Spatial prediction of soil type maps with Neural Networks including quantification of model uncertainty

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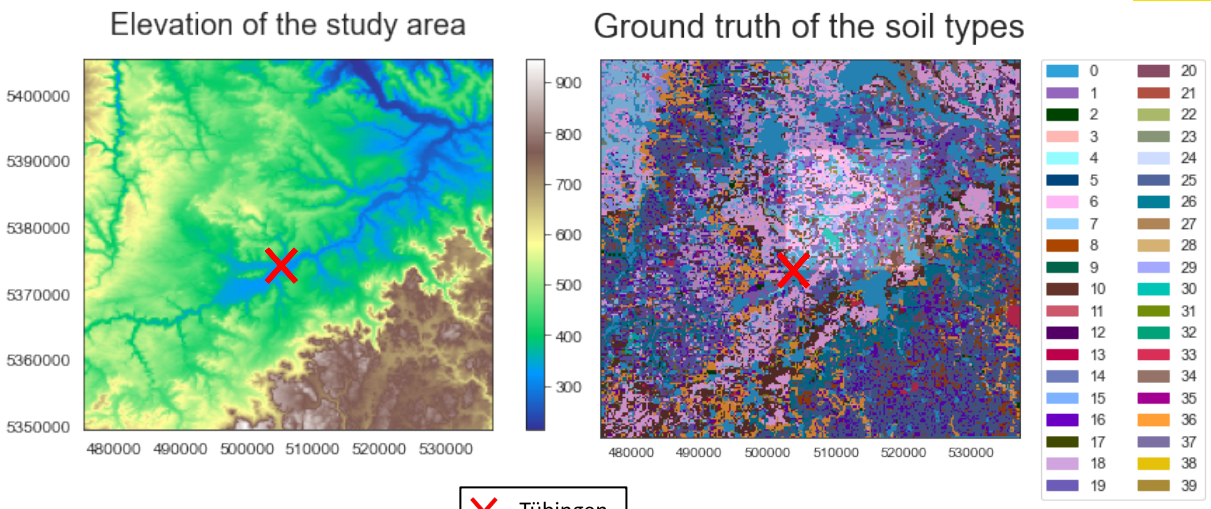
ML

EGU

Study area and the corresponding soil type

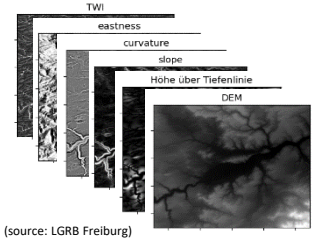
our ground truth



Artificial Neural Network

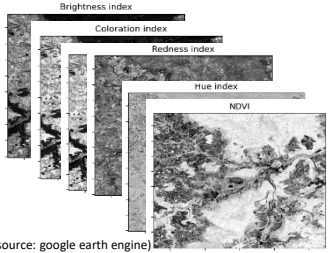
input and architecture

DEM and derivatives

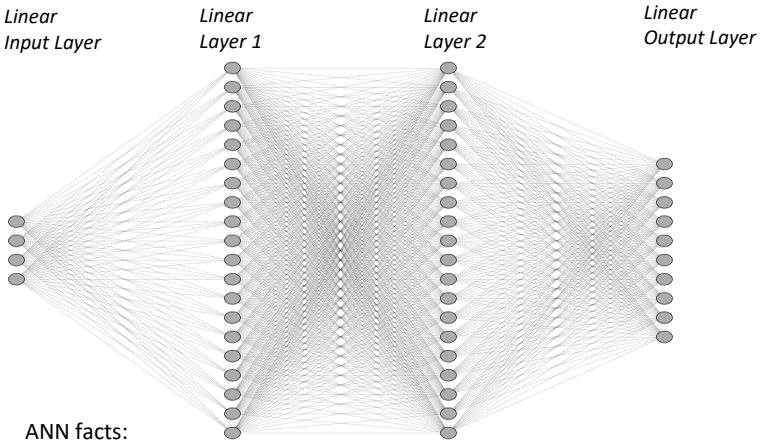


(source: LGRB Freiburg)

Sentinel-2



(source: google earth engine)



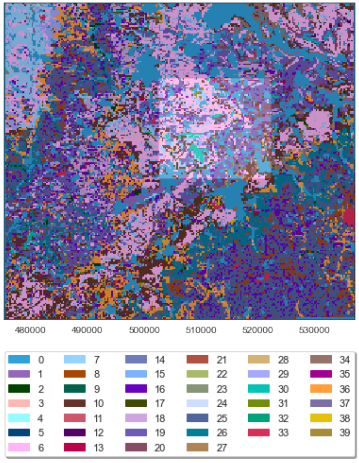
ANN facts:

- 3 linear layers followed by one ReLU activation function each
- Linear output layer for Last-layer Laplace approximation
- Optimiser: Adam, Loss: Cross-entropy Loss

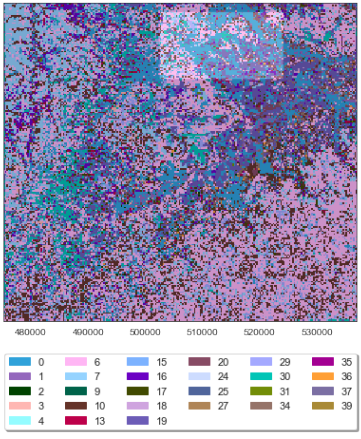
Prediction of the soil map by the ANN

simple and well-functioning

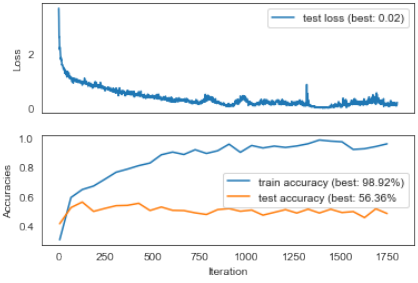
Ground truth of the soil types



Prediction with the ANN



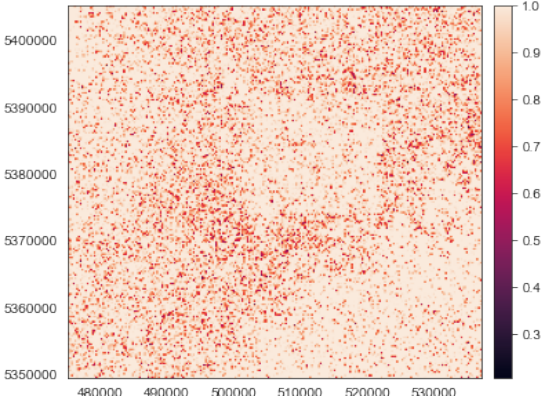
Performance



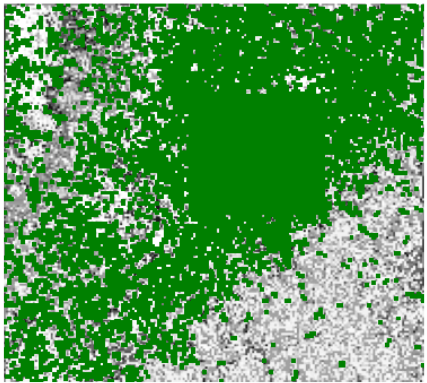
But can we trust the model?

first look

Probability of the predicted class



Comparison of the true labels with the predicted labels

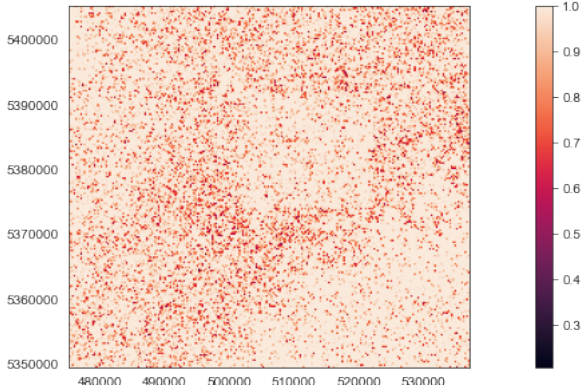


correct predicted label

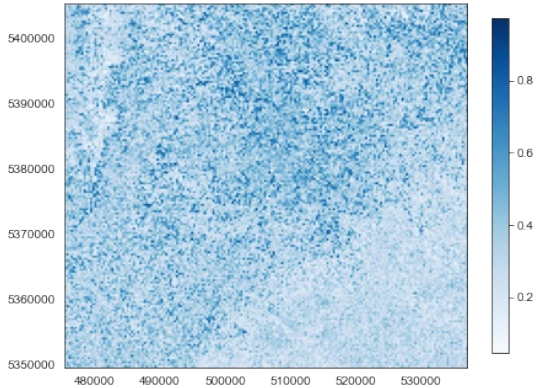
Last-layer Laplace approximation

adding uncertainty of the model

Probability of the predicted class



Uncertainty of the model prediction



Last-layer Laplace approximation:
Kristiadi, Agustinus, Matthias Hein, and Philipp Hennig. "Being bayesian, even just a bit, fixes overconfidence in relu networks." *International conference on machine learning*. PMLR, 2020.

Thank you for your attention!
Any questions?

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Abstract and OSPP Voting: