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Attention-based Crop Yield Prediction

Applied Deep Learning

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Background

- Crop yield relies on diverse factors with complex interdependencies
- DL Methods are well-established in crop yield prediction
- Feature importance changes during growth stages
  e.g. early growth stage has significant impact on yield potential
- Attention layer might be beneficial to guide the models focus

The available data and original model used focuses on soybeans.
Source: Plantura Magzine. Soybean: growing, harvest & uses, 2019.

Research Question

How can an attention mechanism improve the CNN-RNN models ability to predict crop yield?

(Khaki et al., 2020)

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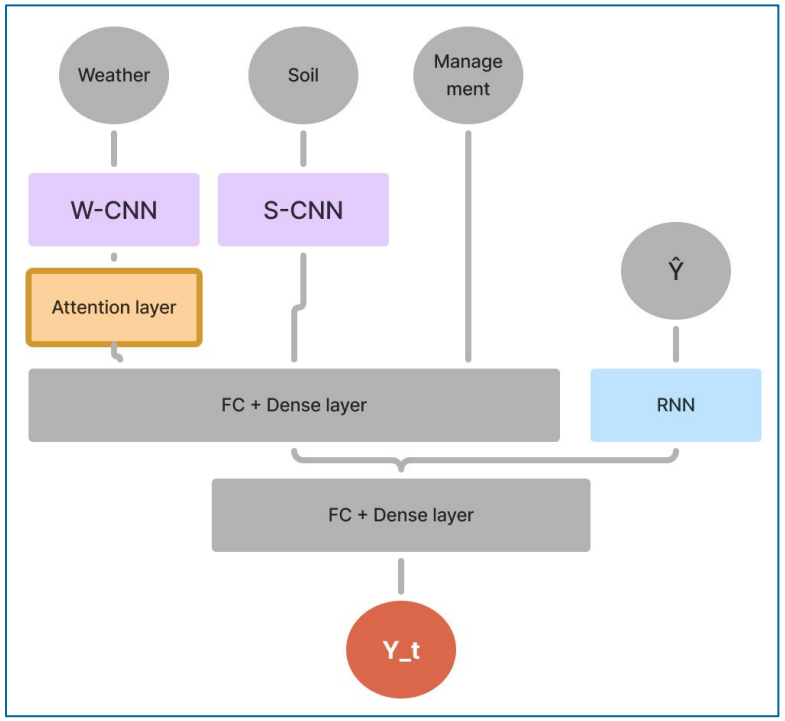
Methodology

- Start with existing CNN-RNN framework
- Enhance with additional Standard-Attention-Layer and Multi-Head-Attention-Layer
- Introduce LIME explainability method



Proposed model architecture of the standard attention model.

(Yi-Ming and Hao, 2023)

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Results

Standard Attention model outperformed Original model by almost **13%**, while being incredibly **resistant to overfitting**.

Multi-Head Attention model shows clear signs of overfitting and was not able to improve the Original model.

Model	Training RMSE	Validation RMSE	Training R^2	Validation R^2
Original	4.125	5.288	0.845	0.684
Standard Attention	4.243	4.610	0.836	0.760
Multi-Head Attention	4.297	5.190	0.831	0.695

Model performance comparison on training and validation data.

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Conclusion

- Challenging re-implementation of outdated code

  -> Carefully choose original paper and inspect the code beforehand!

- It is likely that unexpected challenges arise

  -> Be defensive about time estimates.

- There is no better way to learn than to do - highly recommended!

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References

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