VIEWPOINT

Big Data and its impact on agriculture

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Abstract – This Viewpoint article will discuss the roles the Big Data phenomenon may play in key issues related to agriculture, food production, and environment. The author contributed to Oracle's strategic White Paper document on the applicability of Big Data in agriculture [1] and in this paper he summarizes some of its key elements.

Enhancing world food security

The opportunities and challenges driving the global agricultural community are complex and daunting.

A growing world population, changing dietary habits and volatile weather – to name just a few – are affecting agricultural production today and in the future. How can we increase productivity and achieve food security for what will be close to 10 billion people by 2050? How can we help plants thrive in changing climatic conditions? How can we best support the growers, from subsistence farmers to large-scale farming operations? And how can we assure that only high-quality and safe food reaches the consumer? The Big Data phenomenon may provide answers to these questions [2].

Our world is flooded by data

Data is a growing part of our lives. More and more data is being produced and its usage is becoming more pervasive [2]. The ability to access, analyze, and manage vast volumes of data [3] is increasingly critical to successful operation of leading agribusinesses.

Many agribusinesses are looking for ways to improve production techniques and yields and improve forecasting in order to better optimize supply chains. Gaining new insight through information is critical to maintaining or growing market share for products.

As agribusinesses become larger and more diverse, the growing volumes of data that must be managed are also becoming more complex. External data from social media outlets and supplier network channels combined with sensor and machine data coming from farm equipment and in the farm fields augment traditional sources of data. Today these data sources can include:

- Traditional enterprise data from operational systems
- Farm field sensor data (e.g. temperature, humidity, rainfall, sunlight)
- Farm equipment sensor data (from tractors, plows, and harvesters)
- Harvested goods and livestock delivery vehicles (from farms to processing facilities) sensor data
- Commodities trade data
- Financial forecast data
- Weather data
- Animal and plant genomics research data
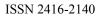- Social media data

Big Data Solutions

Big Data solutions [4] can help improve forecasting and operational efficiency and lead to improved and timely decision making. These technologies enable organizations to analyze a variety of data sources for improved insights. This, in turn, broadens the analytics and predictive options leading to better outcomes.

Agribusinesses have long lists of needed metrics. But what is needed now more than ever is the ability to obtain actionable information from these growing piles of data. Following is a list of top areas where Big Data technologies can impact an agribusiness:

- Weather data
- Improved forecasting of yields and production.
- Better optimized seeds and livestock and new methodologies that improve yields and production.

- Faster delivery of goods produced to distribution centers and consumers.
- Real-time decisions and alerts based on data from fields and equipment.
- Integrated production and business performance data for improved decision making.
- Rationalized performance data across multiple geographies.

Modern agribusiness features tighter relationships between agriculture suppliers and the farming community. The supplier relationship is becoming one of a trusted advisor and also a research and development partner. Sensors are becoming prevalent on modern farms, gathering data in the fields and from farm equipment and providing useful information to the farmer and also to the suppliers. Sensors are also becoming common on shipping containers and delivery vehicles for optimization of delivery of goods.

Big Data could form the foundation for a variety of new capabilities, including identifying correlations between farm field and weather and commodity data for optimal irrigation, fertilization, and harvesting of crops and optimal feeding and shipping of livestock to market. More timely scheduling maintenance of equipment and minimization of energy usage can enable greater operational efficiency.

Predictive analytics can be used to anticipate demand for seeds, fertilizers and animal feed and enable the agribusiness supplier to take appropriate steps to match production to demand. New pricing programs can be established to help manage demand consistent with available supply.

For example, demand for some products is often strongly connected to commodity pricing. The ability to better predict pricing changes could be used for pro-active allocation of supplies and determination of the effect on storage distribution across regions. Having insight and understanding the correlations and effects of even minor weather patterns on the supply and demand could be used to influence major business decisions.

Higher yield and reduced support costs are central to driving profitability and better customer experience or any major agribusiness. Big data technologies can enable improved analysis of yield and quality data, supplier's quality data, and other critical measures for a rich and thorough root-cause analysis resulting in actions for enhanced quality and reduced overall cost. Data related to throughput, capacity utilization, and overall equipment effectiveness, can be combined for further analysis for improved quality.

The ethics of big data in big agriculture

There is a power asymmetry between farmers and large agribusinesses which have the ability to construct an unprecedented predictive business model over each aspect of farming [5]. Farmers increasingly have to reveal their most personal farm details to gain access to the benefits of technology, while those who turn the data into useful information, reveal little to nothing about the back-end processes or how or where the information will be kept or used.

This signals a profound change for the autonomy of farmers, public and private sector With wireless sensors on tractors monitoring or dictating every decision a farmer makes, big agrobusinesses can now aggregate large quantities of previously proprietary farming data, enabling a privileged position with unique insights on a field-by-field basis.

This power asymmetry has to be rebalanced through open-sourced data, and publicly-funded data analytic tools of similar complexity and innovation for use in the public domain.

Conclusions

It is time for a New Revolution in Agriculture. Building on the initial successes of the first Green Revolution in the 1960s, what is urgently needed is a significant and sustainable increase in agricultural production worldwide.

We are facing the challenge to feed 10 billion people by 2050 while already reaching the ecological limits of our planet today. We need innovative solutions that are sustainable and minimize the environmental footprint of farming. Big Data analytics can be one of them.

References

[1] Oracle Corp. (November 2015) Improving agribusiness performance with big data. Architect's guide and reference architecture. Introduction. http://www.oracle.com/us/technologies/big-data/big-data-agribusiness-2797222.pdf
[2] Carbonell, I., 2016. The ethics of big data in big agriculture. Internet Policy Rev. 5, 1 http://dx.doi.org/10.14763/2016.1.405
[3] Hilbert, M., and López, P. (2011). The world's technological capacity to store, communicate, and compute information. Science, 332(6025), 60-65 http://dx.doi.org/10.1126/science.1200970
[4] Mayer-Schonberger, V. and Cukier, K. (2013). Big data: A Revolution That Will Transform How We Live, Work And Think. New York: Houghton Mifflin Harcourt Publishing Company, 2013
[5] Soil, Big Data and the Future of Agriculture Conference, Canberra, 25 June, 2015 http://soilbigdata.org/event