Predictive analytics for enhanced decision making and foresight in agriculture

Nathaniel K. Newlands[1,2]

[1]Agriculture and Agri-Food Canada, Science and Technology Branch, Summerland Research and Development Centre, 4200 Highway 97S, PO Box 5000, Summerland, British Columbia, Canada, V0H 1Z0

[2]Department of Geography, University of Victoria, PO Box 1700 STN CSC, Victoria, Canada, V8W 2Y2

Abstract:

Achieving the global sustainable development goals (SDGs) in the face of societal pressures of population growth, urbanization, and climate change, requires agriculture to grow food, feed, and fibre more intensively on available agricultural land. It also requires using water, chemical and energy inputs more efficiently, without adversely impacting the environment, or converting non-agricultural land.

Digital agriculture offers enormous benefits and opportunities for making agricultural ecosystems more productive, resilient, and sustainable. However, there are methodological challenges in linking diverse types and forms of data from traditional and advanced platforms and technologies (e.g., climate/weather stations, sensors, communication networks, satellites, drones, robots, advanced machinery). How big data can generate meaningful value and insights for optimally guiding complex decision-making across the agricultural value-chain, in near-real-time and/or over the longer-term, remains an open question. Whether due to COVID-19, extreme weather events or longer-term climate change, reliable foresight with sufficient lead-time is critical for effectively responding to known and unknown risks, vulnerabilities, and impacts. Reliable and timely decision making requires agile predictive analytics that integrates statistics and data science (mining, modelling, artificial intelligence, deep/machine learning) in analysing big data and making future predictions.

In this talk, I will discuss a proposed big data strategy and implementation framework for integrating traditional and new digital agriculture data, highlighting the importance of data sharing and integrated monitoring across spatial and temporal scale with smart farms, regional weather networks, remote-sensing data fusion. I will showcase different ways that predictive analytics using AI, machine, deep learning are being applied to improve agricultural production, specifically in tree-fruit fast throughput phenotyping, wine grape disease prediction, and crop yield prediction from the farm field to regional scale. I will also highlight a Canadian success story involving the integration of earth observation with official statistics, demonstrating the value of integrating statistics and data science to enhance operational decision-making.

Keywords:
Artificial intelligence, Big data, Climate change, Predictive analytics; Sustainability