INNOVATIVE GEOSPATIAL TECHNOLOGIES FOR THE AVIATION INDUSTRY

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***Abstract**: New technologies and innovations are emerging in ways that will fundamentally disrupt some of the most important economic sectors. The development of geospatial technologies and remote sensing offers tremendous potential, allowing complex processing and analysis, at a large scale, to be deployed in timely manner. This paper presents the challenges and opportunities we are currently facing when conducting aeronautical studies and how crucial location element is for maintaining operations on aerodromes safe and efficient. Utilizing high resolution imagery and geospatial big data analytics products on a leading cloud-based platform, with a comprehensive image library of over 100 petabytes, ensures performance in providing aeronautical data of the highest quality.*

***Keywords:** Geospatial data, Big Data, Remote Sensing, Change detection, GIS, airport*

1. Introduction

Remote sensing capabilities had been exploited since the 1960s, however, the recent significant improvements in the availability of geospatial data have only been made in the past few years.

Satellite remote sensing development concerns optical sensors as well as radar sensors. Referring to high-resolution sensors, there are three features to be taken into account: spatial resolution, spectral resolution and temporal resolution.

In a continuously changing environment, critical decisions require the highest quality information. For the aviation industry, aerodromes obstacle assessment and airport change detection analysis depend upon very accurate geometrical analysis of objects for the area of interest. Metric or submetric resolution imagery for obtaining 3D models at the imposed level of detail and accuracy are essential.

Leveraging sensors' new capabilities means being able to compute high volume of data, that also increases the complexity of the processing algorithms. The statistical models that were formerly used for average resolution SAR data can no longer be applied. For the hyperspectral imagery analysis, linear models that have been studied in the past, are being replaced with nonlinear mixture models [1].

Accelerating in the fourth industrial revolution, we are experiencing both a fusion and a convergence of technologies. Complementary spatial data technologies such as GIS and artificial intelligence can be used in conjunction to create new business models. Geospatial analytics are already enabling extraction and processing huge volumes of data, adding more value to the models, at lower costs.

2. Materials and Methods

The difference between the way data was heretofore handled, from acquisition phase, processing, analysis and finally delivered, and the digital transformation is highlighted by the need to meet new demands. Having access to information is not enough. Automated processes with built-in decision-making, in real time, based on artificial intelligence and customized workflows for big data, are elementary for improved efficiency and effectiveness [2,3].

Traditionally, analytics were characterized by: relational data, at TBs to PBs scale, working on a schema defined before loading the data, with operational reporting and on demand.

The extended traditional approach involves: relational and non-relational data, at TBs to EBs scale, working on a schema that is defined during analysis, and also on diverse analytical engines to gain insights, designed for low-cost storage and analytics [4] (Fig. 1).

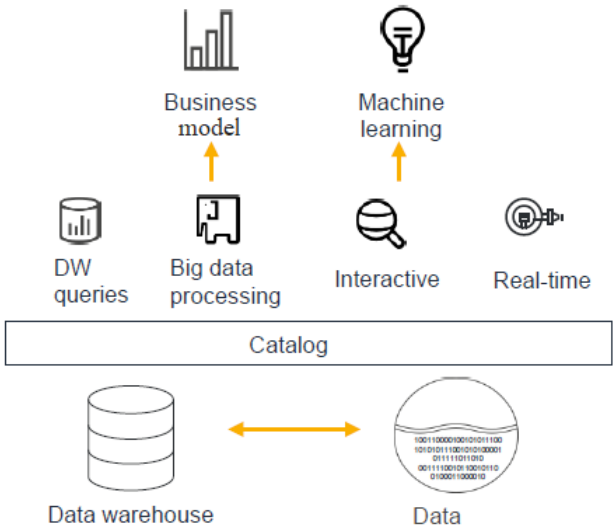

Fig. 1. Big data analytics using machine learning

Before performing the product analysis, data must be organized, well documented, consistently formatted [5] and error free, as errors will be propagated by processing. Cleaning the data is often taking 80% of the actual work.

Using DigitalGlobe's GBDX Multisource imagery and analytics platform, offers subscription access, to consume the world-class content, combining the best industry-leading visible, multispectral and radar Earth Observation data from IKONOS, QuickBird, WorldView-1, GeoEye-1, WorldView-2, WorldView-3 and WorldView-4, analytics and information products.

RadarSAT-2 complements optical satellite data with a wide area change alerting and all season/weather target monitoring. Its mission provides a unique imaging mode, ExtraFine, with 5m resolution and a complete overlapping coverage.

When radar imagery is collected in exact repeated geometry, automated extraction of change information can be done using Amplitude Change Detection (ACD) methodology. This algorithm compares the intensity of aligned pixels, where blue pixels represent new brighter targets and red pixels indicate low reflectance. In order to detect persistent changes, the variation in pixel brightness can be filtered.

3. Results and Discussion

GBDX Imagery and Analytics service allows ESRI ArcGIS Enterprise 10.5.1 users to connect to DigitalGlobe's geospatial big data analytics platform, designed for image exploitation and create derived products, running in the AWS US-EAST-1 cloud infrastructure region and using Harris' Envi remote sensing analytics.

Due to the considerable great size of the aerodromes' coverage areas created for aeronautical safety and the diversity of objects to analyse, obstacle assessment is regarded as a large and complex matter. Bi-temporal image analysis was used to detect changes for objects that are relevant to the airport's protection surfaces (Fig.2, 3).

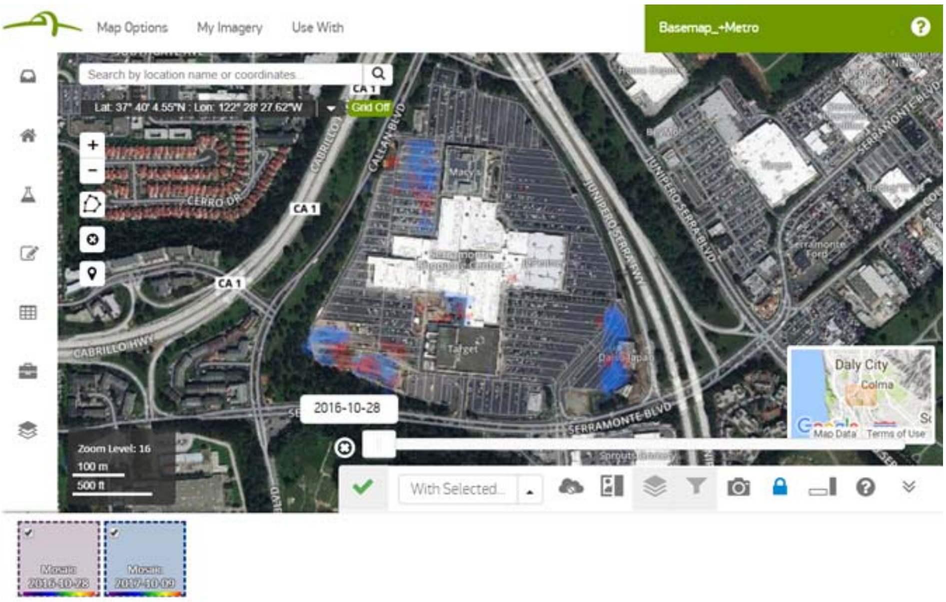

Fig. 2. San Francisco Scene over AOI taken 28/10/2016, used for Airport Change Detection (image courtesy of DigitalGlobe)

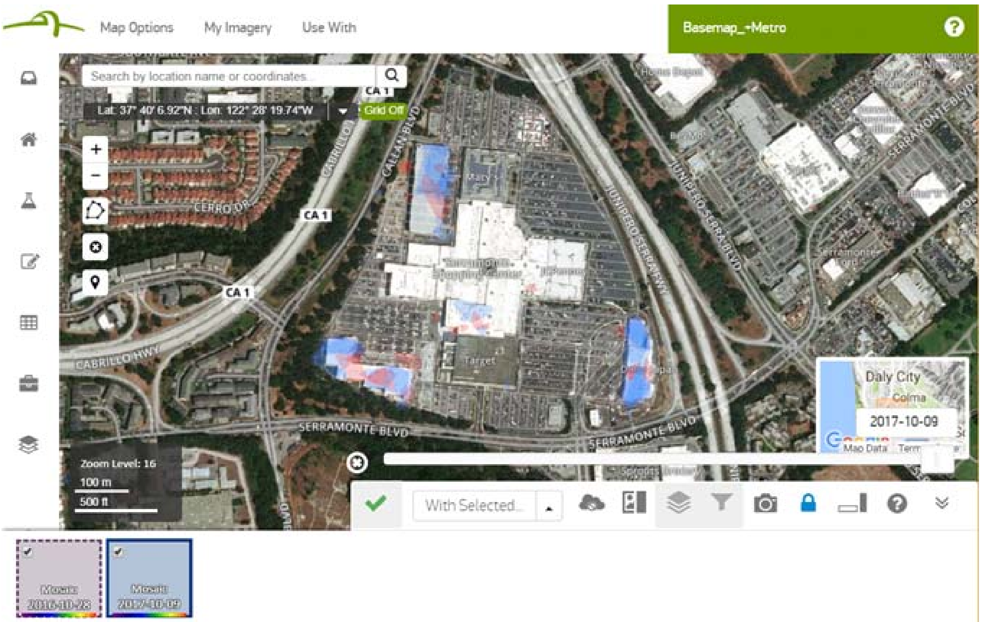

Fig. 3. San Francisco Scene over AOI taken 09/10/2017 used for Airport Change Detection (image courtesy of DigitalGlobe)

It is not intended to derive any obstacle data from the two sets of images, but to identify where change has occurred or to confirm that there has been no significant change and that the existing flight procedures are secure.

3D models are built from high-resolution stereo imagery, using automated 3D processing algorithms. Orthorectification is done at native resolution on the best available digital terrain model (DTM). 3D building models can be accessed using ArcGIS Pro (Fig. 4).

Fig. 4. 3D polygons - Level of detail (LOD 1.3) (image courtesy of DigitalGlobe)

4. Conclusions

New ways of using technology have changed the workflows and the systems of production. The explosion of connectivity plays an increasingly critical role in driving sustainable growth and prosperity, providing access to information and resources. Having unprecedented processing power, storage capabilities and knowledge access creates new products to increase analyst productivity and provide intelligence and insights.

It is shown that, using the implemented algorithms on the available satellite imagery, workflows for aeronautical analysis are enhanced.

5. References

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