

## Bachelor's/Master's thesis at the Chair of Soil Science and Geomorphology

**Title:** Semi-Supervised Learning for Spatial Prediction of Soil Properties

### Background

Recent advances in geospatial technology and machine learning models have led to the development of **Digital Soil Mapping (DSM)**, a framework for predicting soil attributes or classes using spatially correlated environmental covariates. There are two types of machine learning models used in DSM: supervised learning (SL) and unsupervised learning (USL). Both approaches have advantages. SL can provide accuracy and uncertainty estimates, while USL can be used in areas with no observed data. In many DSM applications, there are a large number of covariates available, but soil data are limited due to the expensive and time-consuming collection and analysis process. When there are very few observations, SL algorithms may not perform well. Semi-supervised learning (SSL), a branch of machine learning that combines SL and USL, can be more effective for modeling DSM problems.

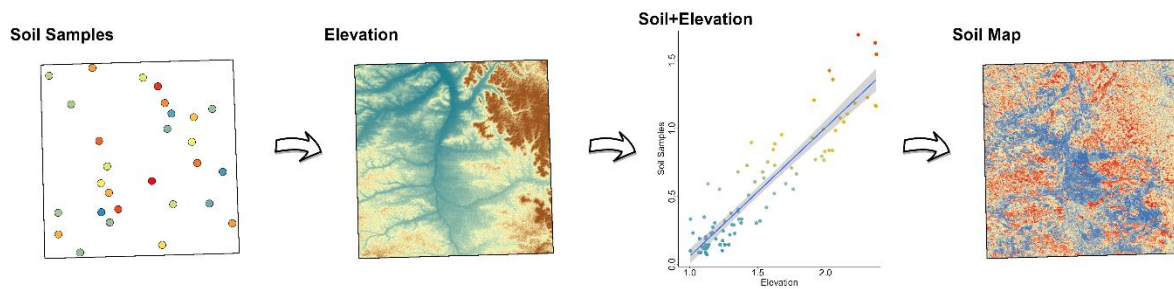


Figure 1. A framework for digital soil mapping

### Objectives

- Develop a semi-supervised learning method for digital soil mapping
- Assess the performance of the method for different environmental conditions
- Evaluate the performance of this approach compared to other machine learning methods.

### Interest

If you are interested in using innovative methods for soil science, geospatial data analysis, and machine learning, and have programming experience, please contact Dr. Ruhollah Taghizadeh ([ruhollah.taghizadeh-mehrjardi@mnf.uni-tuebingen.de](mailto:ruhollah.taghizadeh-mehrjardi@mnf.uni-tuebingen.de)). The student will collaborate with **Dr. Ruhollah Taghizadeh** and **Prof. Dr. Thomas Scholten**.

### References

- Taghizadeh-Mehrjardi, R., Sheikhpour, R., Zeraatpisheh, M., Amirian-Chakan, A., Toomanian, N., Kerry, R. and Scholten, T., 2022. Semi-supervised learning for the spatial extrapolation of soil information. *Geoderma*, 426, p.116094.
- Sheikhpour, R., Sarram, M.A., Gavaghan, S. and Chahooki, M.A.Z., 2017. A survey on semi-supervised feature selection methods. *Pattern Recognition*, 64, pp.141-158.