AI between Plant and Agricultural Science:
Green Paths towards Environmental Intelligence

16 December 2019

Organisers: Sabina Leonelli and Hugh Williamson (University of Exeter)

Introduction

Data science and machine learning are central to the development of high-throughput plant and agricultural research and its application to problems of social and environmental resilience, such as food security. The workshop will focus in particular on the structure, management and use of plant data infrastructures, including the choice of semantic structures, the maintenance of systems and their accessibility - issues that are central to the integration of diverse datasets for computational analyses at an environmental scale.

Having reliable, meaningful and usable ways to integrate, compare and visualise data from different sources and scientific approaches is essential to data analysis in the emerging field of Environmental Intelligence, which seeks to enhance human resilience to environmental changes through understanding the complex interactions between climate, ecosystems, and human social and economic systems. Plant science makes a distinct contribution to this effort through the development of evidence-based agriculture and governance strategies for food security. These strategies are predicated on having efficient plant data infrastructures for integrating diverse datasets and conducting complex computational analyses, for example on the interrelations between genotype, environment and growth data for crop varieties. Building infrastructures that are sustainable and responsive to the needs of plant and agricultural scientists working in high-throughput research settings continues to pose a significant challenge for achieving food security goals.

About the event

This one-day workshop will bring together experts in the plant and agricultural sciences who are working with complex datasets spanning genomic, physiological and environmental data and computational methods of analysis with data scientists interested in the application of cutting-edge technologies to this field. The workshop aims to map future directions for (1) developing and consolidating the Turing Institute's capabilities in the area of data science for plant science, and (2) integrating plant science within emerging networks of Environmental Intelligence. Particular emphasis will be given to mapping the current needs of the plant and agricultural science community, in order to establish a guiding framework for the efficient and responsive deployment of data science and artificial intelligence resources in those fields.Short research presentations will be followed by an extended discussion format, which will provide a forum for identifying possible collaborations and developing proposals for project applications.

9.30-10 Registration

10-10:30 Welcome and Introduction. Chair: Sabina Leonelli
- Challenges in data linkage and analysis for the plant sciences. *Sabina Leonelli* (University of Exeter)
- The Environmental Intelligence initiative. *Gavin Shaddick* (University of Exeter)

10:30-11:30 Presentation session 1: Plant and agricultural science at the Turing
- Mapping plant data infrastructures. *Hugh Williamson* (University of Exeter)
- Environmental signal integration in plants. *Daphne Ezer* (University of York)
- Multimodal, multi-task deep learning for plant phenotyping: an open science approach. *Sotirios Tsaftaris* (University of Edinburgh)
- Growing underground. *Ruchi Chaudhary* (University of Cambridge)
- Decision models and support for agri-environmental contexts. *Julia Brettschneider* (University of Warwick)
- AI in plant science: Opportunities and limitations. *George Bassel* (University of Warwick)

11:30-12.00 Break

12.00-13.00 Presentation session 2: Integrating plant data for environmental intelligence. Chair: Hugh Williamson
- Genomics data in plant pathology. *David Studholme* (University of Exeter)
- Approaches for plant disease surveillance. *Richard Morris* (John Innes Centre)
- Using large genomic datasets to drive forward plant breeding. *Anthony Hall* (Earlham Institute)
- The opportunities and challenges of using AI in agricultural research. *Chris Rawlings* (Rothamsted Research)
- Recoding regulation. *Nicola Patron* (Earlham Institute)
- Solving the challenges of food security. *Rob Davey* (Earlham Institute)

13:00-13:45 Lunch

13.45-15.15 Panel session: Between plant and data science – Mapping needs. Chair: Sabina Leonelli.
- *Ruth Bastow* (DEFRA), *Mario Caccamo* (NIAB), *Carole Goble* (University of Manchester), *Neil Hall* (Earlham Institute), *Richard Harrison* (NIAB) & *Paul Kersey* (Royal Botanical Gardens, Kew)

15.15-15.30 Break

15.30-16.30 Breakout session: Future paths – Identifying proposals and collaborations

16.30-17.00 Summary and closing remarks