Unsupervised Extraction of Features and High-Resolution Data Using AIMEE

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Abstract

Much of poverty comes from the inability to evaluate and realise potential production from land and to understand its vulnerability to influences, e.g. infrastructure and natural disasters. Quick and accurate identification, measurement and evaluation of geographical features over large areas give the capability to overcome poverty like never before.
Understanding what can be produced, where and by how much, is important to all commodities but in particular food. However, this must be looked at in the context of the wider environment and resources like water, timber and utilities as part of the sustainability of production.
Even when production systems are understood, they are vulnerable to changes in the environment, or natural disasters. These changes not only affect primary production but also the infrastructure around it; removing resources, logistics and social support. Gathering large amounts of remote sensing data combined with AI such as AIMEE can increase productivity and its resilience.

Introduction

Poor nutrition is a common symptom of poverty both in the developed and developing world. Inadequate availability and diversity of food can come about for a number of socioeconomic reasons but as well as being a symptom of poverty, much of poverty also comes from an inability to evaluate, realise and maintain the production potential from land. This stems from the inability to see where productivity can be sustainably increased and where productivity is vulnerable to outside influences such as infrastructure and natural disasters (climate, fire, earthquake or epidemic). The ability to quickly and accurately identify, measure and evaluate geographical features over large areas; allows the assessment of capabilities to overcome poverty like never before.

Understanding what can be produced where and by how much, is important for all commodities but is particularly important in food production. The inability to evaluate and realise the production potential is often referred to as the Yield Gap (**Sandras *et al*, FAO 2015**). This is defined as the gap between the actual yields achieved by growers and the potential yield of crops that would be achieved if there was unrestricted access to inputs and husbandry. The vulnerability of production is often referred to as Food Security (**Foresight, 2011**).

Drivers of Food Related Poverty

It is the combination of a Yield Gap and insecurity of production that drive poverty in many parts of the world. Yield Gaps drive up food prices, and restrict availability and diversity of food. This denies people the ability to achieve their potential by affecting their education and productivity. There are additional burdens on healthcare provision, crime prevention and wider domestic productivity. Poor food security can lead to acute famine and can be an additional factor making the impact of natural disasters, such as earthquakes, much worse.

These issues cannot be looked at in isolation. They are tied into the context of the wider environment and to resources such as soil, water, organic matter, timber production (for fuel and building materials), inputs, machinery and utilities. In the context of the changing climate of many, already under productive, areas; the Yield Gap and its vulnerability is a principle consideration in alleviating poverty.

Even when production systems are well understood, they are vulnerable to sudden changes in climate and other environmental conditions, or natural disasters such as earthquakes or fires. These changes not only affect primary production but also the infrastructure around it by removing resources, logistics and social support. Often when a disaster hits an area there is still food available in other parts of the geography put it cannot be accessed by those who need it most. Often it is simply easier to bring in food aid from thousands of miles by air than it is to bring it hundreds of miles over land.

Data Capture, Organisation and Analysis

The ability to gather large amounts of data from remote sensing combined with AI capabilities such as AIMEE (Automatic Intelligent Multi-feature Extraction Engine) allows the responses in production to environmental pressures to be tracked, monitored and improved. The important aspects are being able to capture data rapidly while being able to analyse it alongside other relevant data. A wide range of aspects of food production can be identified: from the primary productivity of crops in response to weather patterns; to identification of roads prone to flooding and so limiting distribution. Weaknesses in the production system can be identified and modifications can be implemented. This achieves increases in productivity and resilience of that productivity. The rapid increase in global value chains (GVCs) with a foothold in developing countries (**Economic Commission for Africa, 2016**) requires that productivity and resilience are well understood, monitored and maintained. This is essential, to avoid collapse of supply chains of agri-products to both local communities and the global customers.

The capture of big data, at face value, has the potential to provide a quantum leap in understanding through the multiple analysis of data coming from a myriad of sources. However, data capture from satellite platforms, ISOBUS data from machinery, mapped data from third parties and in-field sensors; creates its own problems. These range from non-representative point samples to mismatching of mapping coordinates between geographical layers from different sources. Being able to handle these errors and discrepancies is as important as the ability to analyse the relationships between the data sources.

At the centre of AIMEE are automated processes that not only extract data from various resources but which correct for discrepancies in resolution, alignment and coordination. This allows data from different sources to be reconciled, allowing for data to be combined quickly and efficiently to create BtoB data solutions. Without these methodologies to reconcile data, the analysis process would be slow and resource intensive in spite of the accelerated data extraction technology that AIMEE conveys. In order to take full advantage of the Big Data revolution, it is necessary to automate as much of the data process as possible. This is not just confined to the extraction, and analysis of the data through much publicised processes such as AI and self-learning. At the core of any BtoB solution based on Big Data must be an automated capability to create associations between data sets that take into account differences in resolution, alignment and coordination. In addition, the data outputs must meet the necessary criterion of accuracy and precision demanded by customers and required for accurate and informed business decisions. Therefore, data validation and error quantification is paramount to any BtoB solution based on Big Data. These process must also be automated to keep up with the data provision process so that there are no bottle necks or slowing of the process as a whole.

Conclusions

Big Data analyses are part of the wider evaluation of the sustainability of production systems. If a system is truly sustainable, it must be able to produce enough food of the right quality and diversity even when environmental conditions are at their most unfavourable or when disasters strike. The unpredictable nature of many of the events that challenge food security mean that the systems used to evaluate their impact must have the efficiency to be able to process data rapidly enough to provide solutions. AI capabilities such as AIMEE look to optimise the analysis of large data sets, giving new insight into the limitations to food production and how to overcome them. These capabilities must be delivered with efficiency and accuracy. Ultimately the solution is about delivering relevant, verifiable data of a required accuracy and precision. This must be done in a timely manner otherwise the data may be of interest but is of no practical use.

References

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