Acquired experiences during Perceptive Sentinel workshop

Satellite Images in Cloudy Weather

Exported on 12/03/2018

Table of Contents

Introduction

As part of the "Promilleafgiftsfonden for landbrug" (PAF) project named "Øget konkurrencekraft - kunstig intelligens" (PAF7699) and work package named "Satelitbilleder også i gråvejr" (AP1812), the SEGES digital data science team participated in a international workshop regarding Earth Observation (EO) and Machine Learning (ML). This workshop was organized as part of the Perceptive Sentinel (PS) project, which has received funding from the European Union's Horizon 2020 Research and Innovation Programme, see http://www.perceptivesentinel.eu/. Leading European experts in the application of machine learning and artificial intelligence for EO data attended the workshop.

This document describes the acquired experiences of the team during the workshop and how the technical fields of EO and ML can be used in the PAF7699 project and in future SEGES innovation projects and software applications.

1 Goals for the workshop

The following goals are key to a successful workshop for the SEGES digital data science team:

- Establish the **collaboration with workshop participants** within the fields of EO and ML.
- Acquire an **understanding of EO-learn**, which is a developed software in the PS project.
- Determine how the **EO-learn Python library can be utilized in the PAF7699 project**.

2 Acquired experiences

The workshop consisted of the following 5 other participating organisations: Sinergise (SIN), GeoVille (GV), Magellium (MAG), Institut Jozef Stefan (JSI), Agricultural Institute of Slovenia (AIS).

During the workshop, the SEGES digital data science team established professional connections to all participants, especially connections to SIN, GV, MAG, and JSI was in focus as these participants also work within the fields of EO and ML. These established connections make a good foundation for the collaboration between SEGES and the other organisations during the span of the PS project, as well as the PAF7699 project, and later collaborations within the fields of EO and ML.

A main deliverable of the PS project is the open source EO-learn Python library, as explained in the next sectíon. The lead organisation of EO-learn is SIN. However, as EO-learn will be used for managing and transforming EO-data by all participants of the workshop, all participants will contribute to improving the features and usability of the Python library. During the presentations of the other participants within the field of ML, the team was confirmed by the other organisations that data transformation and data preparation for ML models are time-consuming and much more time-consuming than developing the actual ML models. The team also determined that the development and use of EO-learn is a common goal for both the PS and PAF7699 project as well as other SEGES projects.

The team were confirmed in the choice of using a U-net based neural network model for generating cloud-free satellite images, developed in the AP1812 work package of the PAF7699 project, as the other participants within the fields of EO and ML also utilized the same ML model architecture to generate useful predictions using satellite images.

2.1 What is EO-learn

"**eo-learn** is a collection of open source Python packages that have been developed to seamlessly access and process *spatio-temporal* image sequences acquired by any satellite fleet in a timely and automatic manner. **eo-learn** is easy to use, it's design modular, and encourages collaboration – sharing and reusing of specific tasks in a typical EO-value-extraction workflows, such as cloud masking, image co-registration, feature extraction, classification, etc. Everyone is free to use any of the available tasks and is encouraged to improve them, develop new ones and share them with the rest of the community.

eo-learn *library acts as a bridge between Earth observation/Remote sensing field and Python ecosystem for data science and machine learning.* The library is written in Python and uses NumPy arrays to store and handle remote sensing data. Its aim is to make entry easier for non-experts to the field of remote sensing on one hand and bring the state-of-the-art tools for computer vision, machine learning, and deep learning existing in Python ecosystem to remote sensing experts." [Sinergise, https://eo-learn.readthedocs.io/en/latest/, acquired 29 Nov 2018]

The mainly useful feature of EO-learn is:

- The easy implementation of fetching satellite images from SentinelHub.
- The easy implementation of cloud detection using the s2cloudless Python library also developed by Sinergise.
- The easy interpolation and resampling of satellite images over time.

Further background information on EO-learn:

- https://medium.com/sentinel-hub/introducing-eo-learn-ab37f2869f5c
- http://eomag.eu/articles/4478/sinergise-releases-eo-learn-open-source-software-to-bridge-the-gap-between-earth-observation-and-machine-learning.

3 Conclusion

Collaboration with the leading EO and ML organisations in Europe is a catalyst for SEGES to improve its knowledge and usage of these technical and scientific fields. Therefore, establishing professional connections to all participants of the workshop was important and the SEGES digital data science team see this challenge as accomplished.

EO-learn can be a very useful Python library for the team, as it can simplify the tasks of managing and transforming EO data for any project the team is working on, such a the PAF7699 project. Especially, the team sees the benefit of using EO-learn in the PAF7699 project for cloud detection, interpolation and resampling of the utilized EO-data for generation Sentinel 2 images based on Sentinel 1 images.

During the workshop, a conversation with David Kolitzus, Senior Expert and Project Manager from GV revealed that GV has required the best results for generation/interpolating Sentinel 2 images with an approach also using Sentinel 1 images. Thus, confirming that our approach of using Sentinel 1 images and an U-net based neural network model for generating cloud-free Sentinel 2 images can be plausible.