An Infrastructure for Remote and In-Situ Collection and Aggregation of Agricultural Data and Its Application to Yield Estimation

Principal Investigator (PI): Dr. Moise Busogi, Kigali Collaborative Research Centre
Tel: +250 781667420, e-mail: busogi@cmu.edu
Co-PIs: Dr. Yves Hategekimana, Rwanda Space Agency (RSA), Dr. Kalebogile Mfundisi, University of Botswana, Dr. Assane Gueye, CMU-Africa, Dr. Eric Umuhoza, CMU-Africa

Specific Aims:

In the era of digital economy, data is increasingly becoming key to the smooth functionality of a wide range of applications in many domains. Despite the increasing amount of available geospatial data, access to it is still regarded as one of the biggest hurdles in adopting and embracing the advances in emerging technologies. This is partially due to cost, lack of skills, and tools needed for optimal geospatial data analytics. This, in turn, hinders the progress of application of geospatial sensing in various applications pertinent to socio-economic development, such as precision farming, which is regarded as one of the drivers toward achieving the UN's 2030 sustainable development goals (SDGs). To this end, **the overall aim of this project** is to develop an *Open Geospatial Data Platform (OGDP)*, hosted at **Rwanda Space Agency (RSA)**, to enable multi-source geospatial data democratization to improve agricultural outcome. The data will be collected using space-borne, airborne as well as ground-based sensors. **The specific objectives** are:

i. To design and develop an open, and dynamic data warehouse to facilitate the access to GeoSpatial data. The data will be made publicly available for use by the research community.
ii. To provide software solutions to ensure GeoSpatial data democratization; thus, empowering a growing network of scientists, and entrepreneurs to engage in rigorous research and development in applied geospatial sensing.
iii. To develop and validate models for yield prediction: As a proof of concept, a state-of-the-art model for potato yield prediction will be constructed on the top of the OGDP. The model will capitalize on the infrastructural support in the OGDP to showcase the usage guidelines, as well as the benefits of OGDP and its peripheral technologies.
iv. Pilot deployment: as the proof of concept of our model, a pilot deployment will be carried out in collaboration with the "*Cooperative y'ibiyari ya Bunyenyeri*".

We will **approach** this problem by first identifying the type of data pertinent to an effective spatio-temporal data mining in agriculture. Three major sources of data will be considered: Satellite, UAV, and in-situ measurement composed of IoT, and crowdsourcing. Various data architecture models will be considered. With automated data collection system in hand, the next step will be to develop an effective and efficient   process that fuses multi-sensors data into superior quality data. In this project the three different levels of data fusion will be supported: the data level, the feature level, and the decision level. A machine learning model for potato yield prediction will be developed using the fused data as input.

The **outcomes** of the project include an open, and dynamic data warehouse, an API for data access control, and open-source python libraries to empower data democratization in the agricultural domain. **The expected impact** of Open GeoSpatial Data Platform is to empower educators, researchers, innovators and other professionals to contribute to advances in the application of remote sensing in a wide range of applications. Total Project Budget is 9000000 RwF including In-Kind Contribution of partner industry for a duration of 18 months.

Additional information

Investigators/Institutions

Dr. Moise Busogi: Deputy director at KCRC, and assistant teaching professor at CMU-Africa.
Dr. Yves Hategekimana: Head of Department of Earth Observation**,** RSA
Dr. Assane Gueye: Associate Teaching Professor, CMU -Africa, and director of Cylab Africa**.**
Dr. Eric Umuhoza Assistant Teaching Professor CMU-Africa
Dr. Mfundisi, Kelebogile Research Scholar in Physical Geography at University of Botswana-Okavango Research Institute.
Ms. Ange Marie Tesire: Geospatial Analyst, RSA
Ms. Valentine Mukanyandwi: Remote sensing analyst at RSA
Mr. Gedeon muhawenayo: Machine learning research engineer at RSA**.**