Grower Summary

SF/TF 170

The Augmented Agronomist: Synthesis of Privacy-Preserving Neural Networks and Robotics to Assist Decision Support

Annual 2019

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Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the AHDB Horticulture office (hort.info.@ahdb.org.uk), quoting your AHDB Horticulture number, alternatively contact AHDB Horticulture at the address below.

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Project title:	The Augmented Agronomist: Synthesis of Privacy-Preserving Neural Networks and Robotics to Assist Decision Support
Project number:	SF/TF 170
Project leader:	George Onoufriou
Report:	Annual report, October 2019
Previous report:	N/A
Key staff:	Marc Hanheide Georgios Leontidis
Location of project:	Lincoln
Industry Representative:	Richard Harnden, Berry Gardens,
Date project commenced:	30 November 2018

GROWER SUMMARY

Headline

To provide automated agronomy support for agronomists at scale using machine/ deep learning techniques for yield prediction, from high dimensional spatio-temporal data.

This approach will reduce costs whilst maximizing specialist human time in areas that require the most attention.

Background

This work on the augmented agronomist has been undertaken to help focus human time to the most vital areas, and act as an arm for agronomists to help locate problem areas in the crop earlier than possible and improve yield prediction. This system is also being created to improve trust, and security around the usually enigmatised deep learning models, and ensure data owners privacy.

Summary

Over the course of this project we intend to complete the following key objectives:

- **Provide agronomists and growers with yield predictions.** This is the primary advantage provided by the augmented agronomist system which will provide alerts to the operator of deviations from forecasts, and highlight areas where predicted yield potential is not on target. This information will enable the operator to focus efforts in areas which require most attention in order to maximise yield potential.
- **Create an autonomous data collection system**. Hand collecting data at scale would be infeasible due to both time and cost investments being too high while also providing inconsistent results. We will develop a repeatable and autonomous data collection platform so that we can collect spacio-temporal data for yield consistently and at scale.
- **Create a data aggregation and utilization pipeline.** This pipeline will be designed to be able to collect and aggregate distributed (i.e. from multiple growing sites) and autonomous data.
- **Deploy an agronomy assistive neural network to predict plant yield ahead of harvest.** This includes neural network assessment of its own certainty in its predictions, allowing certainty metrics to be used to determine areas of interest.

Financial Benefits

At this point in time it is unclear how significant the financial benefits will be as it is still early in research. However, if we compare this work to similar deep learning studies we would expect around an error of less than 15% (RMSE%) in yield prediction (Konstantinos et al 2018; Maimaitijiang et al 2020). Adding to this the uncertainty metrics to flag the uncertain cases to reduce the model's error over time, and we aim to eventually achieve <5% error.

Action Points

- There are no action points at this early stage of the project.