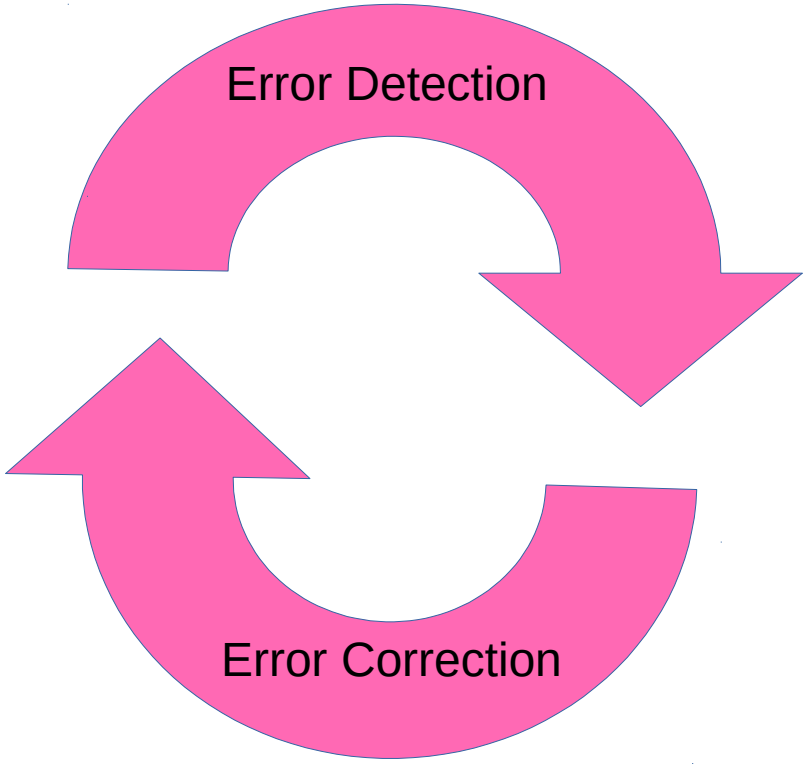
neat-EO.pink :
Computer Vision framework for GeoSpatial Imagery

@o_courtin

@FOSDEM 2020



Cybernetic Loop, Norber Wiener, ~1940s

Earth Observation

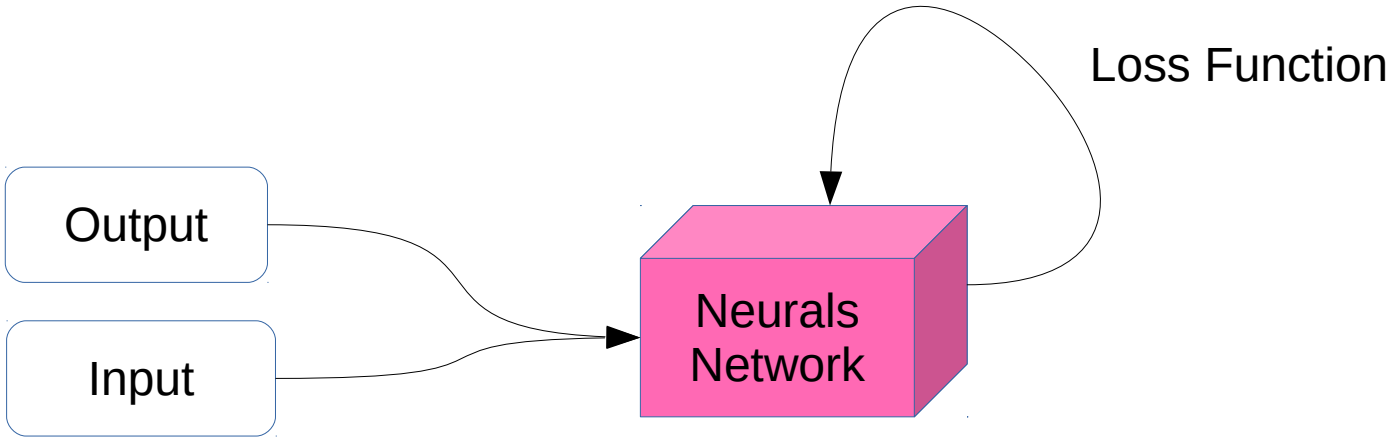
Widely Used: *Govs Agencies, NGOs, Scientists, Companies, Farmers...*

Huge Data: *~100To / Day*

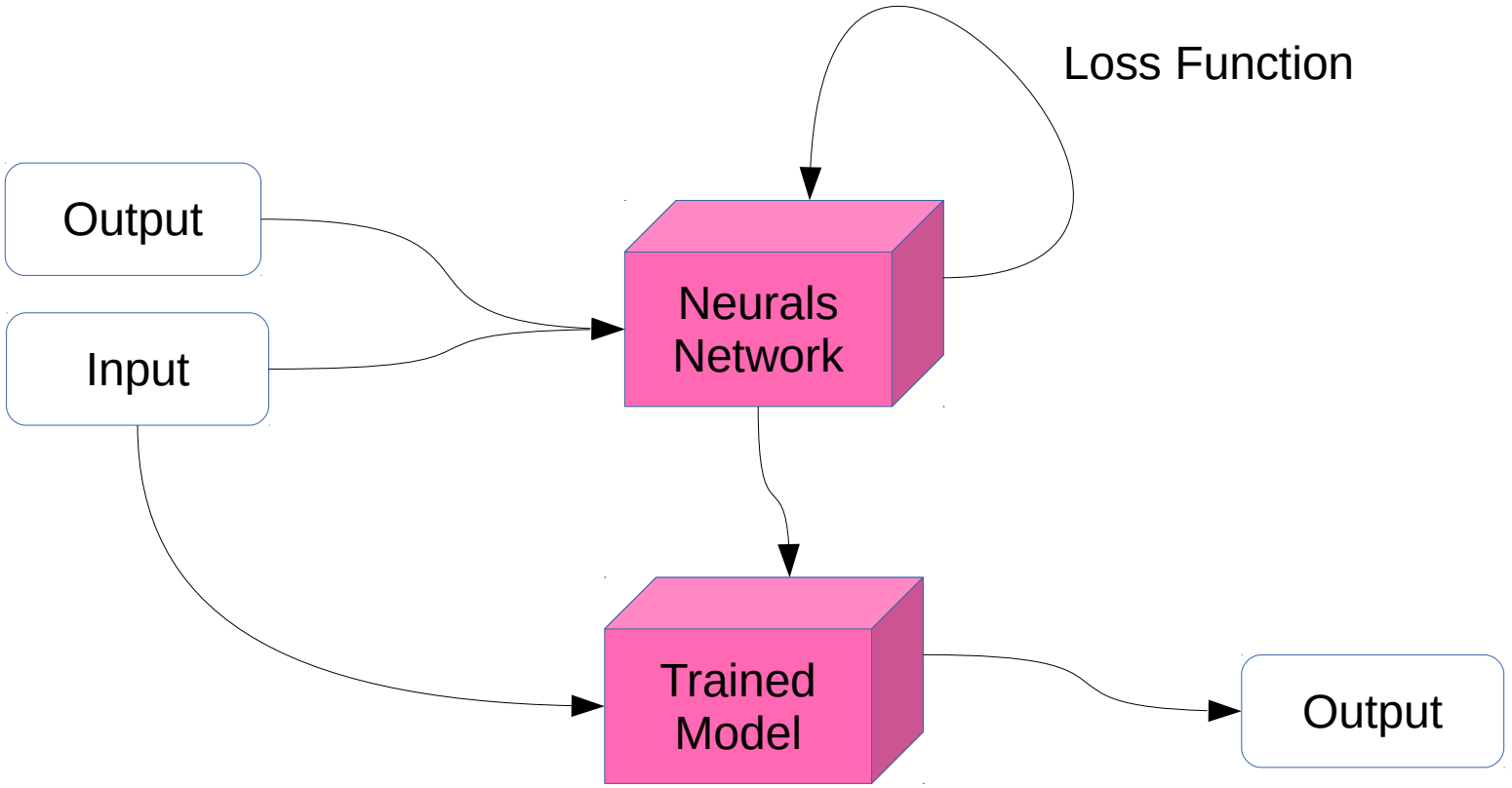
Wasted Data: *~80% of acquired pixels remains unused*

From Pixels to Insights

Supervised Learning



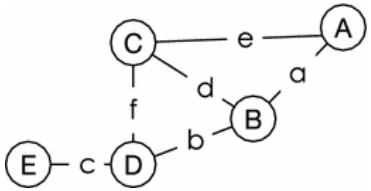
Supervised Learning



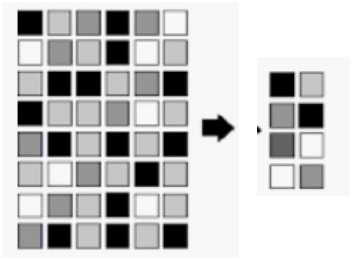
A Trained model ?

$$a_0 + a_1 X^1 + a_2 X^2 + \cdots + a_n X^n$$

Polynom



Weighted Graph



Lossy Data Compression

Grey Box

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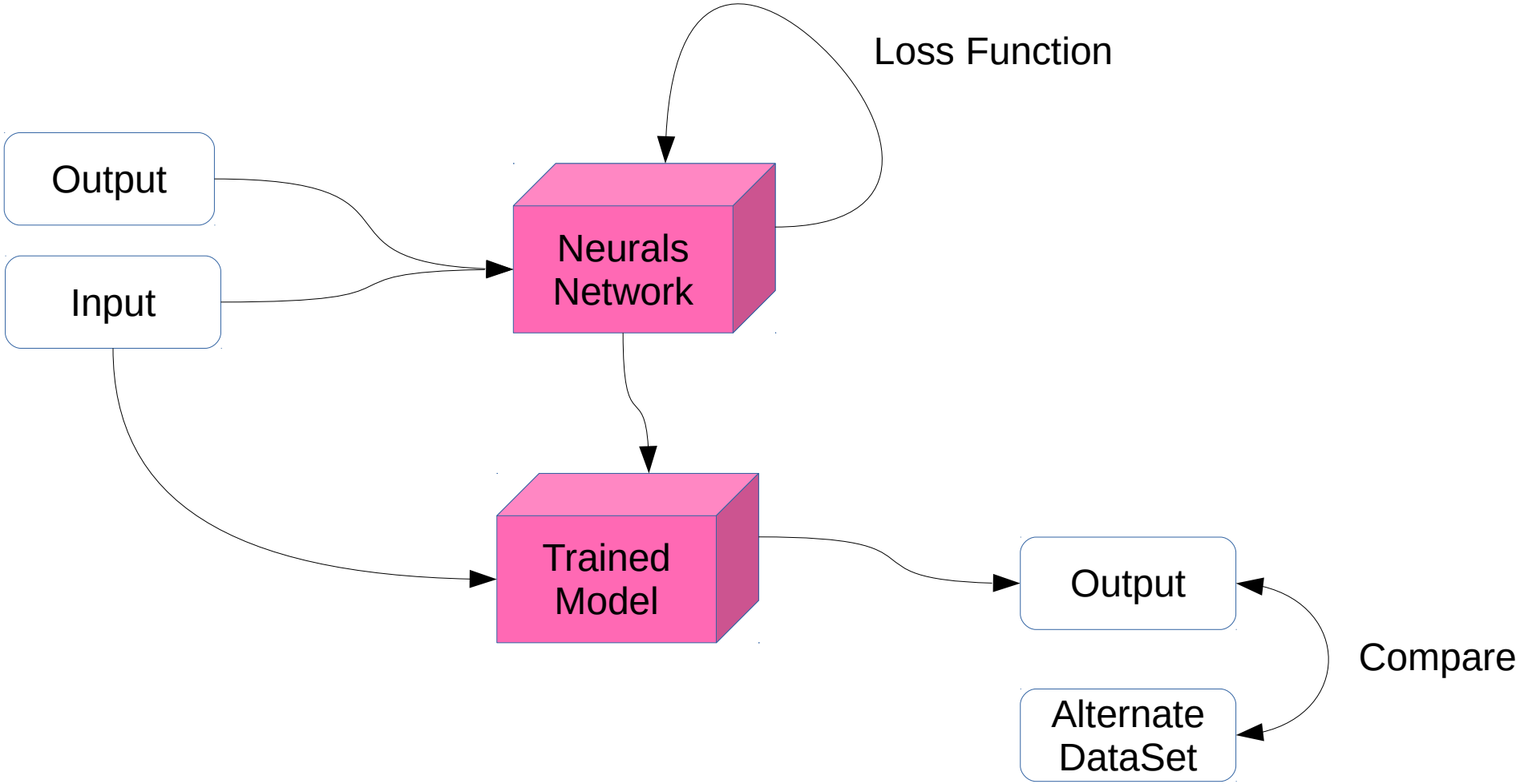
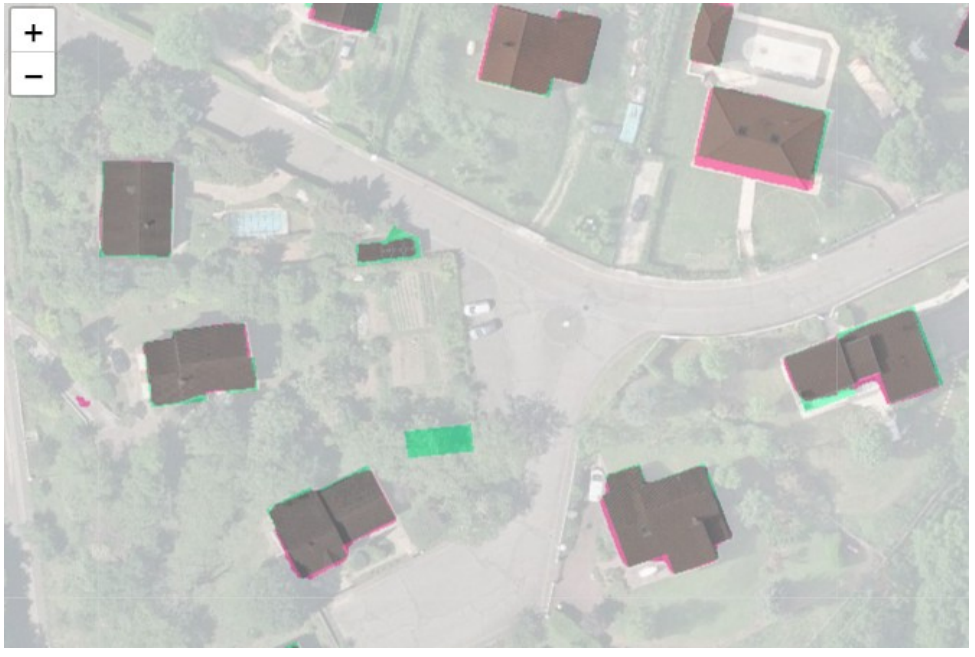
Computer Vision framework for GeoSpatial Imagery

Quality Analysis



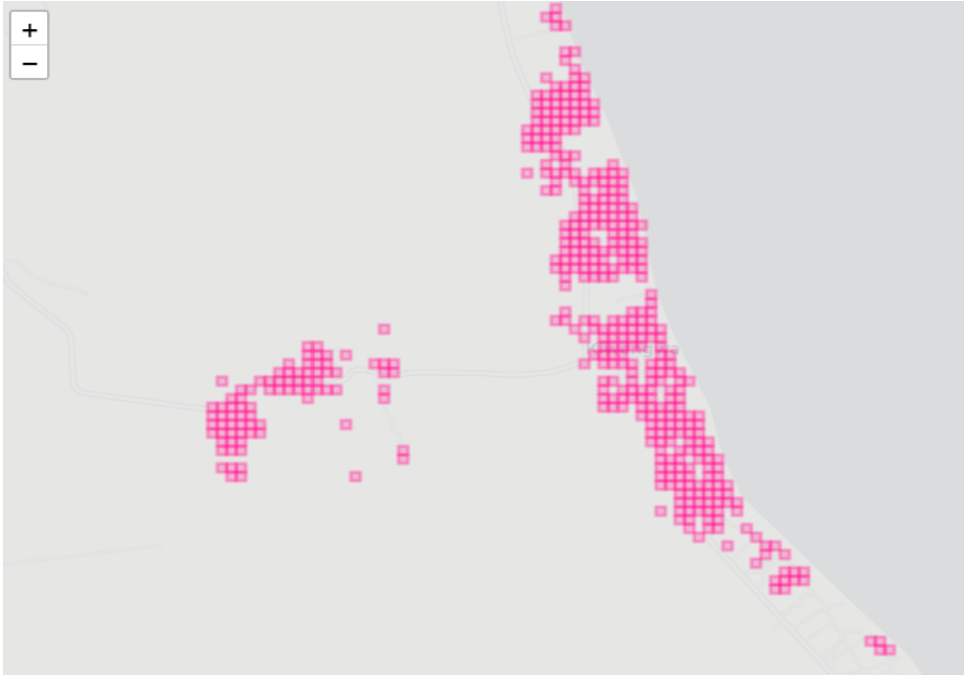
Neat WebUI to ease compare



Pink : Predicted by trained model

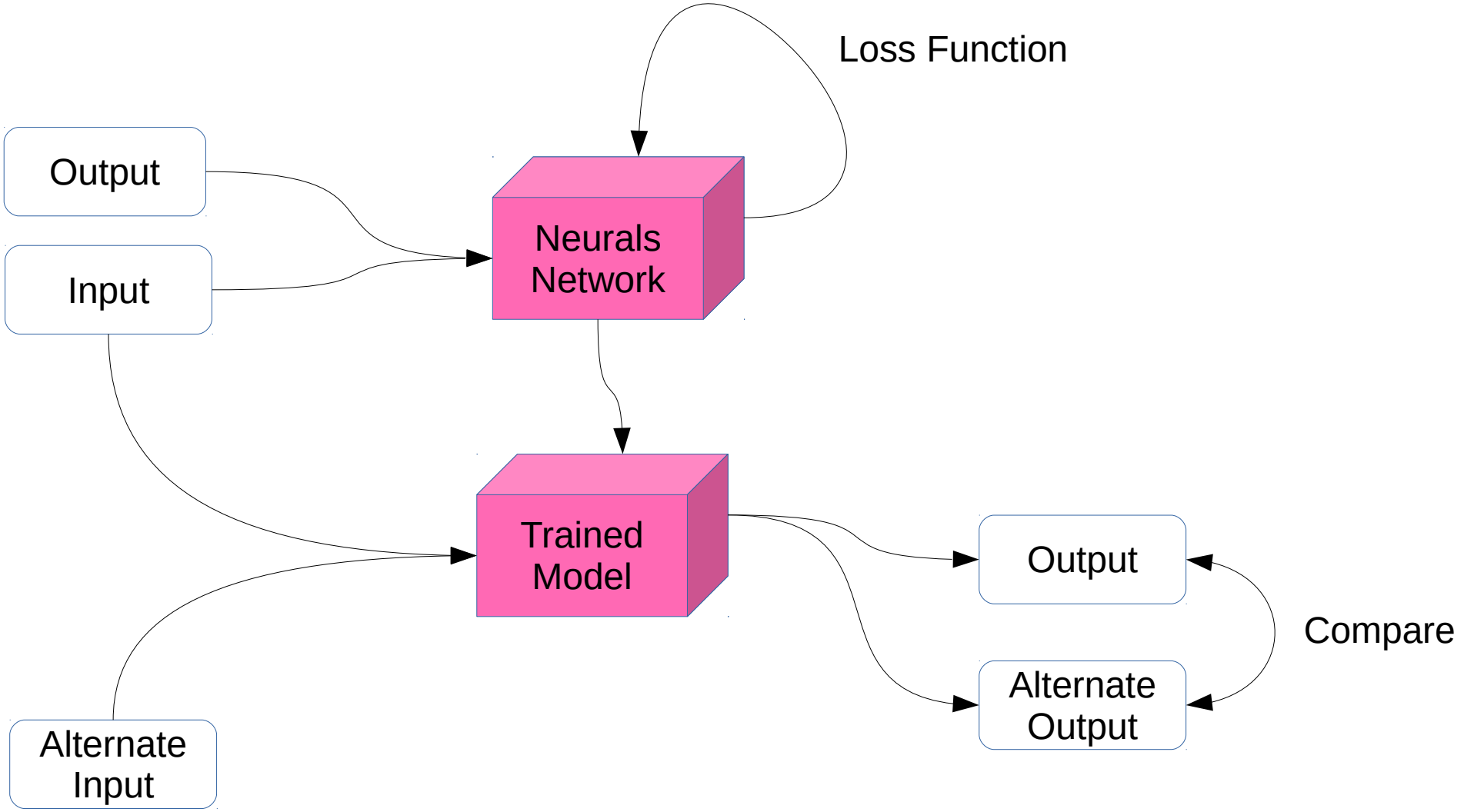
Green : Alternate dataset

Grey : Both agree

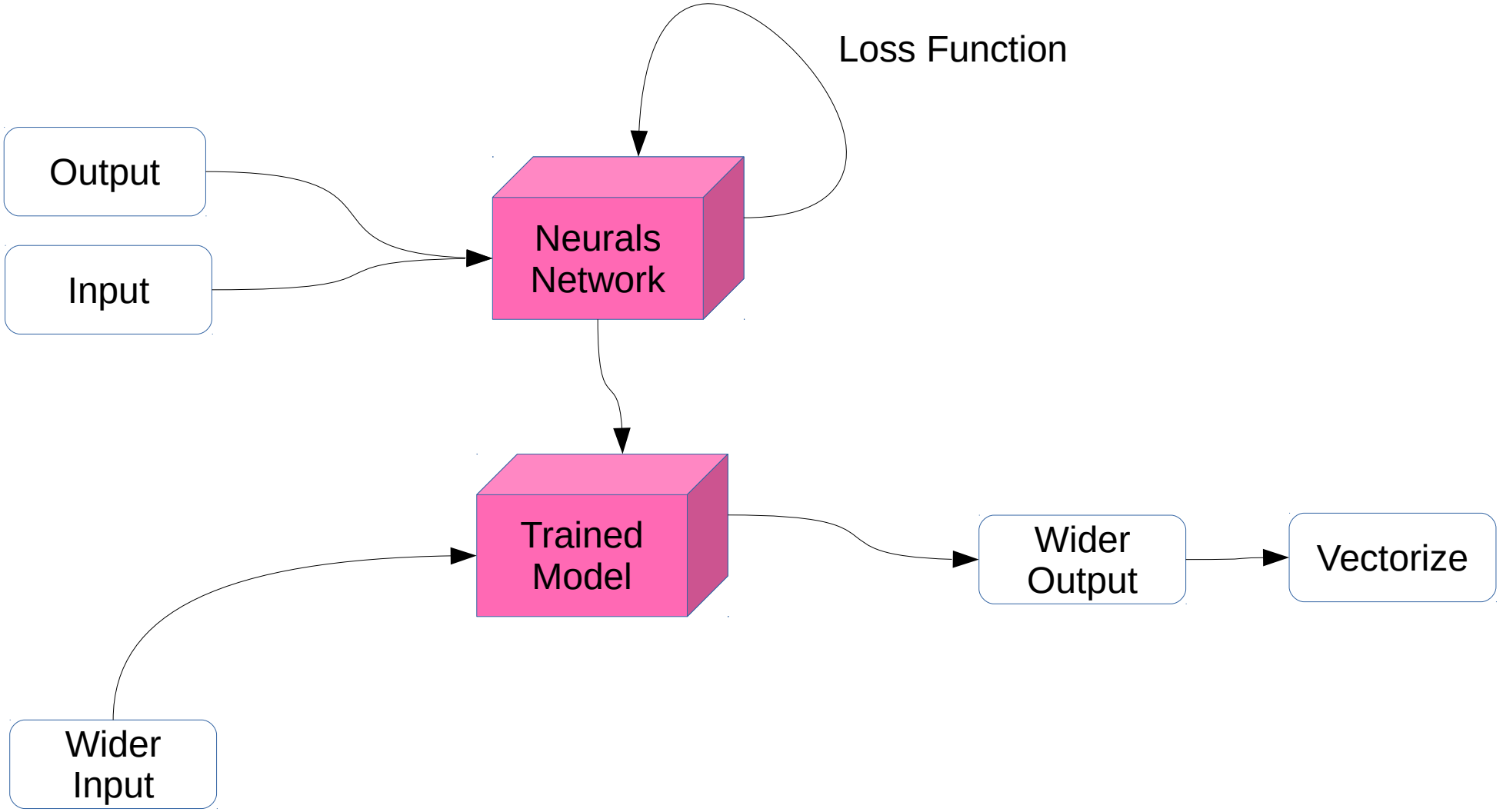


Spotify significative differences

Change Detection



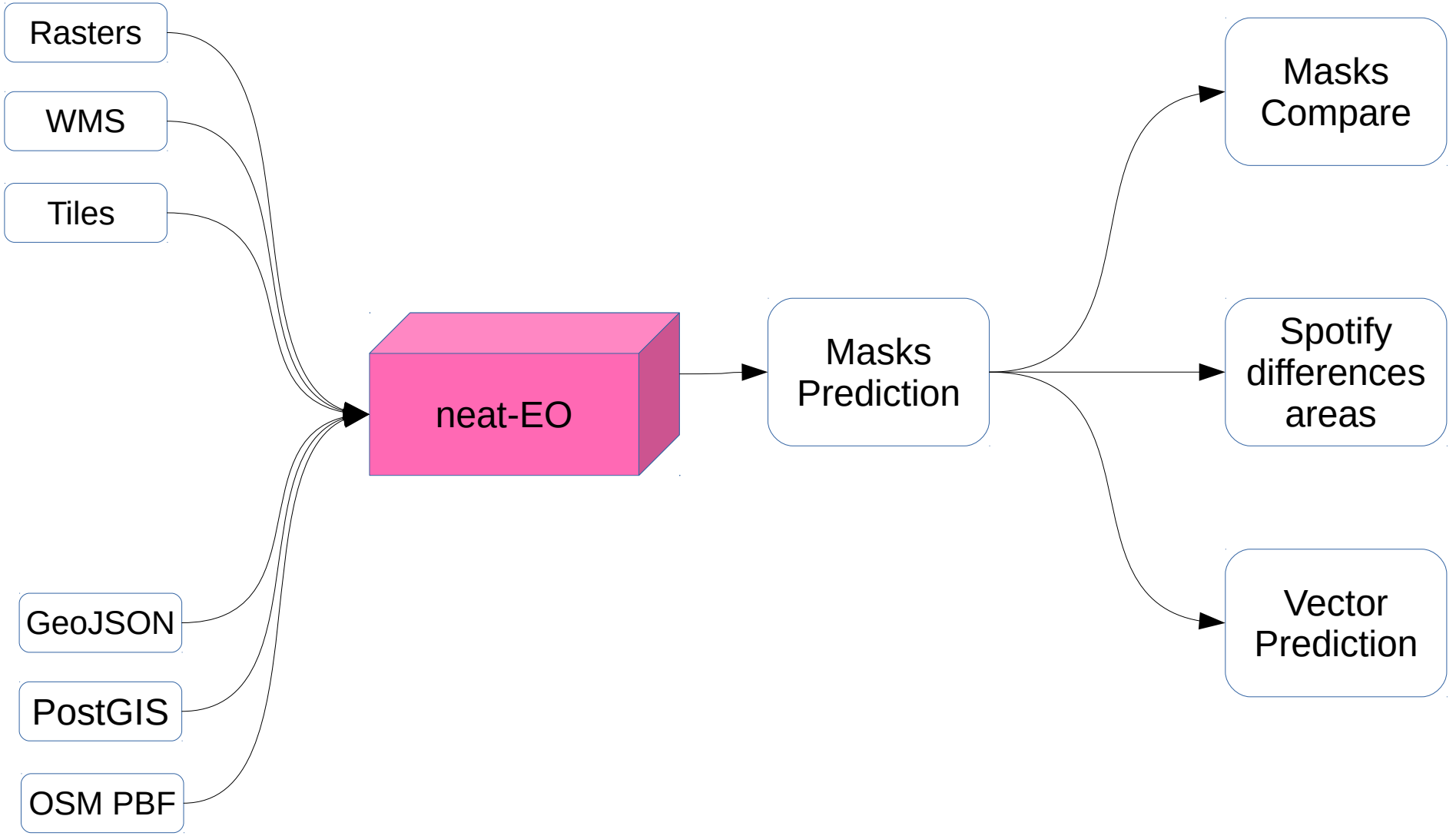
Feature Extraction



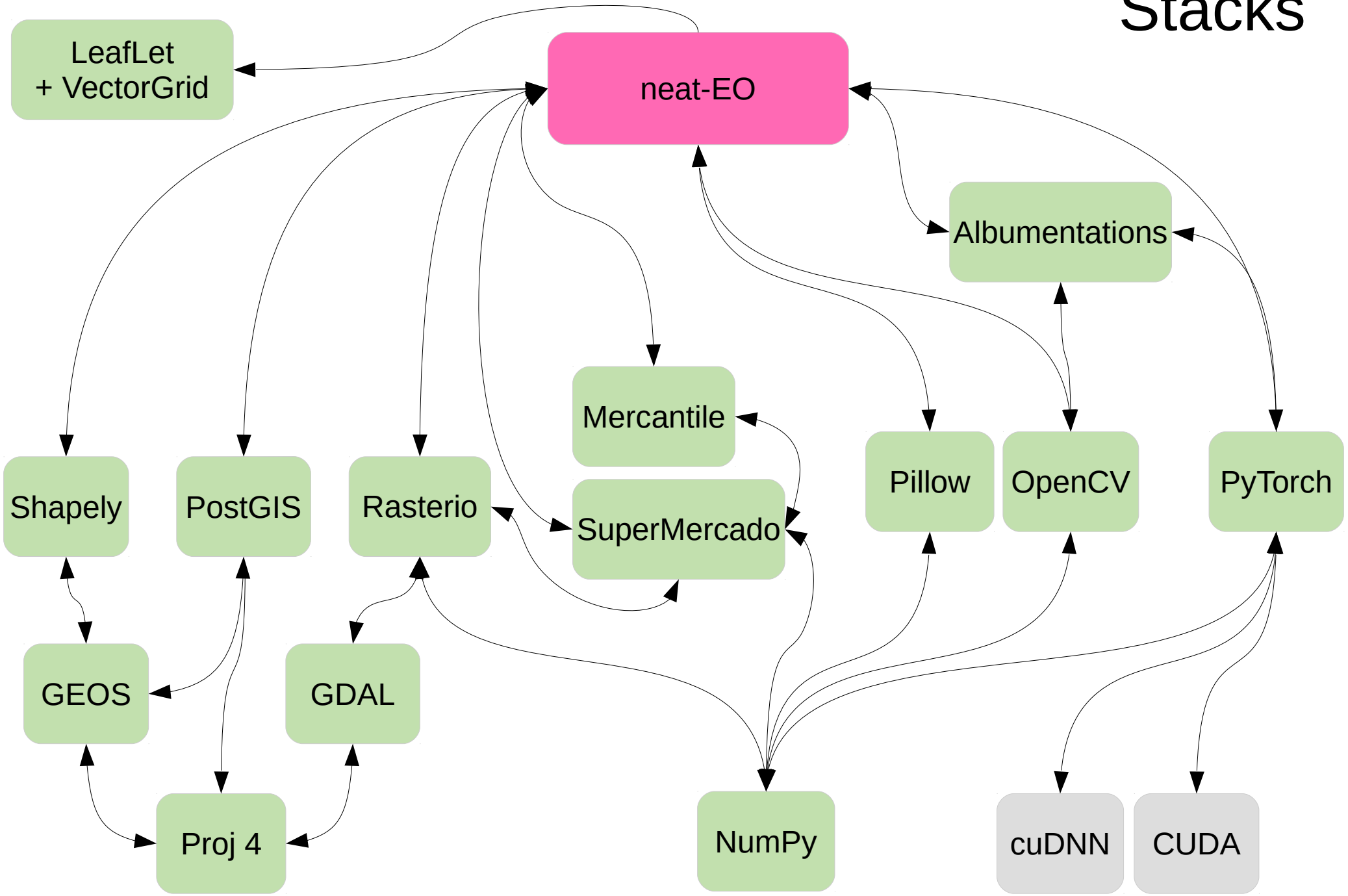
Command Line Interface

Tools:

- `neo cover` Generate a tiles covering, in csv format: X,Y,Z
- `neo download` Downloads tiles from a remote server (XYZ, WMS, or TMS)
- `neo extract` Extracts GeoJSON features from OpenStreetMap .pbf
- `neo rasterize` Rasterize vector features (GeoJSON or PostGIS), to raster tiles
- `neo subset` Filter images in a slippy map dir using a csv tiles cover
- `neo tile` Tile raster coverage
- `neo dataset` Perform checks and analyses on Training DataSet
- `neo train` Trains a model on a dataset
- `neo export` Export a model to ONNX or Torch JIT
- `neo predict` Predict masks, from given inputs and an already trained model
- `neo compare` Compute composite images and/or metrics to compare several XYZ dirs
- `neo vectorize` Extract simplified GeoJSON features from segmentation masks
- `neo info` Print Neat-EO.pink version informations


Rasters
WMS
Tiles
GeoJSON
PostGIS
OSM PBF
neat-EO
Masks Prediction
Masks Compare
Spotify differences areas
Vector Prediction

Stacks


LeafLet
+ VectorGrid
neat-EO
Albumentations
Mercantile
Shapely
PostGIS
Rasterio
SuperMercado
Pillow
OpenCV
PyTorch
GEOS
GDAL
Proj 4
NumPy
cuDNN
CUDA

Easy to deploy

```
pip3 install neat-EO
```

101 Tutorial

- Install neat-EO
- Download data
- Data Preparation
- Training
- Inference
- Compare to OSM
- Spotify differences areas
- Vectorize features

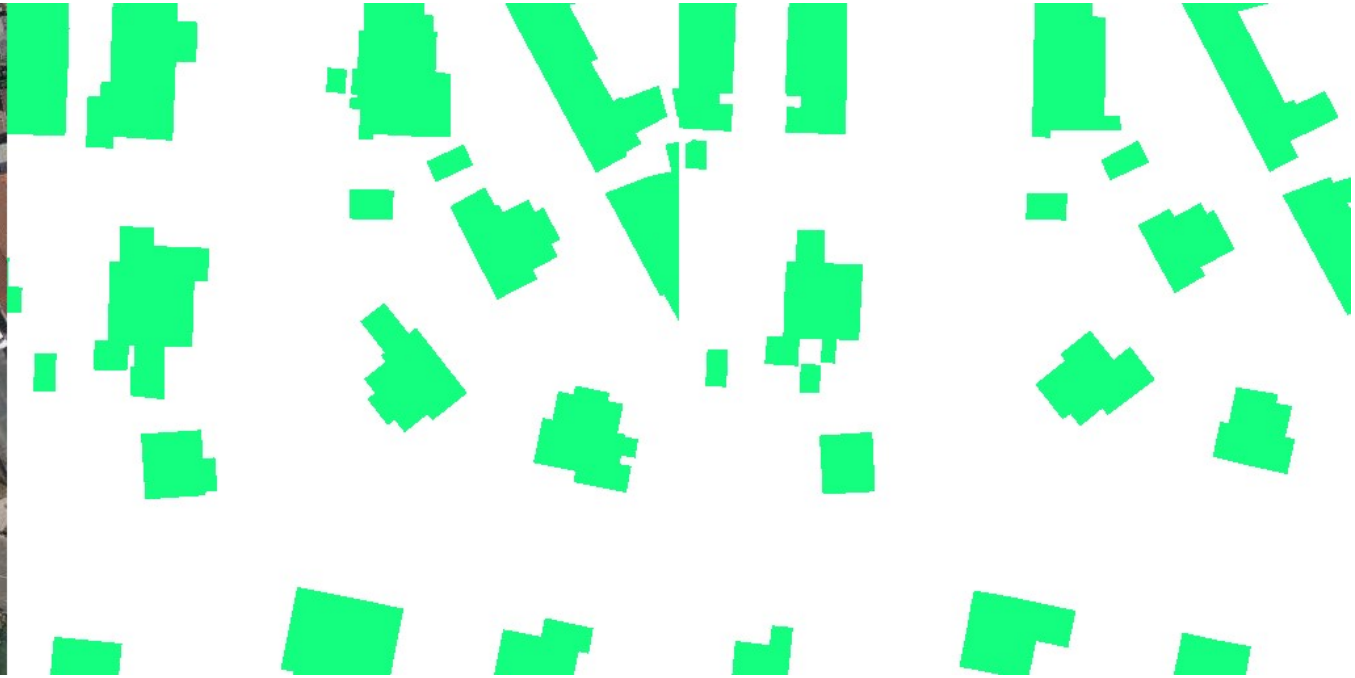
https://github.com/datapink/neat-eo.pink/blob/master/docs/101.md

So all you need is :

- Imagery → *any file format readable by GDAL*
- GPU → *NVIDIA > 8Go VRAM*
- Labels → *usualy the key point*

GIGO

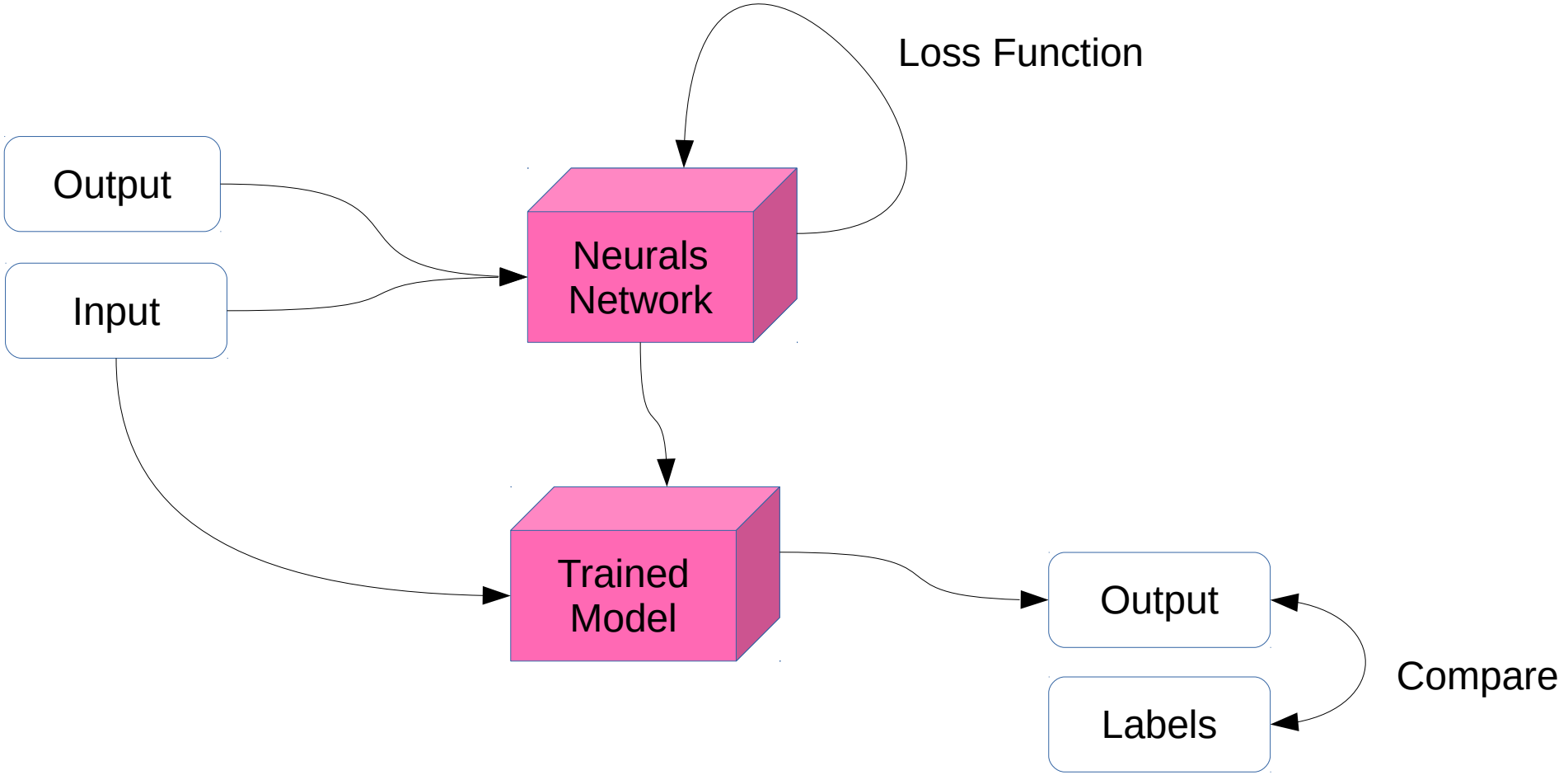
Imagery



City OpenData

OSM

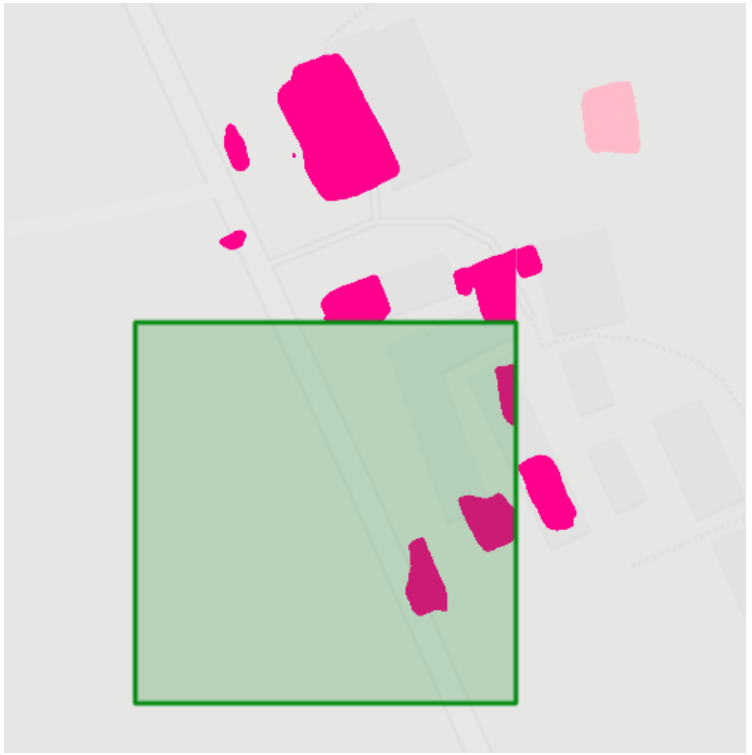
Quality Analysis on DataSet Training



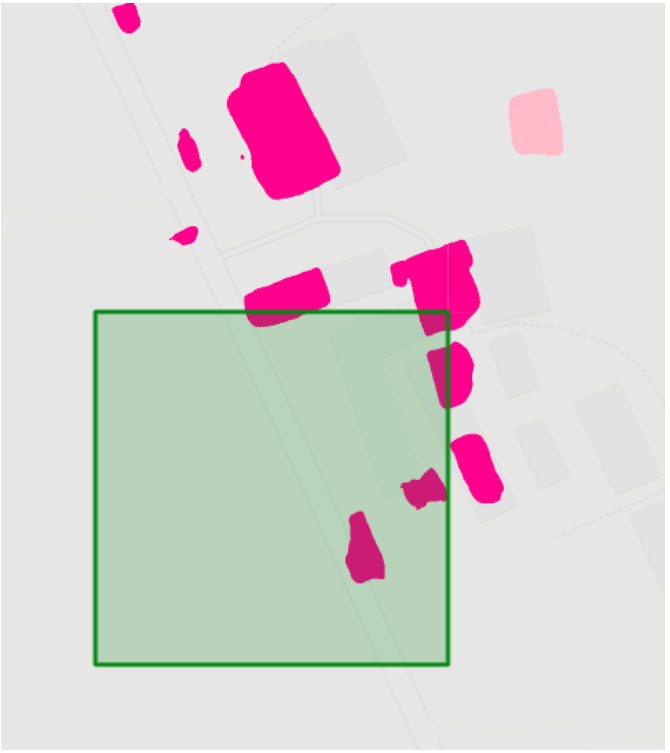
WebUI BuildIn Binary Selector

What’s new ?

Metatiles option on predict



Without



With (but x3 time slower)

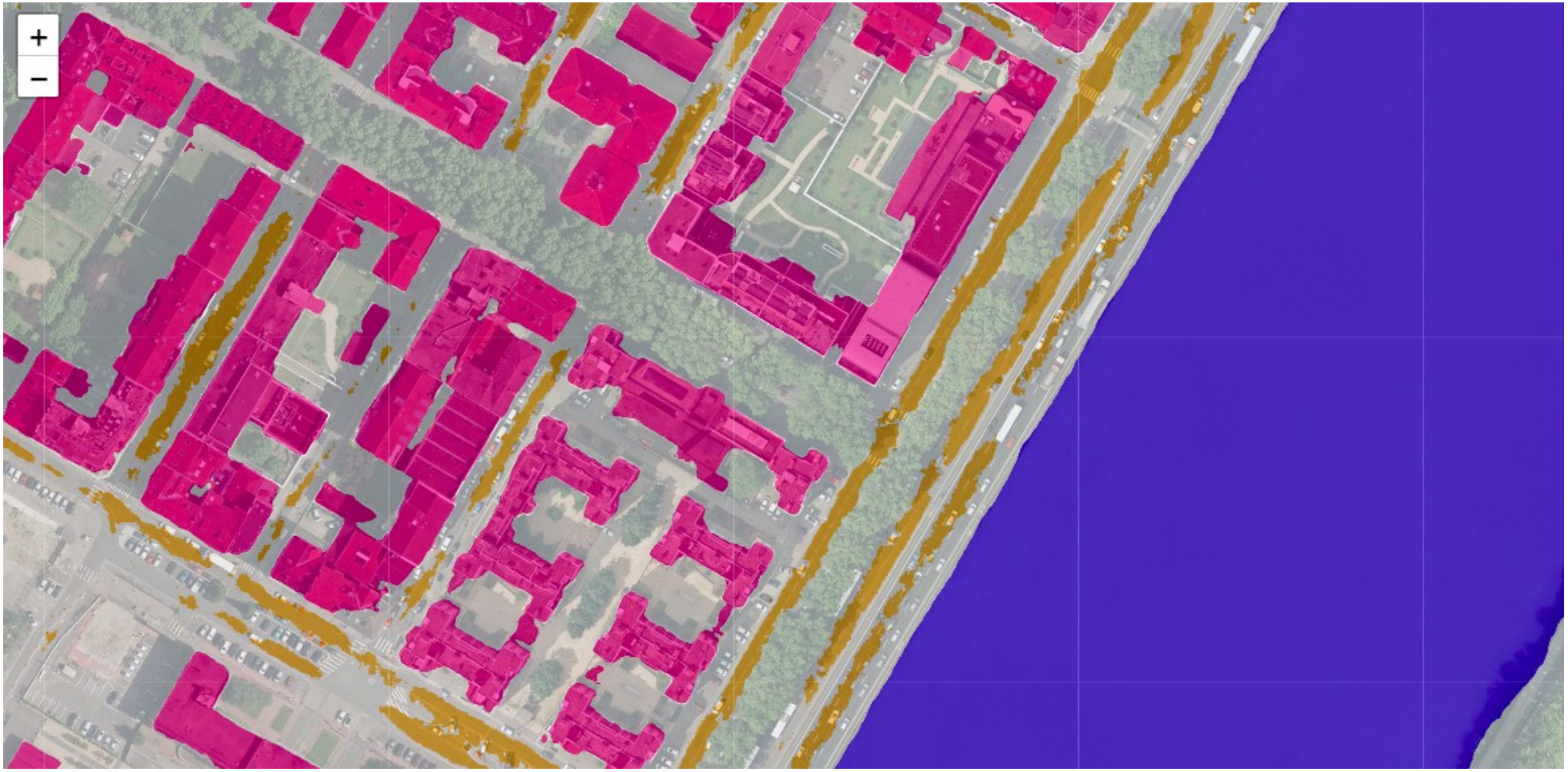
Multi GPUs efficient scaling

neo train

neo predict

Allow to scale to x8 GPUs

Multi Classes



Including auto weighted umbalaced classes option

Limits

- Predict Imagery DataSet must be quite related to the training one

- Still need about thousands labels per class (as a rule of thumb)

- Don’t deal (for now) with topology,
  so behave badly on connected stuff (as roads)

Request For Funding

- Increase again accuracy
  - Low Resolution
  - Topology

- Reduce significantly amount of needed labels (weakly supervised)

- Improve again performances

Open Source AI4EO

rastervision

An open source framework for deep learning on satellite and aerial imagery.

eo-learn

Neat-EO.pink

Computer Vision framework for GeoSpatial imagery, at scale

RoboSat

Generic ecosystem for feature extraction from aerial and satellite imagery

Berlin aerial imagery, segmentation mask, building outlines, simplified GeoJSON polygons

Solaris

An open source ML pipeline for overhead imagery by CosmiQ Works

Why using neat-EO.pink ?

- GIS Standards compliancy

- Easy Data Preparation

- Build-In WebUI

- Modular and extensible

- Handle MultiBands Imagery and DataFusion

- High Performances

- Accurate (state of art Computer Vision)

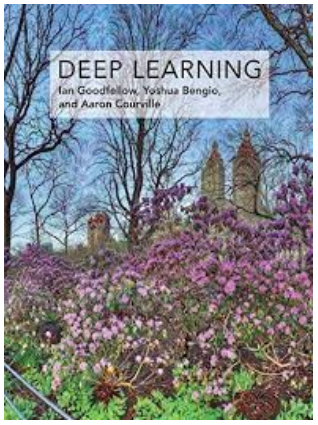
Human Learning

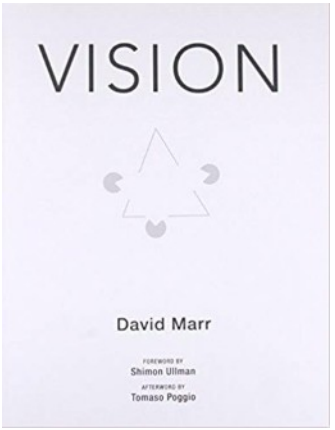
https://neurovenge.antonomase.fr/NeuronsSpikeBack.pdf

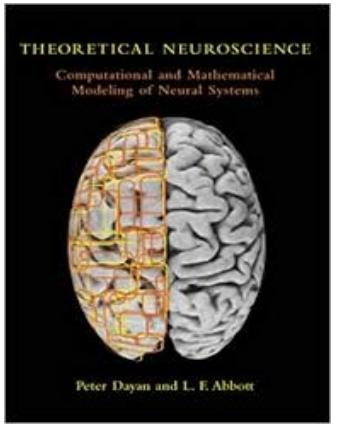
http://cs231n.stanford.edu/

http://www.numerical-tours.com/python/

http://www.math.ens.fr/~feydy/Teaching/culture_mathematique.pdf [FR]







Extract insights from GeoSpatial data with Deep Learning

@data_pink

www.datapink.com

Take Away

- Industrial OpenSource AI4EO Imagery framework available

- Performances already OK to use it on regions or countries

- No need anymore to be a Computer Vision expert to use it

- Plain OpenData can be use to train accurate model

- Funding and Pull Requests can make the difference

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