Retrieve Roads from Aerial Imagery Using Deep Learning

Capstone Project Data Presentation, CPLN 680, Spring 2021, UPenn

Jiamin Tan

Object

Learn how to train a neural network to detect roads from high resolution aerial images.

Main Data Source

https://spacenet.ai/

Dataset Overview

Table 1: SpaceNet imagery and building label details

AOI	Area (km^2)	# Buildings (Polygons)	GSD (cm)	Sensor	Date
Rio	2,544	382,534	50	WorldView-2	2011–2014
Las Vegas	216	151,367	30	WorldView-3	2015-10-22
Paris	1,030	23,816	30	WorldView-3	2016-02-29
Shanghai	1,000	92,015	30	WorldView-3	2015-06-06
Khartoum	765	35,503	30	WorldView-3	2015-04-13

The Data – Over 8000 Km of roads across the four SpaceNet Areas of Interest.

See the labeling guide and schema for details about the creation of the dataset

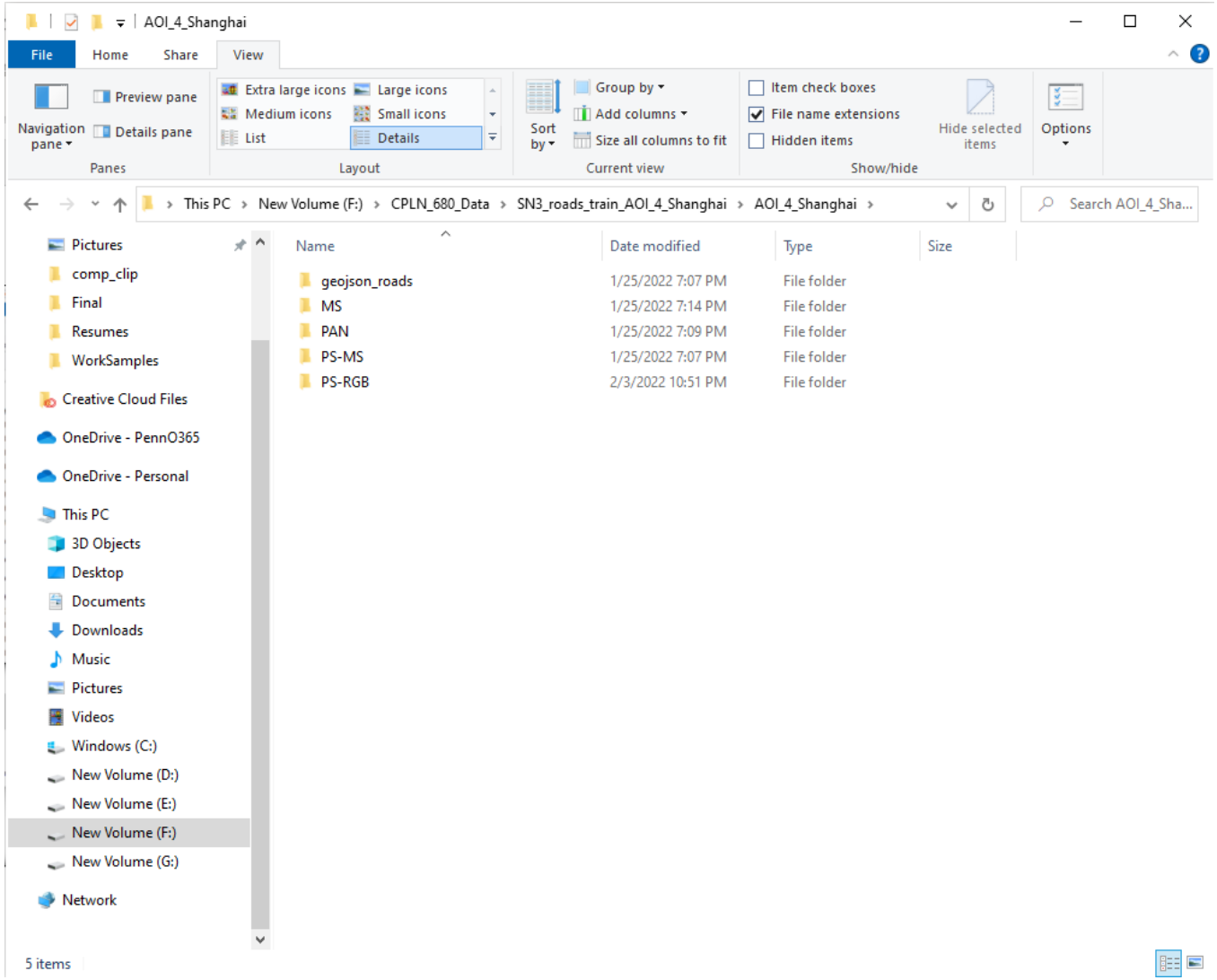
AOI	Area of Raster (Sq. Km)	Road Centerlines (LineString)
AOI_2_Vegas	216	3685 km
AOI_3_Paris	1,030	425 km
AOI_4_Shanghai	1,000	3537 km
AOI_5_Khartoum	765	1030 km

Road Type Breakdown (km of Road)

Road Type	Vegas	Paris	Shanghai	Khartoum	Total
Motorway	115	9	102	13	240
Primary	365	14	192	98	669
Secondary	417	58	501	66	1042
Tertiary	3	11	34	68	115
Residential	1646	232	939	485	3301
Unclassified	1138	95	1751	165	3149
Cart track	2	6	19	135	162
Total	**3685**	**425**	**3537.9**	**1030**	**8677**

https://spacenet.ai/spacenet-roads-dataset/

Van Etten, A., Lindenbaum, D., & Bacastow, T.M. (2018). SpaceNet: A Remote Sensing Dataset and Challenge Series. *ArXiv, abs/1807.01232*.



geojson_roads: ground truth labels

MS: Multi Spectral

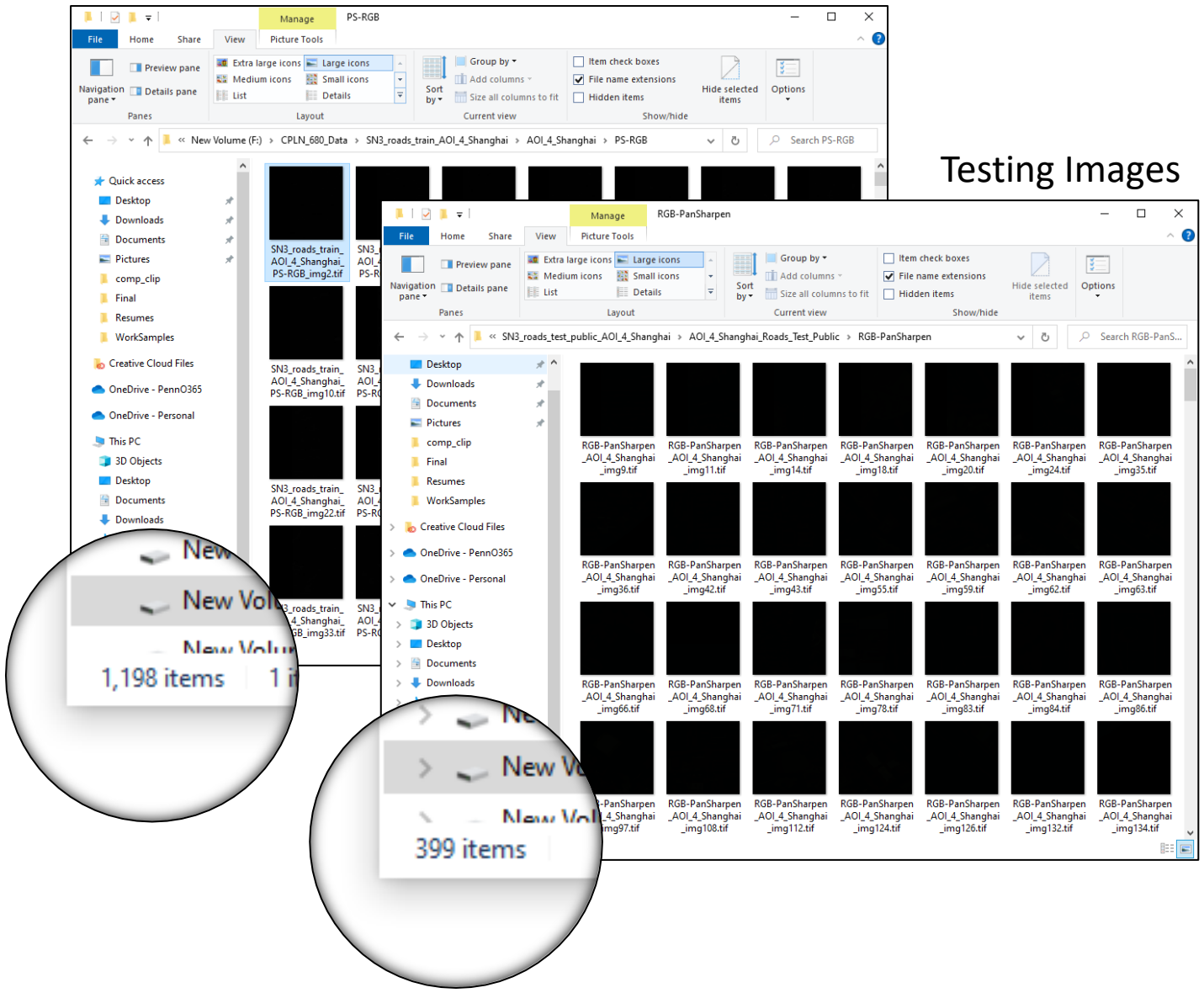
PAN: Panchromatic

PS-MS: Pan-Sharpened Multi Spectral Imagery

PS-RGB: Pan-Sharpened RGB Imagery

Training Images

Testing Images

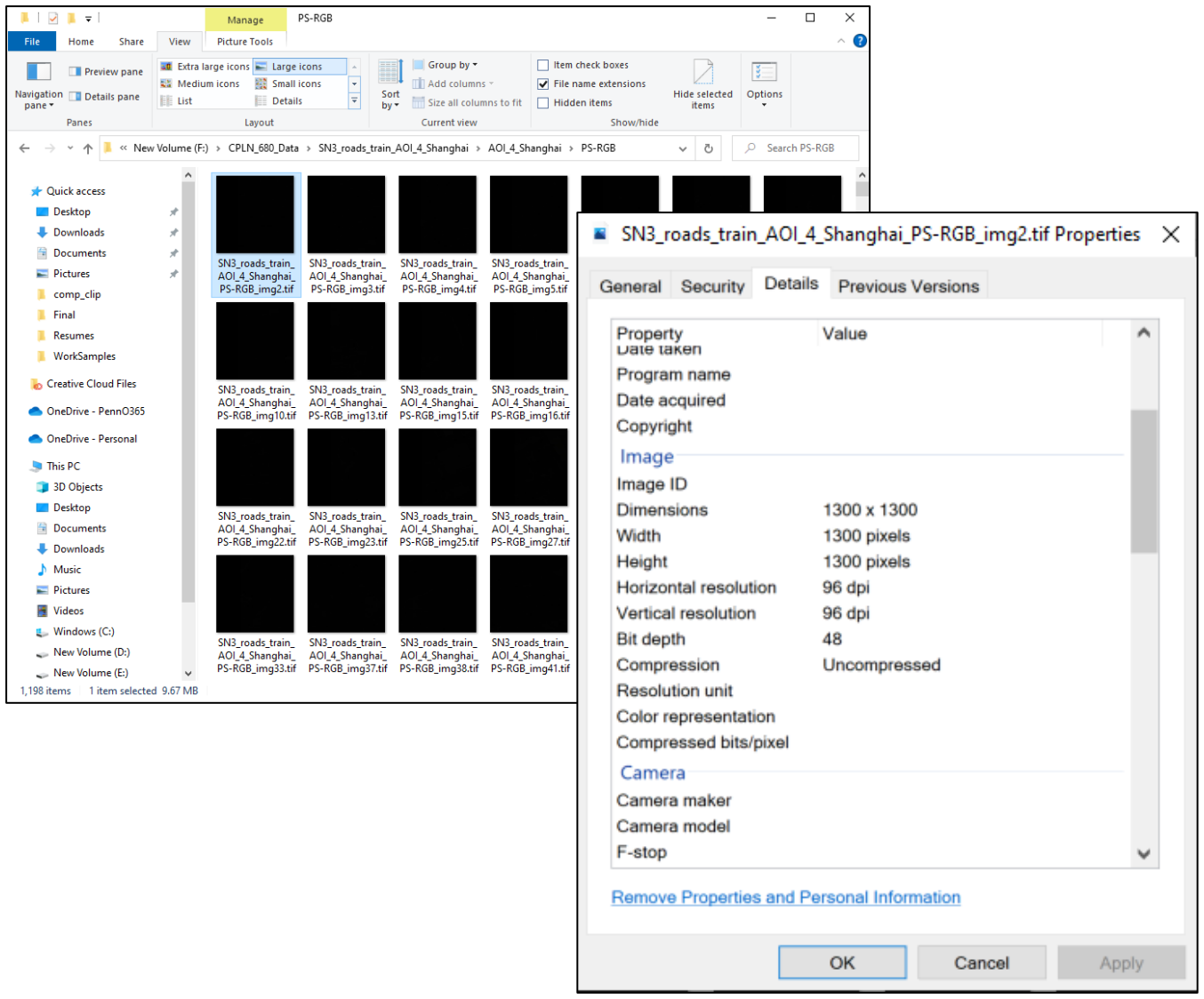


The testing set does not come with labels

Recreate testing set by splitting the training set

https://spacenet.ai/spacenet-roads-dataset/

Training Images



For each pan-sharpened Image:

1300 x 1300 pixels.

Each pixel has a spatial resolution of 0.31m x 0.31m.

Each tile is, therefore, 400m x 400m.

Bit depth is 48, so 16 bit for each band, and the value of a pixel in each band is from 0 to 65535.

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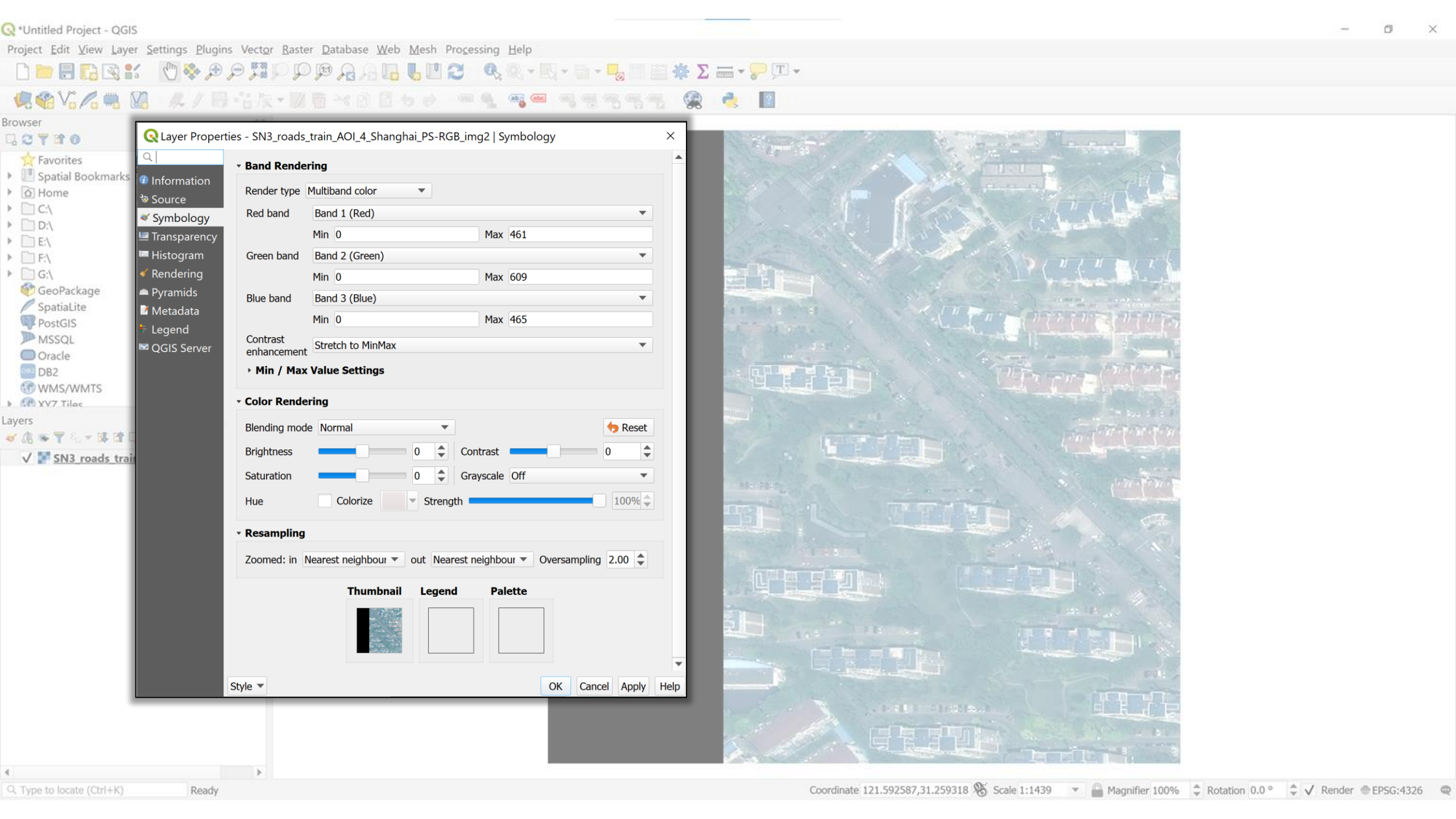
XYZ Tiles

Layers

SN3_roads_train_AOI_4_Shanghai_PS-R(

Type to locate (Ctrl+K) Ready

Coordinate 121.592587,31.259318 Scale 1:1439 Magnifier 100% Rotation 0.0 ° Render EPSG:4326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Band Rendering
Render type Multiband color
Red band Band 1 (Red)
Min 0 Max 461
Green band Band 2 (Green)
Min 0 Max 609
Blue band Band 3 (Blue)
Min 0 Max 465
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Color Rendering
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Saturation 0
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Scale 1:1439
Magnifier 100%
Rotation 0.0 °
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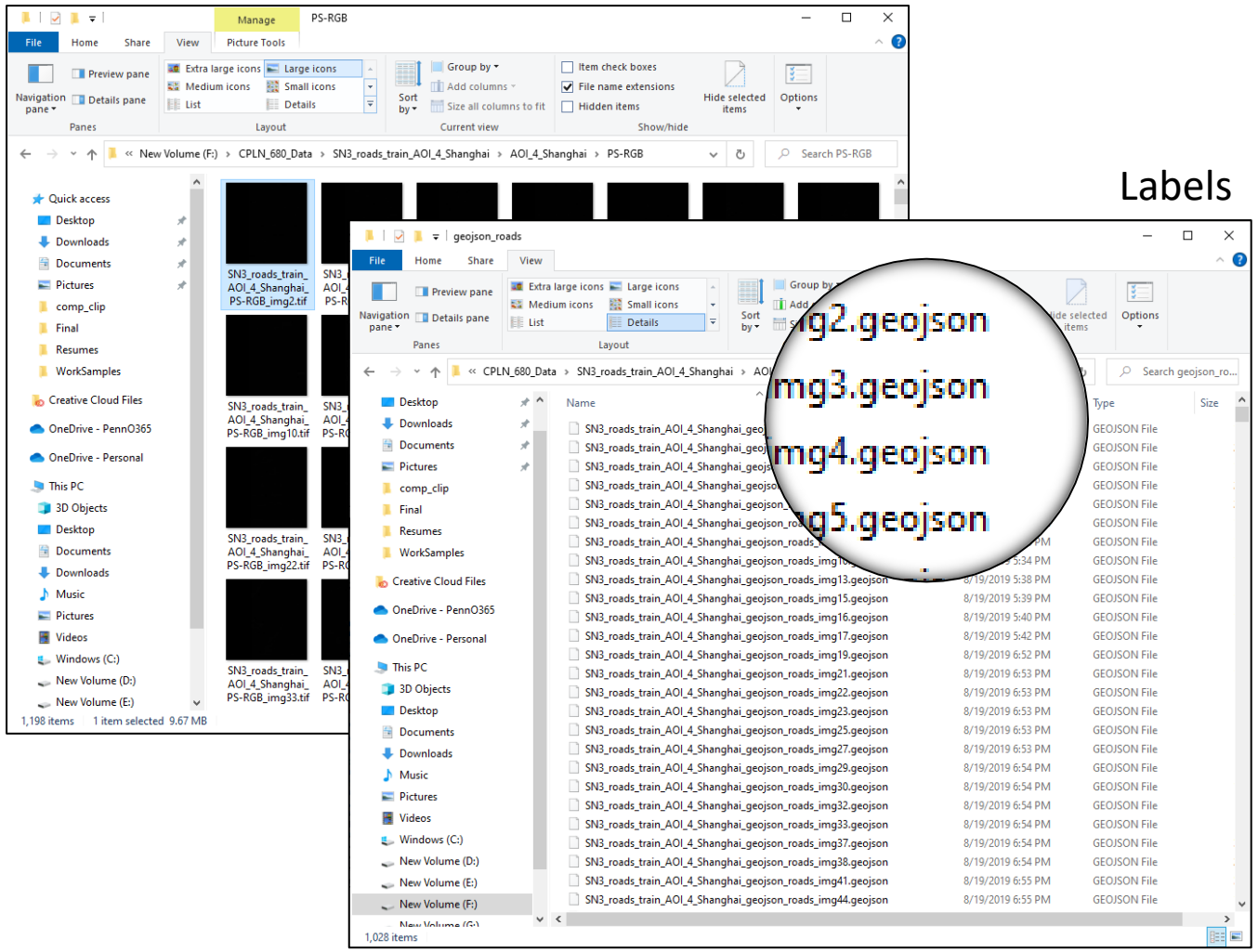
Training Images



Labels

.geojson files stores strings (roads) as ground truth.

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Layers

SN3_roads_train_AOI_4_Shanghai_geojs
SN3_roads_train_AOI_4_Shanghai_PS-R(

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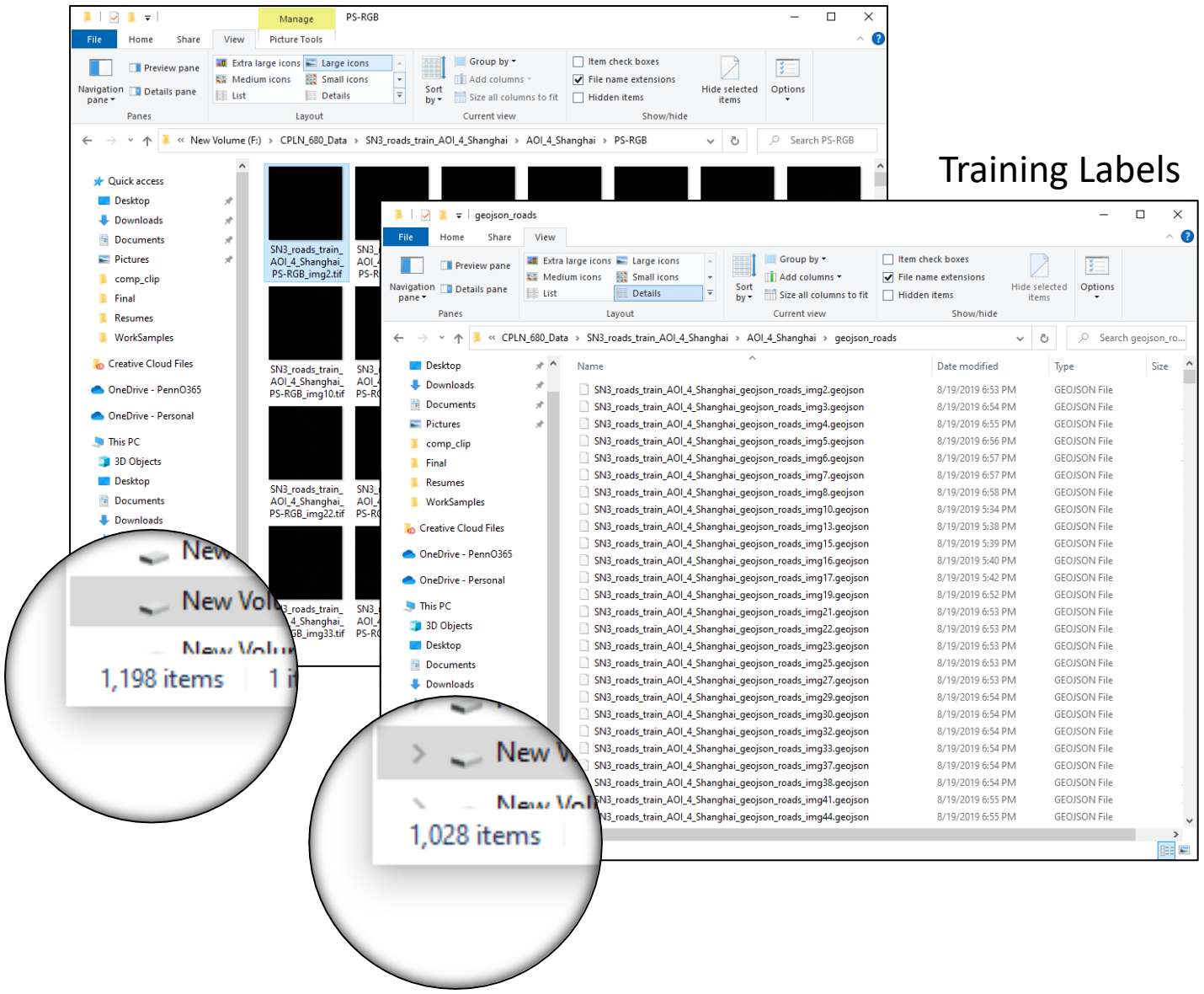
Coordinate 121.594667,31.257565 Scale 1:1439 Magnifier 100% Rotation 0.0 ° Render EPSG:4326

Training Images

Training Labels



The number of .geojson files doesn't match the number of images.

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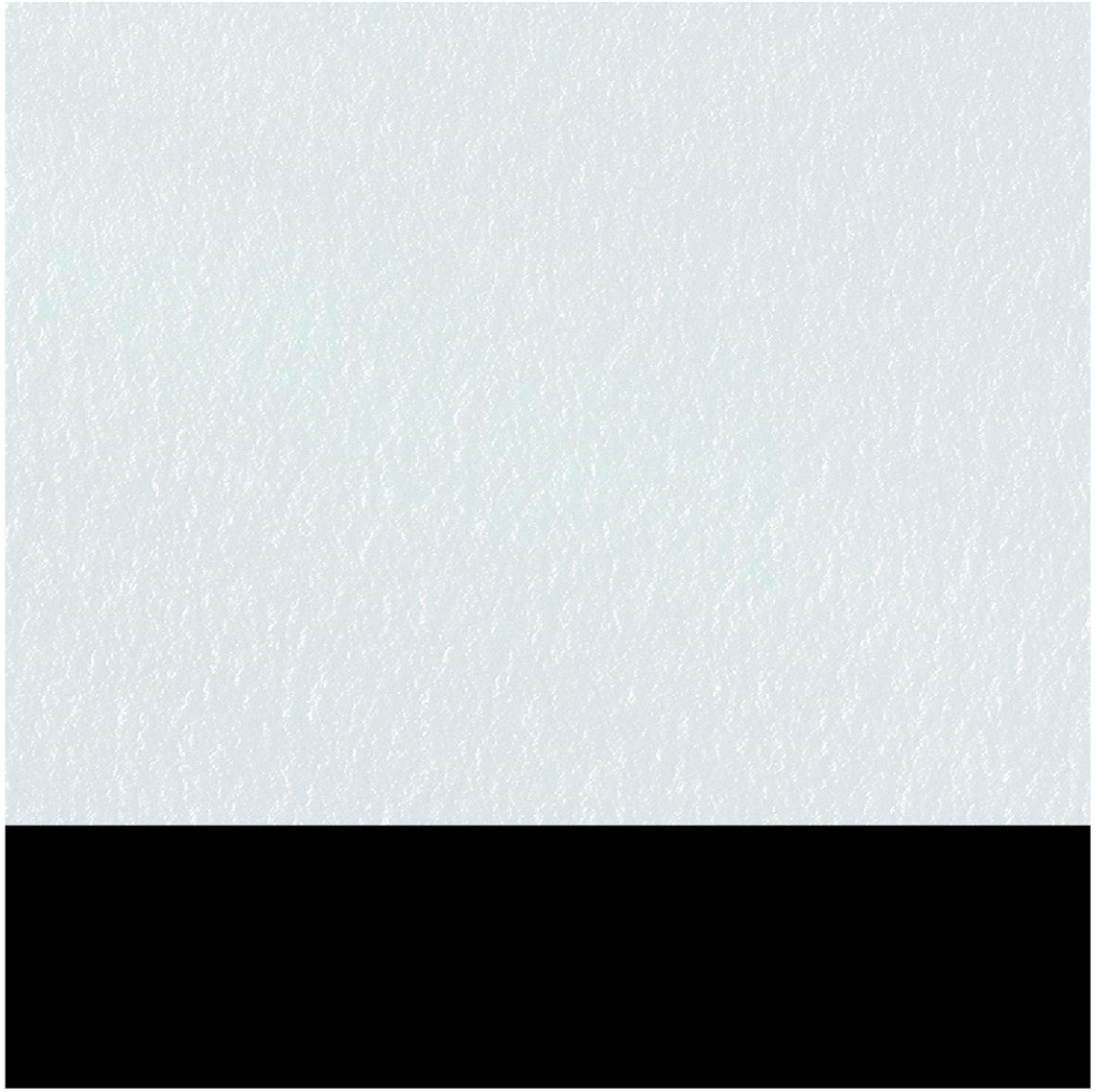
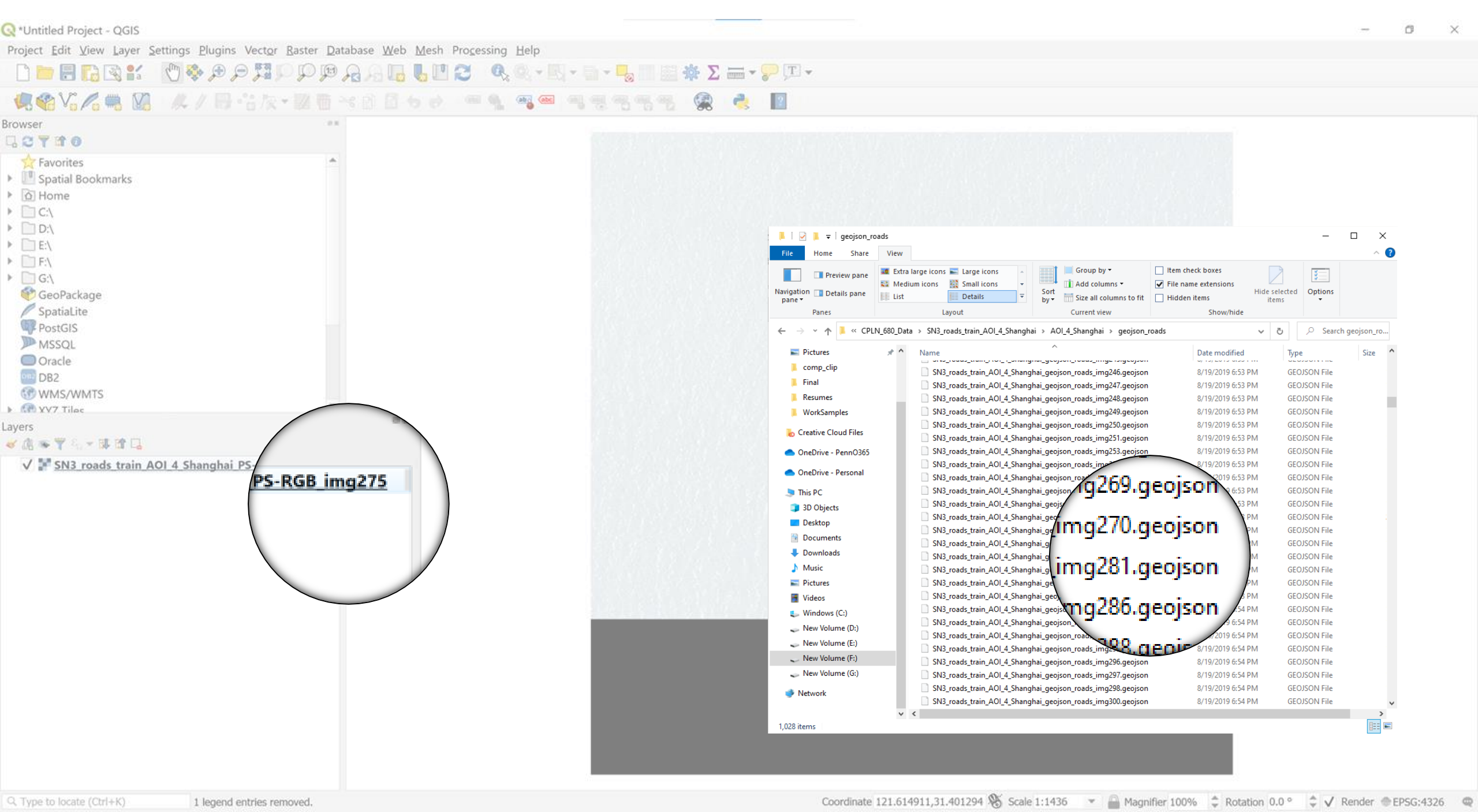
SN3_roads_train_AOI_4_Shanghai_PS-RGB_img275



Type to locate (Ctrl+K) 1 legend entries removed. Coordinate 121.614911,31.401294 Scale 1:1436 Magnifier 100% Rotation 0.0 ° Render EPSG:4326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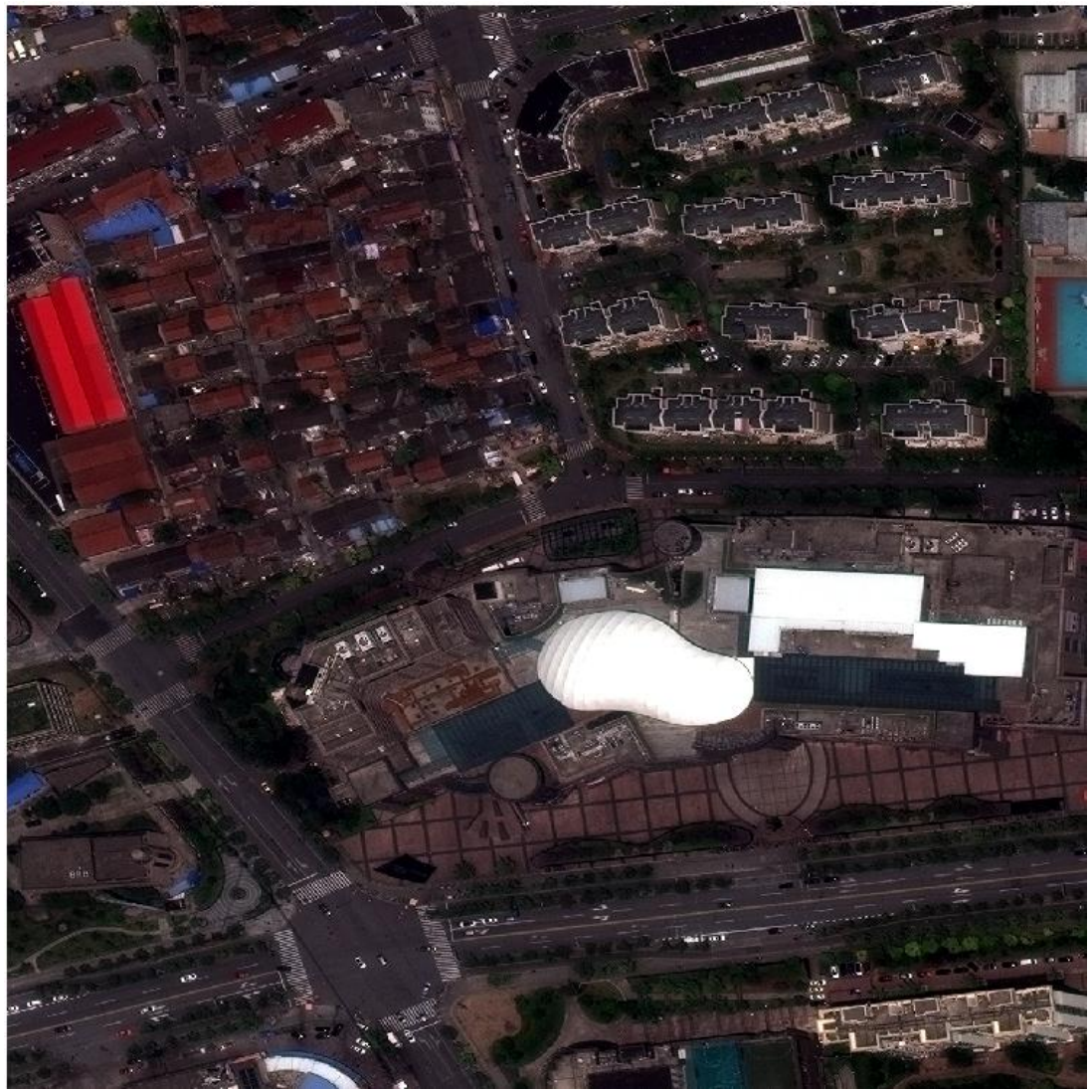

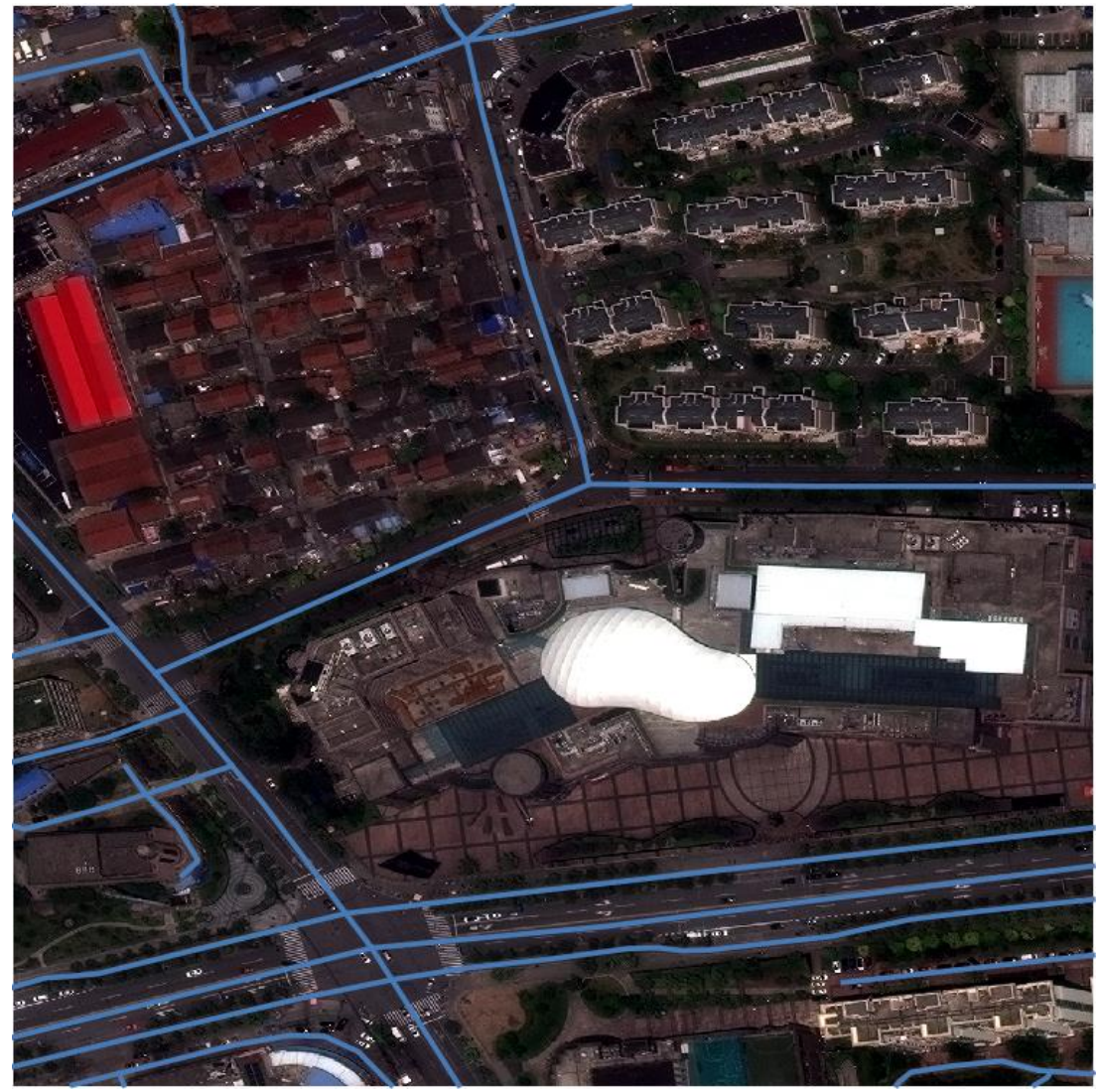

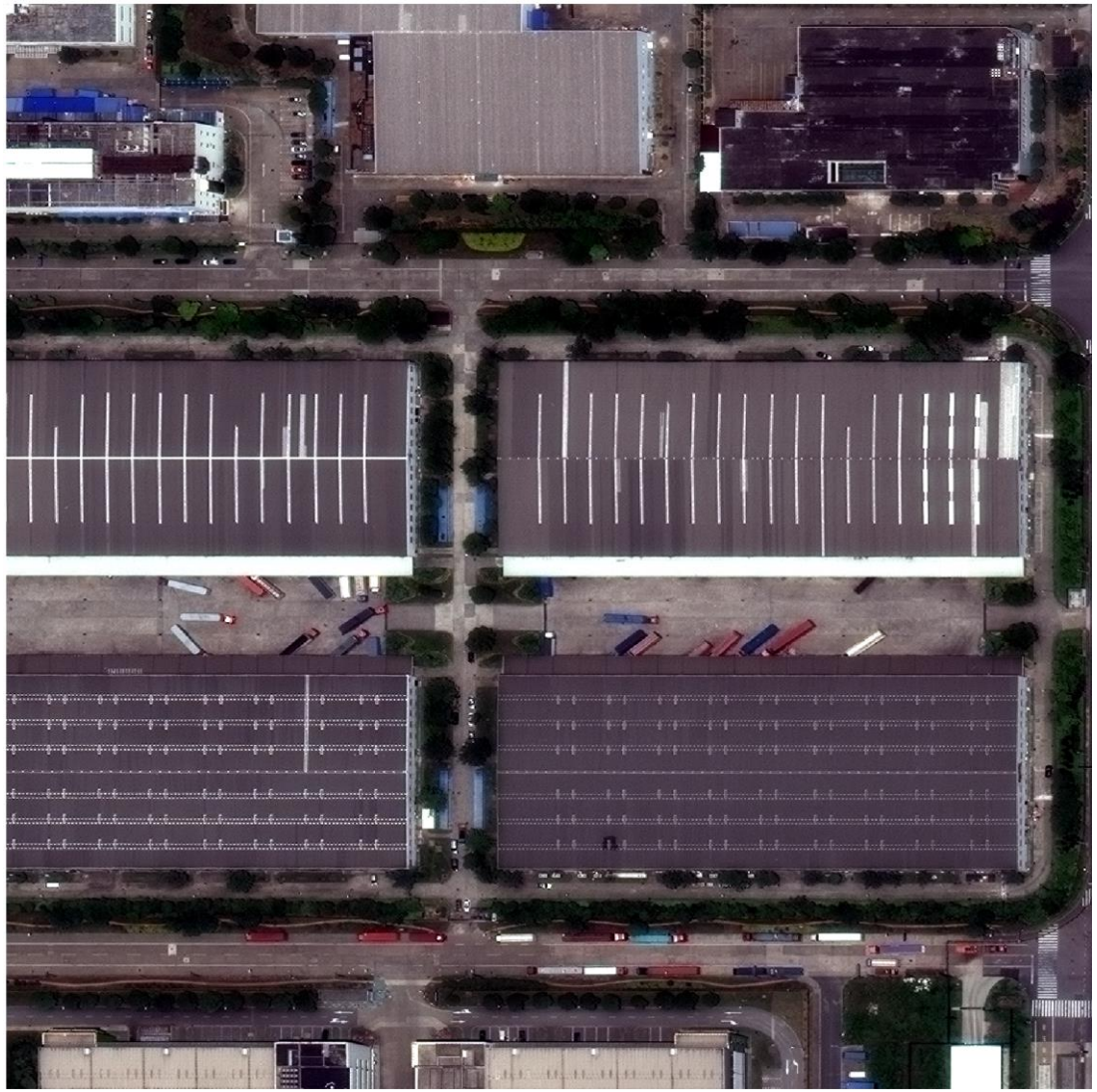

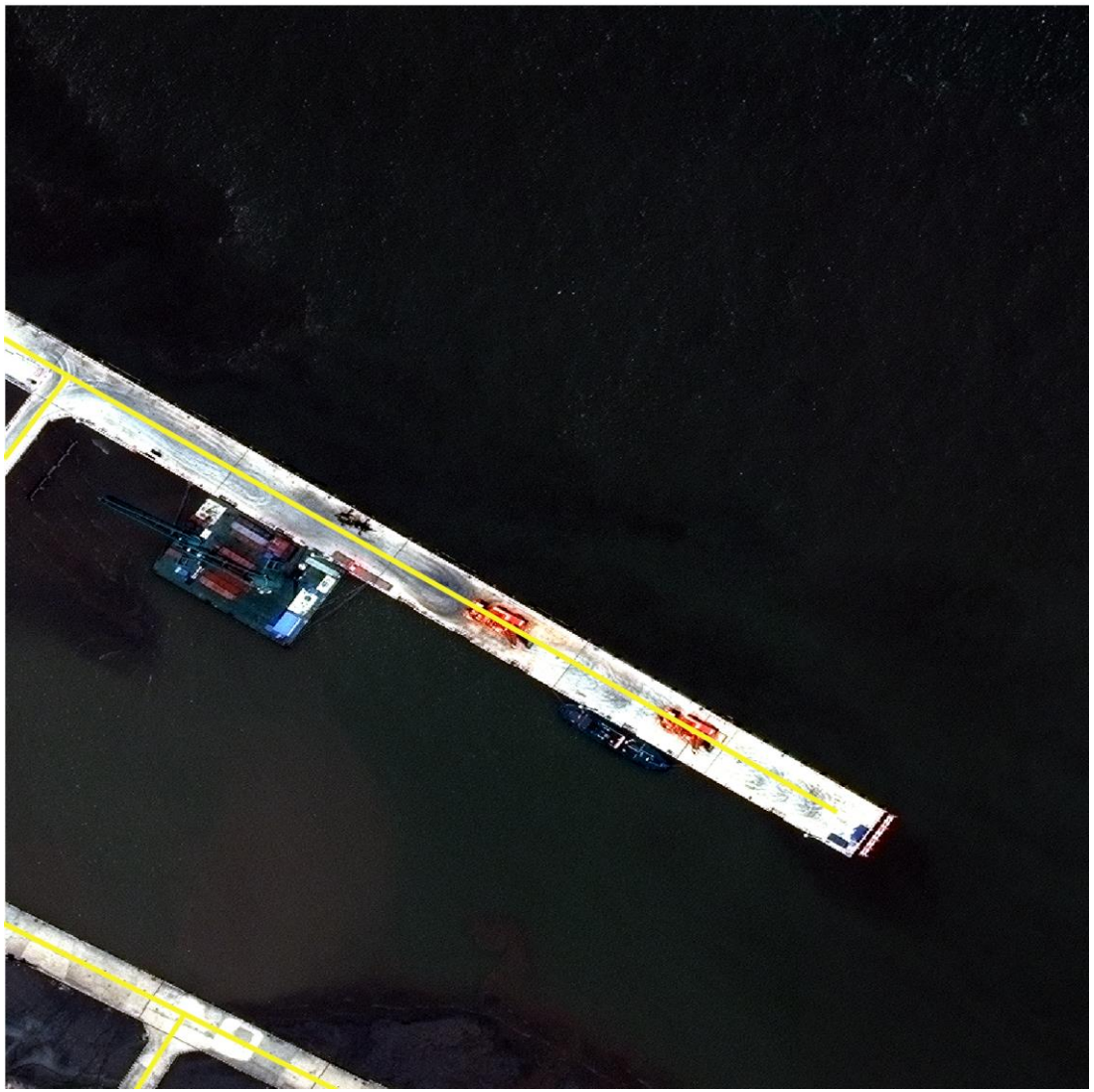

Next Steps

Figure out how to import 48-bit images as arrays into Python.

Generate another dataset containing OSM information which can potentially help with the training processes.

Thank you!