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How the diversity of training data improves the 2D UNet building detection

GeoML seminar, 27.2.

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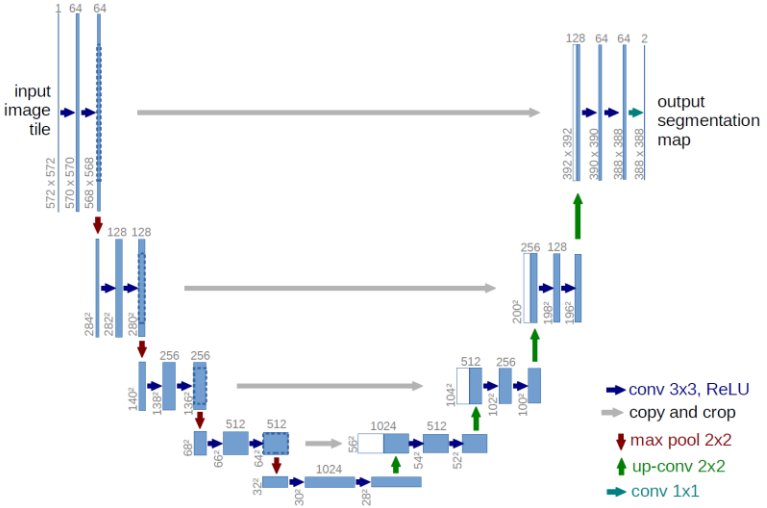
Outlines

- 2D UNet and building detection
- Why we need to add the diversity of training data
- Utilizing Puhti for building detection
- Conclusions

2D UNet and building detection

- Input data types:



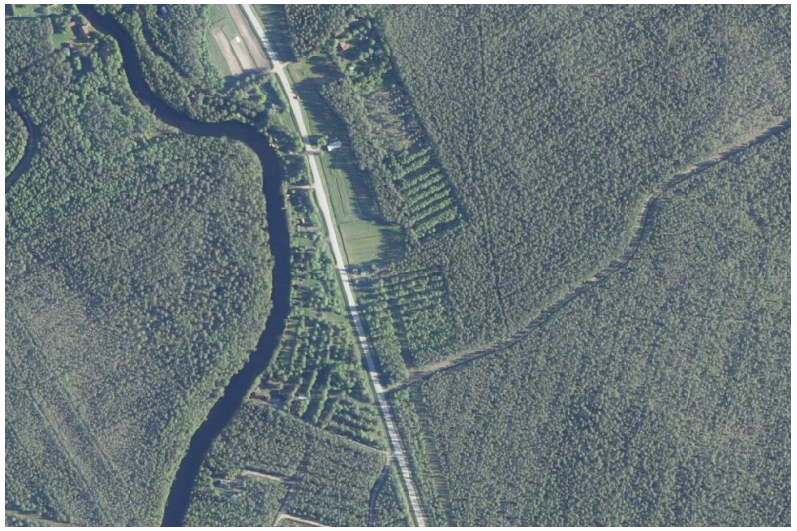
Labels (for training) True orthophoto DSM DEM

Training data

- We have been working to include data from all around Finland for our 2D UNet
  - Currently: 35 training areas from all around Finland, about 110 areas in Finland
- Earlier datasets had 30cm pixel resolution, new datasets have 25cm pixel resolution
- Moving towards using lidar DSM from aerial DSM based on better results with lidar DSM

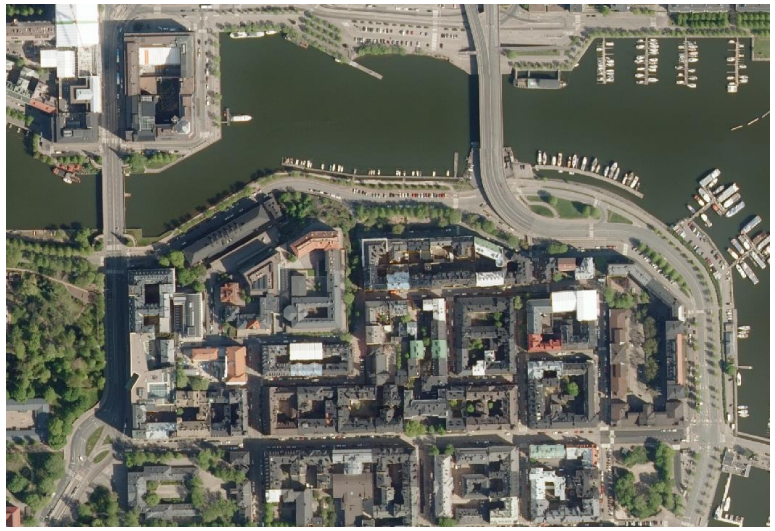
Adding diversity to training data

Pyhäntä, rural area



Helsinki, suburban area

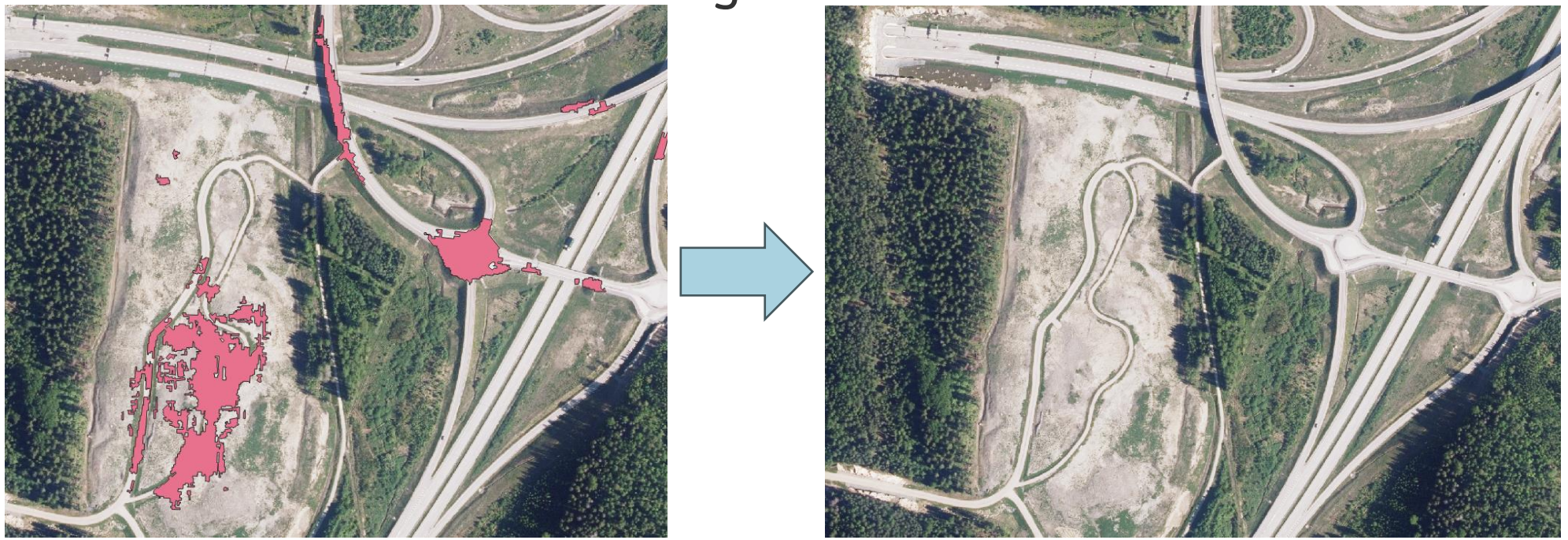
Helsinki, urban area



By giving the UNet model data from diverse Finnish environments, we can make it perform well in multiple types of areas

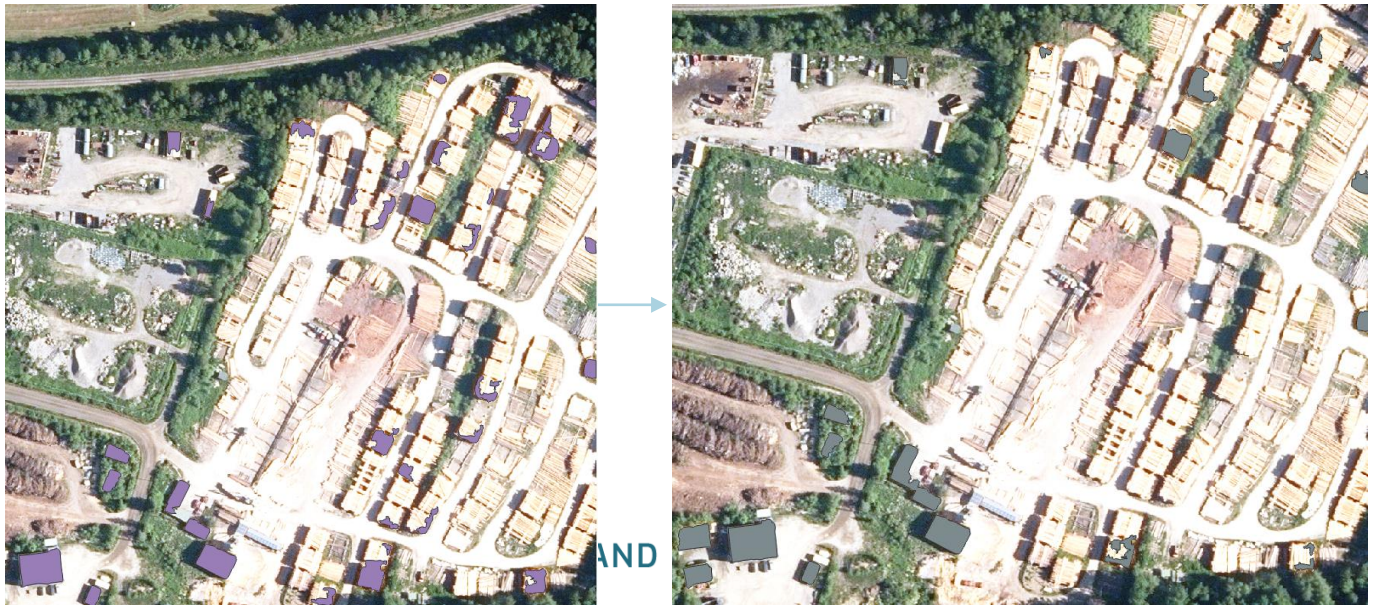
Adding diversity to training data

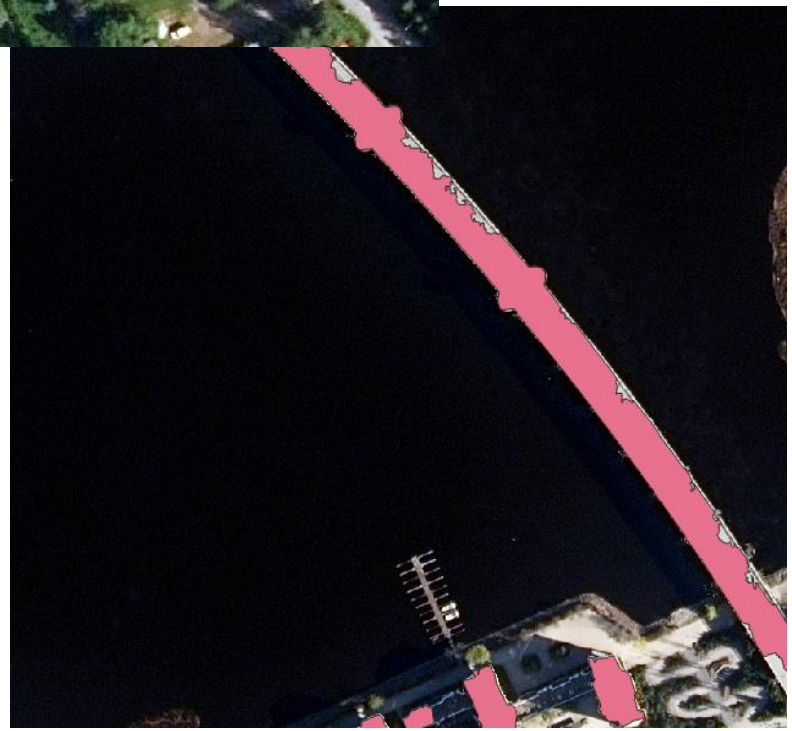
- First datasets given to the model were from Helsinki -> a lot of false detections in the rural and forest areas
- Originally all training datasets had 30cm pixel resolution -> a lot of false detections when moving to use 25cm data



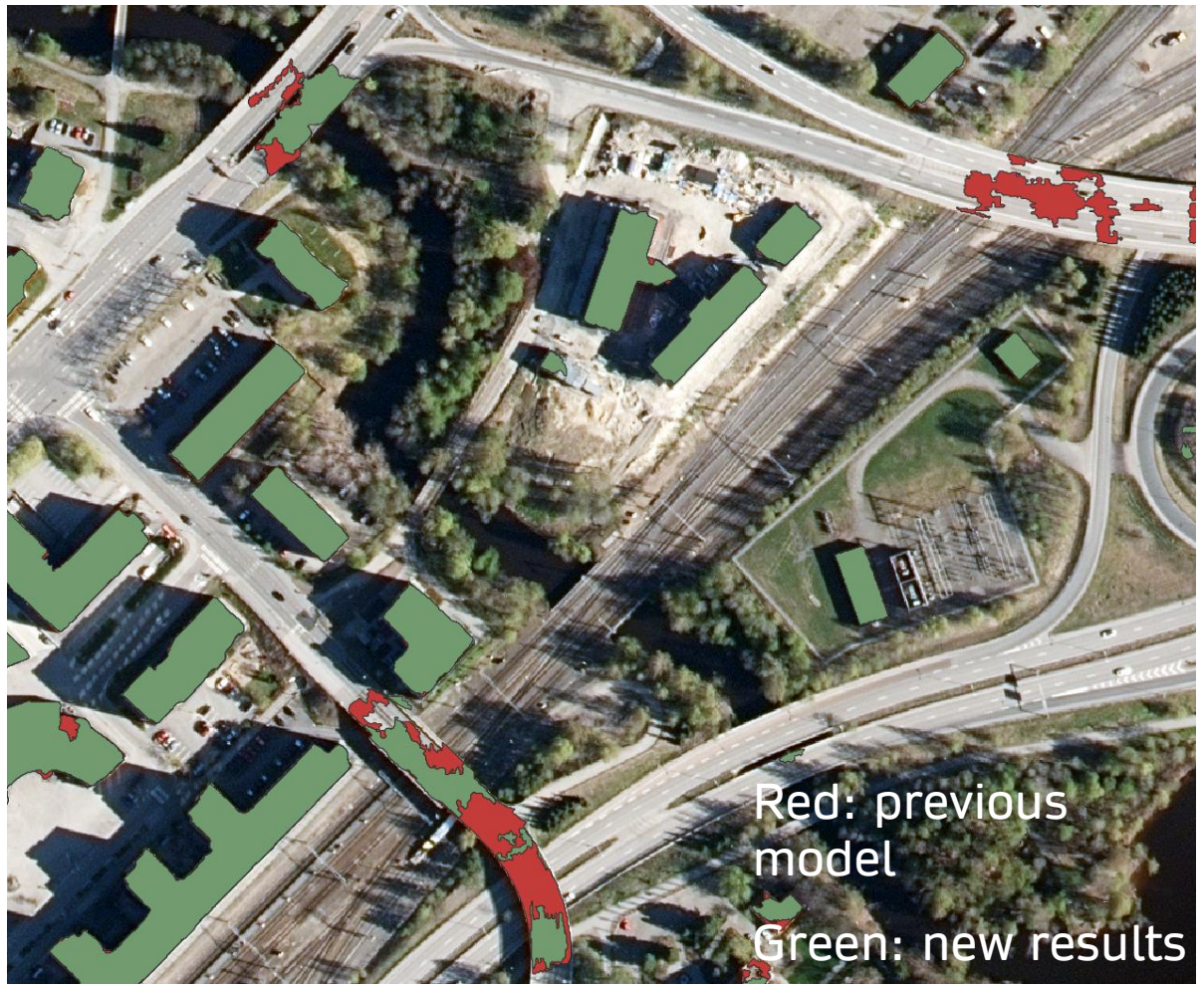
Some features are hard for the model

- For example, bridges, large buildings, construction areas, containers…
- Adding corrected training data with the hard features helps model to learn them better and reduces false detections





- Some examples
- Sometimes the false detections are related to the data (e.g. falsely high areas in DSM) instead of the model



Utilizing the services from CSC for building detection

- Training models on Puhti
- Producing building detection outputs if a large area needs to be processed at once
- Reserving resources for training with “sinteractive -i -g 1” command from command line, -g 1 meaning 1 gpu is reserved
- Training dataset sampling is done as a separate process so 2 cores are reserved for the training in Puhti
- The memory amount required and reserved depends on the dataset size in the current implementation

Utilizing the services from CSC for building detection

- Training datasets are stored in .npz (numpy zip file) format for saving space
- Model needs to be retrained every time new data is ready and added for the model

- Thanks for the support from the CSC!

Conclusions

- By adding diverse data from different environments from Finland, as well as data with difficult features, 2D UNet will perform better all across Finland
- CSC and Puhti have been in an important role in the development of our 2D UNet model

Thank you!

Advancing together

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