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AGU Hydrology Days

Predicting Soil Texture Using 1-D Convolutional Neural Networks based on Field Hyperspectral Images

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Abstract. The particle size distribution of soils is used to classify the soil into texture-based categories. However, the determination of soil particle size distribution using laboratory procedures can be costly, time intensive, and is often impractical across large spatial regions. While soil data products, such as the Soil Survey Geographic Database (SSURGO), can be used for geospatial analysis, many modeling applications require higher fidelity soil texture information. Hyperspectral images contain information on a material's reflectance at various wavelengths in the visible and near-infrared parts of the electromagnetic spectrum. Supervised machine learning models have shown promise for predicting soil texture from hyperspectral images captured in laboratory (controlled) environments; however, the prediction of soil texture using field hyperspectral images is less certain. The objective of this study is to better understand how one dimensional convolutional neural networks can be used to predict soil texture from field captured hyperspectral images. A published convolutional neural network modeling procedure for laboratory soil classification is adapted to predict soil texture based on field captured hyperspectral images. The field imagery was captured at two field sites located in Northern Colorado by passive hyperspectral cameras at semi-vegetated locations. Soil samples were collected at each imaging location, classified using laboratory procedures, and used to evaluate model performance. Results of the field adapted convolutional neural network indicate that field captured hyperspectral images may be viable for the prediction of soil texture for large scale modeling procedures.