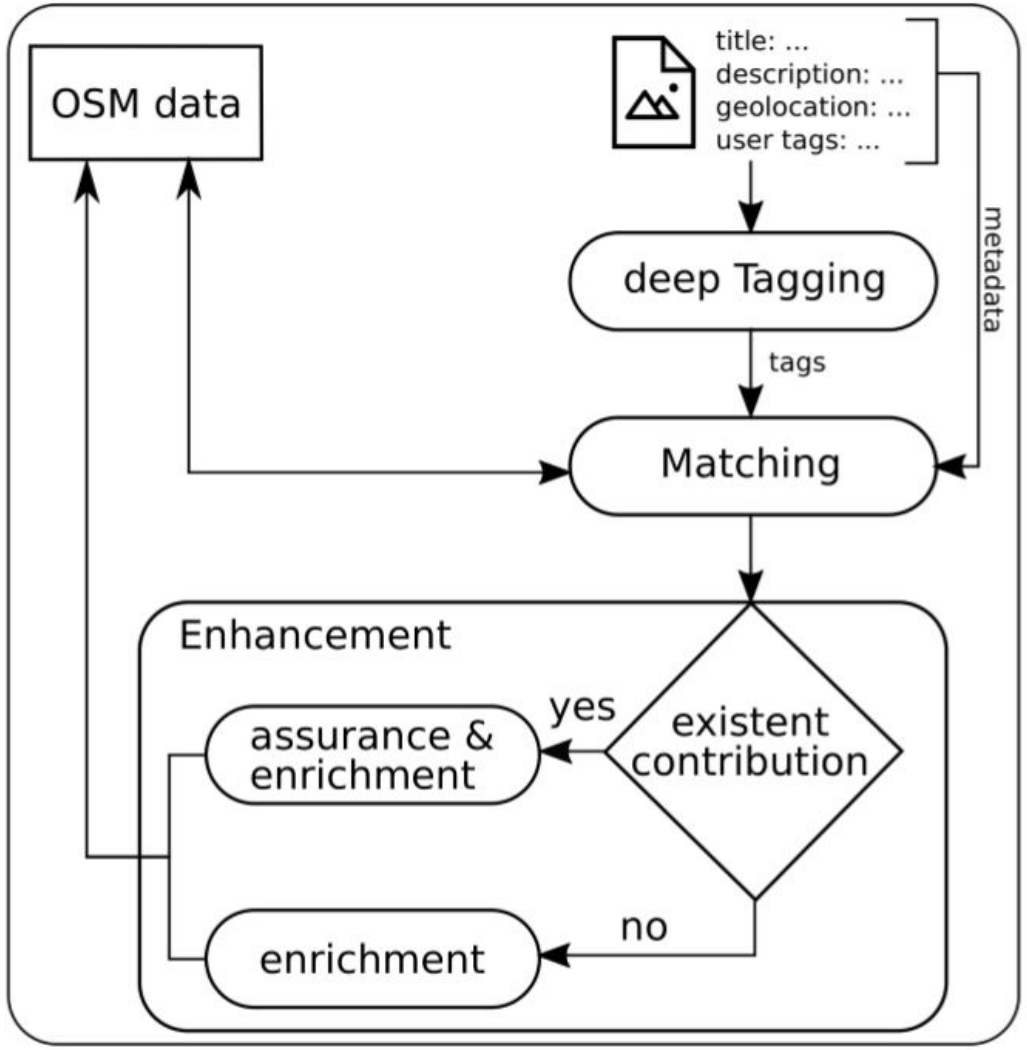
```
/tmp/cat.jpg
3473: /m/04rky - mammal (score = 0.90)
1261: /m/01yrx - cat (score = 0.87)
3981: /m/068hy - pet (score = 0.87)
5723: /m/0jbk - animal (score = 0.84)
4605: /m/09686 - vertebrate (score = 0.82)
841: /m/01l7qd - whiskers (score = 0.70)
2430: /m/0307l - cat-like mammal (score = 0.69)
4349: /m/07k6w8 - small to medium-sized cats (score = 0.68)
5643: /m/0hjzp - kitten (score = 0.31)
50: /m/012c9l - domestic short-haired cat (score = 0.18)
```

Images classifier API



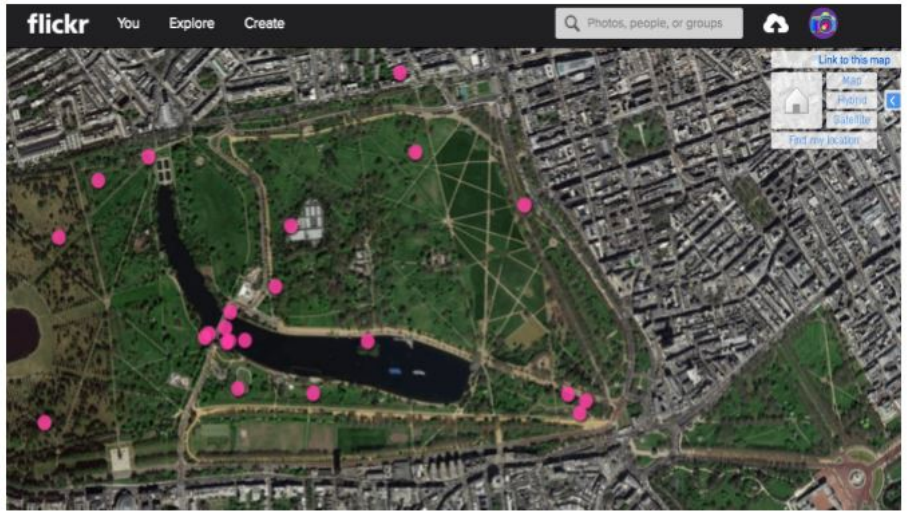
sea (score = 0.92)
coast (score = 0.86)
beach (score = 0.85)
ocean (score = 0.82)
shore (score = 0.81)
body of water (score = 0.78)
bay (score = 0.60)
vacation (score = 0.51)
cape (score = 0.46)
horizon (score = 0.36)

Tagging-Matching-Enhancement (TME)



Assurance scenario

(a) The Hyde Park in London on the OSM with tags of: name = Hyde Park, leisure = park, and access = yes

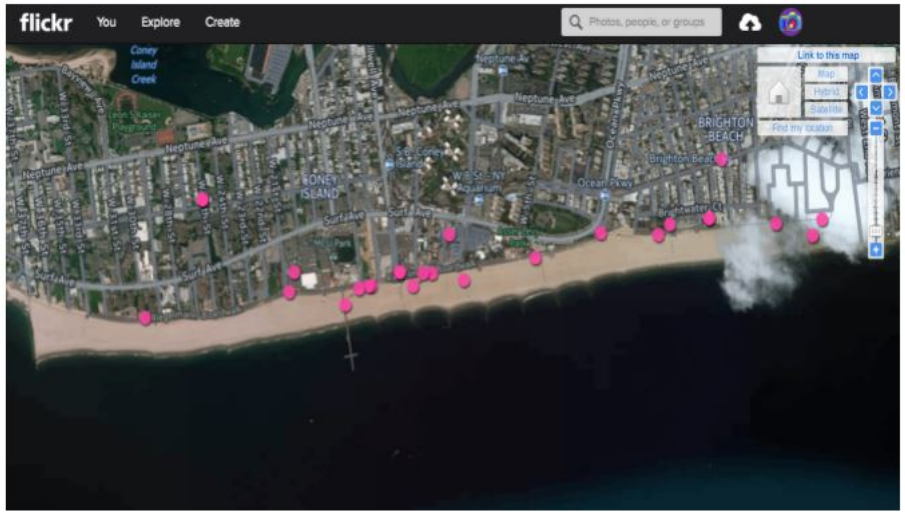


(b) The Hyde Park in London on Flickr web platform includes around 87,000 geotagged photos related to this park

(c) Applying deep tagging on these photos results in “park”, “landscape”, “nature”, “tree”, “grass”, and “footways” tags

Enrichment scenario

(a) The Coney Island Beach at NY on OSM with tags: name = Coney Island Beach, natural = beach, and ele = 1



(b) The Coney Island Beach at NY on Flickr web platform includes around 125,00 geotagged photos

(c) Applying deep tagging on these photos results in “dog”, “beach”, “recreation”, “sailboat”, and “water sports” tags

(d) Applying deep tagging on these photos results in “bench”, “chair”, “fence”, “wood”, and “seat” tags

Future Work

- Building a scalable version of DeepTags using Amazon Web Services (AWS)
- Conducting empirical evaluation on large datasets including geo tagged photos and OSM objects
- Evaluating the impact of data enrichment on hotels at trivago platform

Software Engineer – Geo Search

Software Engineering - Düsseldorf, Deutschland

Level: Professionals

Start date: As soon as possible

Apply

Join our dynamic software engineering department and help shape the future of trivago. In this role you will help our users to roam freely around a map to find their ideal hotel. You will be able to see direct impact of your work on a huge global platform.

Your responsibilities:

- Provide 4 million daily visitors with an intelligent and intuitive map experience for finding hotels.
- Write clean, composable, and testable code.
- Contribute in architecture decisions and innovative feature development.
- Combine different storage technologies to implement efficient and high