1 year post-doctoral position

Detection of the Flavescence dorée grapevine disease by hyperspectral imagery
Spectral signatures analysis and development of a specific vegetation index

Purpan Engineer School - INP UMR 1201 DYNAFOR - 75, Voie du TOEC - BP 57611 – 31064 TOULOUSE Cedex 3 – FRANCE

1 Context – OenoMIP Project

The OenoMIP project aim to define and develop operational geoinformation services for the vineyards monitoring. The objective is to complete the Enoview® service operated at TerraNIS (http://terranis.fr/) using not only satellite imagery but also UAV imagery and field data to provide pertinent information to the vine growers and wine makers.

In that framework, the work proposed here concerns the early detection of diseases areas over vineyards - and more particularly the grapevine yellow disease Flavescence dorée- with hyperspectral imagery. Flavescence dorée is a serious phytoplasm –borne disease transmitted from one grapevine to another in the field by the leafhopper Scaphoideus titanus. The disease is widespread in many European countries which results in reduced vitality of vines, harvest losses, and reduced wine quality due to high acid and low sugar contents of fruit from infected plants. The main visible symptoms appear in the summer: The canes droop because of a lack of lignification in the new shoots, with the leaves curling downwards and becoming yellowish in white cultivars or reddish in red ones. The intensity of the coloration is variable and may affect the entire grapevine, only one shoot or a small number of shoots. Over a vineyard, only one grapevine can be affected but the disease sometimes affect more than 70% of the vineyard. For all these reasons, using remotely-sensed data to detect the Flavescence dorée symptoms remains challenging. Therefore, spatial resolution of data used must be adapted to detect one plant over the entire field, to detect different intensity of the disease over a plant, and spectral resolution must cover the spectral bands useful to discriminate healthy leaves from leaves affected by the disease.

Ground truth data (leaves spectral signatures, disease severity,...) and imagery (hyperspectral from aerial camera and in the visible and near infrared domain from UAV and satellite sensors) over selected fields over the Gaillac vineyard (around 100km North-East of Toulouse) have been acquired in September 2015. These data will help to reach the three main objectives of this study:

1) To analyze the existence of specific spectral signatures for healthy and sick leaves according to the grape (white or red) from the leaves reflectance collection;
2) To propose a spectral index derived from hyperspectral data that could be used to detect the symptoms of the Flavescence dorée; this index can correspond to a combination or a ratio of spectral bands.
3) To test if vegetation indexes, based on red and near infrared spectral bands, already used in the literature to detect Grapevine yellows diseases are adapted to detect the symptoms of the Flavescence dorée in the context of our study.
2 Steps and Objectives
The main steps and objectives of this post-doctoral position are:

1. To analyze the vine leaves spectral signatures acquired in September 2015 in the Gaillac vineyards (around 100km North-East of Toulouse). Spectral signatures have been acquired with a field spectroradiometer (300-2500 nm) for healthy and sick vine leaves and for red and white grapes. The objective is to select the spectral bands that better discriminate the vine disease in order to propose the most accurate vegetation(s) index(es) to classify healthy and diseased vine leaves. The recruit will use feature extraction python tools developed at the DYNAFOR lab.

2. To calculate these vegetation indexes from hyperspectral imagery acquired over the field area in September 2015, in order to assess their accuracy over vineyards.

3. To participate to the 2016 field campaign in September/October 2016. For this campaign, leaves reflectance measurements and also probably plant spectral measurements will be performed. The field data will be acquired again over the Gaillac area and also another area if possible.

4. To contribute to the dissemination of the work in the scientific community by participating to conferences and writing scientific papers.

3 Requirements
Candidates should have a PhD in applied remote sensing or geomatic with knowledge in applied statistic or machine learning, programming and image processing. Expertise in R, Python or Matlab are required.
A good knowledge of English and French is mandatory.
Candidates should demonstrate their abilities to disseminate the results of the project through journal papers and communications.

4 Application
The candidate should send (in English) an extended CV (including formation, experiences, list of publication and scientific responsibilities), a motivation letter and reference’s contacts to sylvie.duthoit@purpan.fr, mathieu.fauvel@ensat.fr and herve.brustel@purpan.fr. Review of applications begins on December, 2015, and will be closed when the position is filled.

5 Additional information
Supervision: Sylvie Duthoit and Mathieu Fauvel.
Location: Purpan Engineer School, INP UMR 1201 DYNAFOR - 75, Voie du TOEC - BP 57611 – 31064 TOULOUSE
Expected starting date: Between the end of January and the end of April, 2016.
Duration: 12 months
Salary: monthly net salary of about 1700 €.