Big Data Applications and Prospects in Precision Agriculture

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Outline

• Introduction
• Overview of Precision Agriculture in Australia and Europe
• Big data applications in PA: opportunities and challenges
• Implications of Big Data for farm management
• Observations and Remarks
Introduction

• Increasingly competitive markets with rising input costs but declining agric commodity price (declining TOT)

• Climate change, resource supply contraints & changing consumer demand

⇒ Farmers seek for productivity improvement
  – technology progress, on-farm innovation, resource allocation (structural adjustment), R&D
⇒ produce high quality products in environmentaly sustainable way
⇒ Precision farming: managing spatial and temporal variabilities
Introduction (cont’)

• Transformative technological trends:
  – **Internet of Things (IoT):** cheaper sensors and increased inter-connectivity provide rich-data sources on agricultural production systems.
  – **Big Data (BD):** analysis of data provides insights for better farm decision making and fast-track research.
  – **E-commerce:** targeting consumer preference

• Ability of applying BD solutions for real-time business decision will be a divide between survival and bankruptcy (Kitikidau and Arambatzis 2015).
Precision Agriculture in Australia

• Australia’s agro-climatic conditions, large average farm size and low farm income subsidy provide good conditions for precision farm management (Whelan 2007)

• PA in Australia is dominated by the grains farm
  – use of auto-steering as high as 90% but yield monitor & VRT is low (Bramley and Trengove 2013)
  – VRT for P and N

• Farm Information Systems for horticulture. E.g, https://www.youtube.com/watch?v=j-gJQXQoqX0

• Availability & use of decision support technology platforms is at a low stage
Precision Agriculture in Australia (cont’)

• Research and Robotics at University of Sydney
  – PA Lab
  – Australian Center For Precision Agriculture (CFPA)

• RIPPA (Robot for Intelligent Perception and Precision Application )
• Variable Injection Intelligent Precision Applicator (VIIPA)
  – First Autonomous on-farm field trial – Nov 2015
  – Weed management, animal monitoring & invasive pest management

• Rover Farm Trials https://www.youtube.com/watch?v=KGfyuiUgFYQ
  – Self reconfigurable crop row monitoring
  – Easy to transportation

• LadyBird Real-time targeted Spot Spray with image-based detection
Precision Agriculture in Europe

• Auto steering, controlled traffic farming, yield mapping, VRT (lime, fertilizer, pest ), (semi)-automated irrigation management
  – Wide diversity in adoption across EU countries

• So far PF adoption in Europe is regarded as lower than expected
  – high investment cost in equipment
  – high learning cost owing to complexities of the systems (Kutter et al. 2011)

• Now Europe entering the era of PA with combined use of data (EurActiv quoting Phil Hogan, 23 October 2015)
Precision Agriculture in Europe

• Intelligent Robots and Information Systems
Big Data and Precision Agriculture

• An enabler to achieve practical need of PA, i.e., improve farm management decisions (Brett Whelan, August 2015 to AFI)

• Target consumer needs/markets, e.g., premium markets

• Better align research and development

• Tracing and tracking

• Motivate value adding at farm and latter in the value-chain

• Facilitate embodied technology in farm equipment and hence adoption of PA
Big Data and Precision Agriculture

• Some perceive PA to flourish as ‘Big Data Business’ (Tien 2012)

• Objective of BD analytics (Tien 2013):
  Data → Information → Knowledge → Wisdom

• Many applications in agric retail but not so in production (Sonka and Cheng 2015)

• Example areas of Big Data application in agriculture
  – robotic management
  – decision support systems

• In Europe, Food and Agriculture is identified as one of the seven societal challenges where Big Data is hoped to considerably contribute to the solutions.
Implications of BD for Agriculture

• Prospect for robotic management
  • Labor employment issues
  • Consumers’ perception about agric commodities may be influenced

• Make it hard for less efficient farms to survive

• Accompanying technical and managerial capabilities

• Business model for farm consultancy
  – cooperatives vs contractors
What needs to be done?

• New methodologies for automated micro decisions in farm management

• Decision Support platforms for farmers

• Synergy between Small data and Big Data (Cheng 2015)

Remarks:

• BD is not just for Big entities
• Big chances of misled decisions, so invest in farmer/manager expertise
Questions? Comments?

Thank you.