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TOWARDS OPERATIONALISATION OF GEOSPATIAL BIG DATA IN OIL PALM PLANTATIONS: THE SIME DARBY EXPERIENCES

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Abstract: Big Data is no stranger to geospatial community since remote sensing and satellite imagery is known for its massive data size and high-performance computing requirement. Geospatial big data refers to handling of spatial data sets beyond the capacity of standard computing systems. This paper focuses on the two game changing technologies in the oil palm industry; the Unmanned Aircraft System (UAS) and the Internet of Things (IoT). The big data generated by these uprising technologies will revolutionise the oil palm industry towards the true implementation of oil palm precision agriculture. This paper elaborates the key challenges and opportunities as Sime Darby Plantation is moving towards the operationalisation of geospatial big data analytics.

Keywords**:** geospatial, big data, oil palm plantation, precision agriculture, Sıme Darby

INTRODUCTION

Geospatial data has always been big data due to its nature of size and processing requirement, even prior to the use of Big Data general term. Sime Darby Plantation Berhad has embarked into geospatial initiative since 1997 with the adoption of Global Positioning System (GPS) for mapping. As the technology for earth observation evolved with high resolution satellite imagery to Unmanned Aircraft System (UAS) or popularly known as drones, more plantation players have come on-board to join the excitement. Another worth mentioning technology is the Internet of Things (IoT) where network of information is dynamically transmitted from sensors on the ground. Both of these technologies heavily manipulate the powerful Geographical Information System (GIS) to reveal patterns and to make sense of the data.

Along with this exponential increase of geospatial big data, the capability of high performance computing is being required greatly than ever, for modelling and simulation of geospatially enabled contents. However, because of limited processing power, it has been hard to fully exploit high-volume or high-velocity collection of geospatial data in many applications (Lee and Kang, 2015). The use of spatial data sets from high resolution satellites and UAS especially for precision agriculture have emerged emerging exponentially. Consequently, the conventional method of processing for these datasets becomes obsolete to insufficient processing power.

Sime Darby Plantation is known to be the largest listed plantation company and the world's largest producer of Certified Sustainable Palm Oil (CSPO) (Aruna, 2017). Having its upstream operation in 5

countries including Malaysia, Indonesia, Liberia, Papua New Guinea and Solomon Island, the following table tabulates the detail.

Table 1: Sime Darby Plantation upstream operation.

	Malaysia	Indonesia	Liberia	Papua New Guinea	Solomon Island	TOTAL
Number of Estates	126	72	5	47	3	253
Number of Mills	33	24	1	11	1	70
Number of Strategic Operating	33	23	4	5	1	66
Total Landbank Area (Ha)	348,252	283,385	220,000	130,059	8,304	990,000
Total Oil Palm Planted Area (Ha)	303,104	202,696	10,482	79,247	6,765	602,294
Total Rubber Planted Area (Ha)	11,627	1,432	107	-	-	13,166
Total Sugar Planted Area (Ha)	-	-	-	5,613	-	5,613
Total Cattle Grazing Area (Ha)	-	-	-	8,956	-	8,956

Reference:*http://www.simedarby.com/clients/simedarby_group/assets/contentMS/img/template/editor/Corporate%20Profile%202017/CPSime%20Darby%20Plantation.pdf (April, 2017)*

This paper gives an overview of the potential, requirement, and challenges to operationalise Geospatial Big Data in oil palm plantation based on Sime Darby Plantation Berhad experience.

METHODS

Conventionally, we use to bring the data to a single processor to process our geospatial data. With geospatial datasets became extremely large in terms of volume, velocity and variety, the single processor model is no longer valid. Therefore, a set of techniques and technologies with new forms of integration to reveal insights from datasets that are diverse, complex, and of a massive scale is required. Hence, big data analytics came into the picture to bring multiple processors to the data (parallel processing) that increase computing power exponentially. The following figure illustrates the comparison between the conventional and big data analytic approach.

CHALLENGES AND OPPORTUNITIES

The year 2017 marks the centennial celebration of Malaysian palm oil, following the first commercial planting of oil palm by Henri Fauconnier at one of Sime Darby Plantation estate, Tennamaram Estate, Selangor (MPOC, 2017). Despite vast improvement throughout the years in terms of yield and operational efficiency, the oil palm industry is still considered technologically conservative as compared to its competitors.

With the UAS programme in Sime Darby Plantation moving towards operationalisation in conjunction with ground sensoring data through IoT, the amount of data generated would be overwhelming. In order to turn this overwhelming data set into knowledge, a stern investment is needed to elevate the current IT infrastructure to support big data analytics. Geospatial big data analytics will reveal more patterns and connections that will vastly improve the way we respond to outstanding problems and issues of the oil palm industry. To further elaborate the challenges, the parameters tabulated in Table 2 is used as the basis for the propagation of data volume for UAS dataset which is the main contributor to geospatial big data.

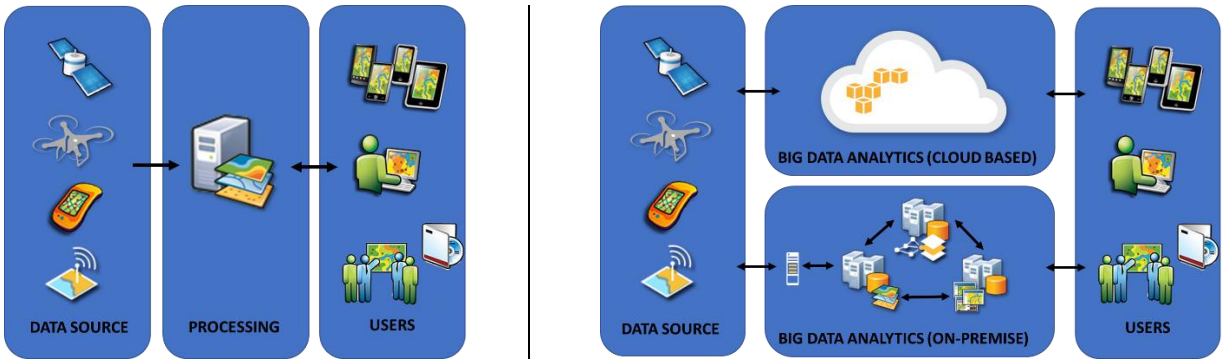

Figure 1: Comparison between (a) conventional way of handling geospatial data and (b) geospatial big data analytics.

Table 2: Typical UAS flight mission parameters.

Area Coverage	:	1000 Ha
Camera Resolution	:	12.1 MP [1]
Camera Type	:	RGB
Altitude	:	300 m AGL [2]
Ground Resolution	:	10 cm GSD [3]
Overlaps	:	80% (Forward) x 70% (Side)
Raw Image Size	:	13 GB
Processed Image	:	26 GB (Orthomosaic and DSM [4])

[1] Mega Pixel
[2] Above Ground Level
[3] Ground Spatial Distance
[4] Digital Surface Model

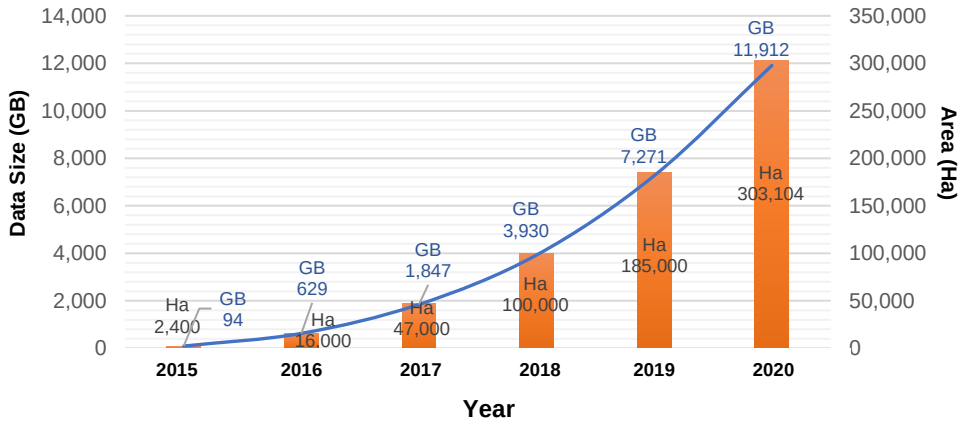

Figure 3: Propagation of UAS data volume for Sime Darby Plantation Malaysia operation.

Based on this trend, Sime Darby Plantation required a minimum storage capacity of 24TB to archive a full cycle of UAS imagery over its entire oil palm upstream operation. With a minimum re-imaging taking place every year, the size of such data can easily grow by at least 20% every year. In a case where multi-spectral or even hyper-spectral imaging is deployed for more detailed scientific investigations, the data growth could easily reach to more than 50% yearly. Besides of data storage, the challenges continue with data analysis, data search, data sharing, data transfer, updating and information security.

In terms of opportunities, the collections of extremely large data sets may be analysed computationally using deep learning to reveal new patterns, trends, and associations in which the conventional methods have failed. This new insight offered by geospatial big data analytics will revolutionise the way oil palm plantation is managed with real-time connectivity with the stakeholders in order to achieve optimum efficiency and better productivity.

CONCLUSIONS

In this paper, we overview some of the key challenges and opportunities brought by geospatial big data to the oil palm industry. Geospatial big data analytics is fundamental to harness the true potential of precision agriculture in oil palm plantation management through understanding of hidden correlations and patterns to solve outstanding challenges and problems at the scale like never before. In order to ensure successful operationalisation of big data analytics, all stakeholders like the top management, estate operation, IT professionals, agronomist and scientist have to be engaged through enterprise GIS platform and well-planned scalable IT infrastructure. In a nutshell, the challenges to operationalise geospatial big data include data capturing, data storage, data analysis, data search, data sharing, data transfer, updating and information security. As a conclusion, geospatial big data analytics in oil palm plantation offer great opportunity to develop sustainable future not only to our nation's economy but also to the environment.

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