A multi-scale data assimilation framework for layered sensing and hierarchical control of disease spread in field

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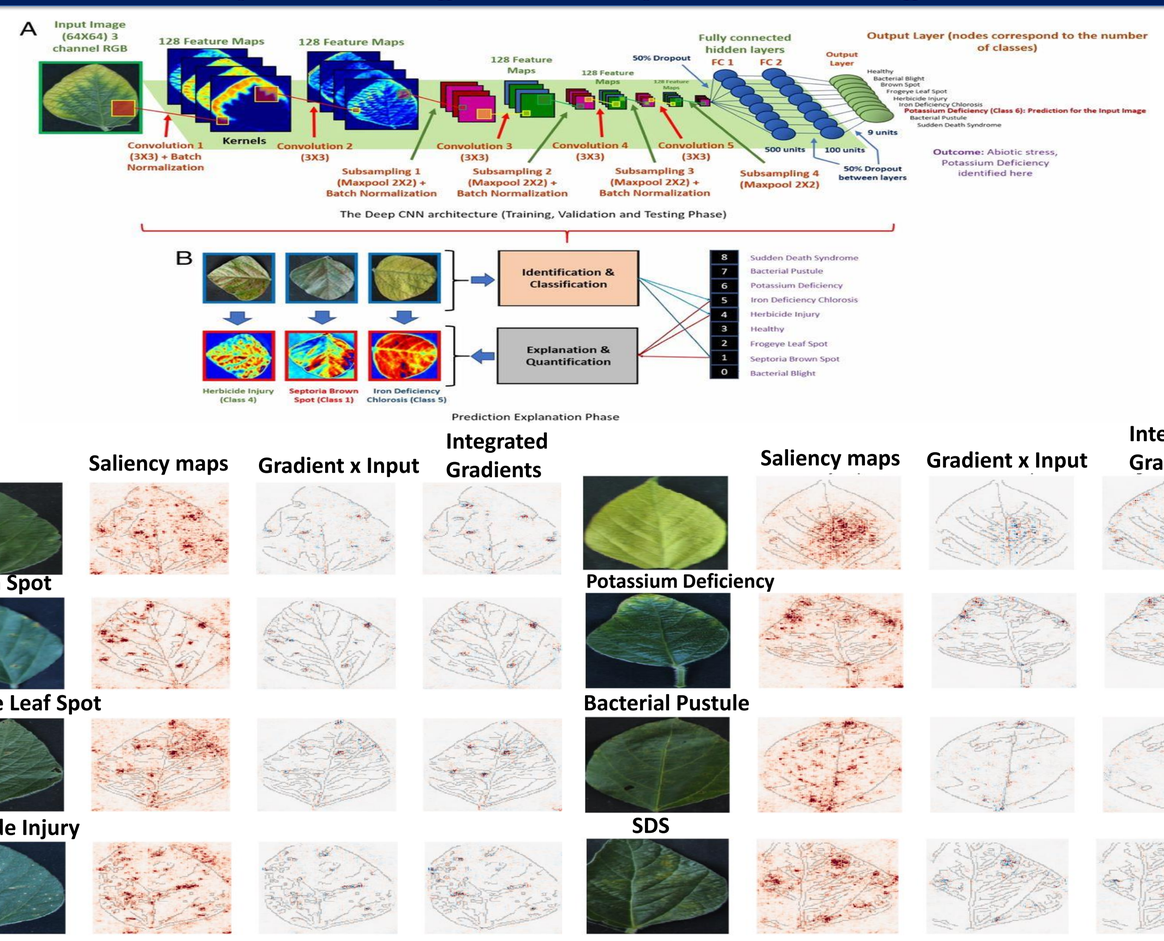
Explaining a deep learning model for soybean stress classification



Problem:

- To accurately identify 8 different stresses on soybean [Glycine max (L.) Merrill] using a convolutional neural network architecture developed for mobile devices.
- To understand the influence of image pixels on the classification decision of a deep learning model.

Contributions:

- We have shown that MobilenetV2 architecture can effectively be used for soybean stress classification.
- Local explanation methods were used to understand the influence of the image pixels on the classification score.

Loss estimation based active learning framework for soybean stress classification

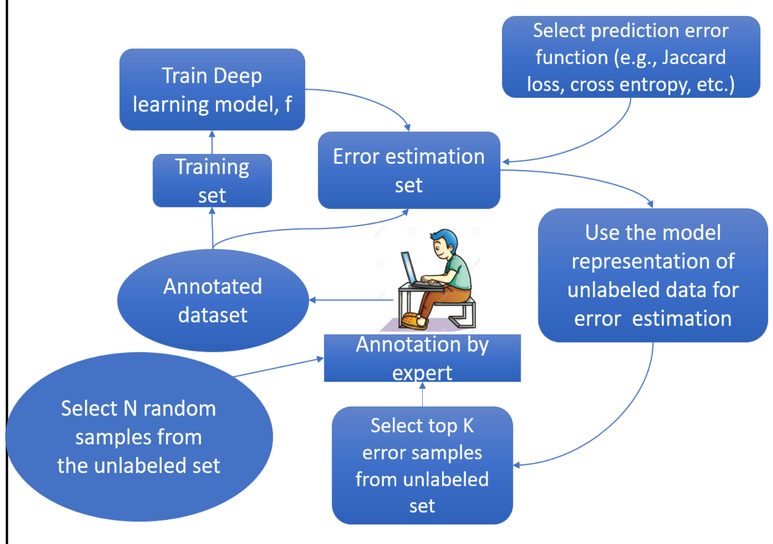
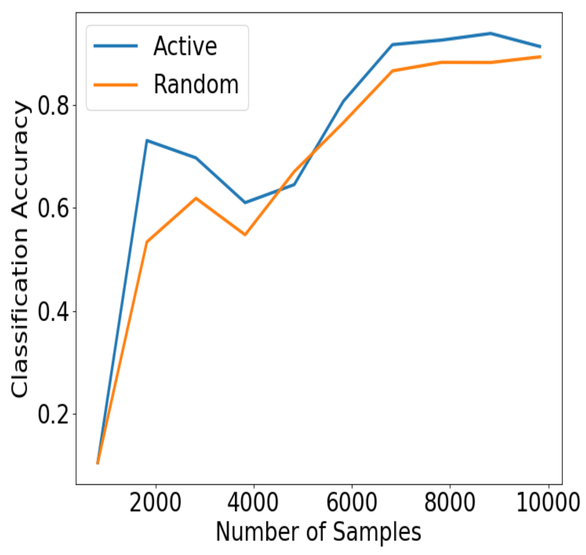


Illustration of Active Learning workflow



Problem:

- To achieve maximal classification performance for a deep learning model under a fixed labeling budget.

Contributions:

- We developed a task agnostic active learning framework for a deep learning model based on unlabeled data loss estimation.
- Our method performed better than random sampling based annotation for soybean stress classification.

Broader Impact

- Farmers are interested in early crop stress mitigation for increasing profitability.
- Stress identification and quantification could enable plant breeders and agriculture companies to develop stress resistant/tolerant crop varieties.
- Interpretability and active learning methods could enable development of robust deep learning models with less labeled data for CPS problems.

Interdisciplinary education :

- From Engineering: Sambuddha Ghosal, Koushik Nagasubramanian, Zaki Jubrey.
- From Agronomy: Sarah Jones, Matthew Carroll.

Outreach:

- Organization of the Second International Workshop on Machine Learning for Cyber Agricultural Systems (MLCAS) 2019 at Ames, Iowa.

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