Using Deep Learning to Predict Optimum Crop Management Decisions

Rodrigo G. Trevisan [1,]

rodrigo7@illinois.edu

David S. Bullock[2] Nicolas F. Martin[1,]

[1] *Department of Crop Sciences, University of Illinois*

[2] *Department of Agricultural and Consumer Economics, University of Illinois*

Introduction

- On-farm experimentation
- Precision agriculture tools
- Crop response variability
- Spatial and temporal variability
- Predictive models
- Convolutional Neural Networks
- Semantic segmentation

Objective

To evaluate deep learning models to predict the optimum seed and nitrogen rates as well as the crop yield at the optimum rates

Methods

- Checkerboard style field trials
- Four cornfields in Illinois
- Six topographic derivatives + EC
- Opt. seed and nitrogen + yield
- U-Net based CNN
- Image-based data augmentation
- Leave-one-out cross-validation

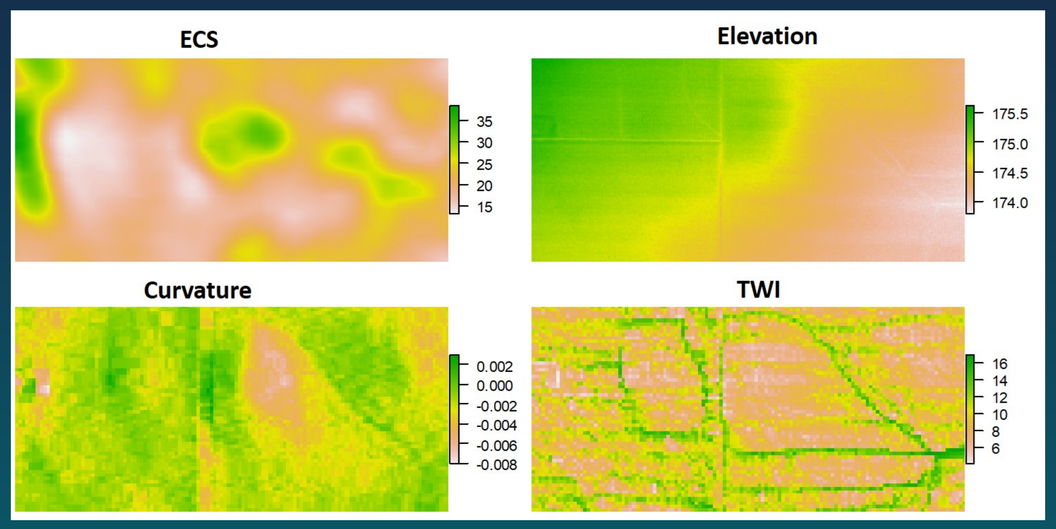
Results

- Importance of independent training and validation sets
- Low power of generalization in new fields
- Need for more predictor variables and independent observations

Acknowledgments

This research was funded in part by a USDA National Institute of Food and Agriculture Food Security Program grant, award number 2016-68004-24769.

Predicting the spatial variability of optimum crop management decisions using an adapted semantic segmentation convolutional neural network



osf.io/g3dq8

Figure 1: During the training process, the error in the training set is reduced while the error in the independent validation set is increased, characterizing model overfitting.

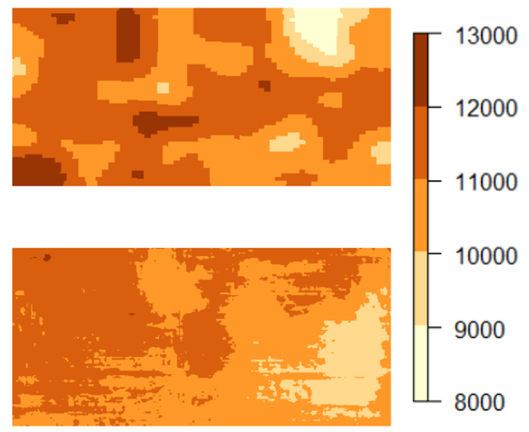


Figure 2: Spatial distribution of observed (top) and predicted (bottom) corn yield (kg/ha).

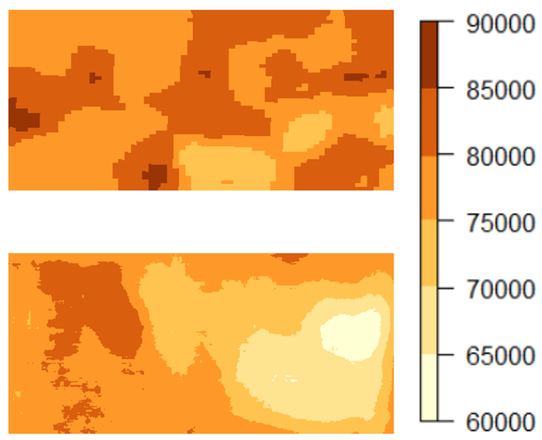


Figure 3: Spatial distribution of observed (top) and predicted (bottom) optimum seed rates (kseeds/ha).

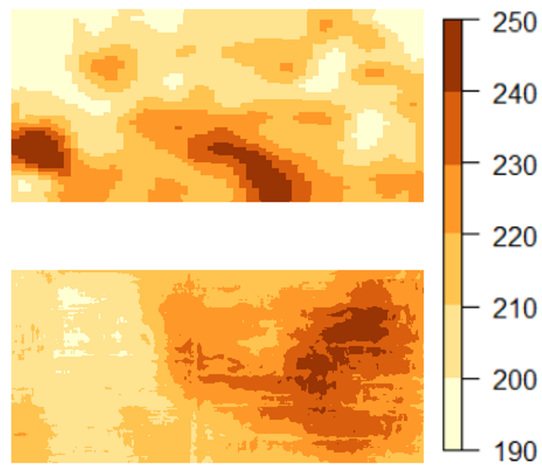


Figure 4: Spatial distribution of observed (top) and predicted (bottom) optimum nitrogen rates (kg/ha).