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Big Data Applications and Prospects in Precision Agriculture

Tseganesh Wubale Tamirat[1]

Robert Farquharson[2]

[1] University of Copenhagen, Department of Food and Resource Economics
[2] University of Melbourne, Faculty of Veterinary and Agricultural Sciences

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 contries
- 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 devlopment
- 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 $\rightarrow$Information$\rightarrow$Knowledge$\rightarrow$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 expertize

Questions? Comments?

Thank you.