Spatio-temporal classification of satellite image time series

CES THEIA "Land Cover"

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1 Context - CES OSO Project

The objective of the project CES OSO is to provide land cover maps over the metropolitan France territory using satellite images time series, provided by the new satellite mission *Sentinel-2*. These maps will be provided on a regular basis. The period between two maps will depend on the application. At least, one map per year will be provided.

In order to construct these maps accurately and with a reasonable time delays, automatic methods are needed together with ground-truth data, both to train the methods and to validate their outputs.

Recent results can be seen here:

http://osr-cesbio.ups-tlse.fr/~oso/ui-ol/2009-2011-v1/layer.html

The project gather several French teams (*CESBIO, CIRAD, COSTEL, INRA DYNAFOR, IGN MATIS, INRA ISPA, Météo France, SERTIT*), working on different part of the processing chain. The whole project is lead by the J. Inglada, CESBIO.

2 Objectives of the internship

The objective of the internship is to develop and implement a classifier that includes both spatial and temporal constraints.

Constraints from the spatial domain are needed to include spatial dependencies at the pixel levels. Constraints from the temporal domain come from the fact that some land covers do not change between consecutive years, while some do. For instance, there are inter-annual rotation between crops lands, while urban cover do not (or have a small probability to) change between two years.

Furthermore, Sentinel-2 data will provide high-dimensional satellite image times series, with for a given area, about a thousand of spectro-temporal variables per year. Hence a classifier robust to the dimension of the data is required.

Finally, the volume of data to be processed is very large, *e.g.* several Terabytes of images, and the processing chain should be able to run on such large data set.

Markov Random Field method will be investigated to fuse information from the temporal and spatial domain [2, 3]. High dimensional discrimination methods, such as kernel methods [1], will be used for the spectro-temporal classification.

The processing chain will be implemented in `C++` in the Orfeo Toolbox.

3 Requirements

The candidate should have background in signal and image processing, applied statistics or machine learning, and remote sensing. A good level of English and programming skills are required.

Candidate should demonstrate their abilities to develop and implement statistical based techniques.

4 Application

The candidate should (in English) an extended CV (including formation, experiences ...) and a motivation letter to mathieu.fauvel@ensat.fr and gabriele.moser@unige.it.

Review of application begins on *[2016-11-14 Mon]* and will be closed when the position is filled.

5 Additional information

Supervision: Mathieu Fauvel and Gabriele Moser
Location: Université of Toulouse - UMR DYNAFOR-ENSAT
Expected starting date: March/April, 2017
Duration: 6 months.
Salary: $\approx$ 580 euros per month.

References

[1] G. Camps-Valls and L. Bruzzone. *Kernel Methods for Remote Sensing Data Analysis*. Wiley, 2009.

[2] F. Melgani and S. B. Serpico. A markov random field approach to spatio-temporal contextual image classification. *IEEE Transactions on Geoscience and Remote Sensing*, 41(11):2478–2487, Nov 2003.

[3] A. H. S. Solberg, T. Taxt, and A. K. Jain. A markov random field model for classification of multisource satellite imagery. *IEEE Transactions on Geoscience and Remote Sensing*, 34(1):100–113, Jan 1996.