

Forecasting prices of agricultural commodities from satellite data

The French National Research Institute for Agriculture, Food and Environment (INRAE), the Laboratoire des Sciences du Climat et de l'Environnement (LSCE) and ATOS, are looking for a motivated young scientist candidate for conducting a **three years PhD thesis with a hiring by ATOS as a permanent staff position** on an **exciting topic with strong implication for global food security**: the development of machine learning tools for predicting agricultural commodity price variations based on high resolution satellite data.

Background

Crop productions have strong influence on agricultural price commodities. Several approaches have been developed and are currently used by market analysts and governmental agencies to predict prices of agricultural commodities. Many of these approaches rely on regional crop productions predicted before harvest from weather data, field surveys and expert knowledge. However, in practice, it is difficult to obtain reliable regional crop production data sufficiently in advance before harvest, in particular because of the multiplicity of the factors influencing regional crop productions and of their associated uncertainties. Satellite data products offer interesting alternative sources of information for analyzing local environmental conditions at high resolution. As satellite images are known to be related to land and vegetation characteristics and to key weather factors known to be related to agricultural productions, they could potentially be used to predict price changes for major agricultural commodities at the global scale, without the need of crop production estimates. However, so far, this approach has not been thoroughly tested.

Objectives

The objective of this thesis is to develop and test a **methodological framework for predicting agricultural commodity price variations based on high and moderate resolution satellite data** directly, without using regional agricultural production values. This framework will be designed for several major crop species (in particular, maize, soybean, rice, wheat) located in different parts of the world, with the ambition to provide strategic information for managing food security. It will rely on machine learning and deep learning algorithms able to identify key features of satellite images showing strong predictive capabilities. To facilitate the use of satellite imagery, Atos will provide dedicated access to Mundi platform (Mundiwebservices) able to support a quick and simple using of specific tools integrated on Jupyter Notebook.

Academic supervision

- David Makowski. INRAE, Paris (david.makowski@inrae.fr).
- Philippe Ciais. CEA-LSCE, Orme des Merisiers (philippe.ciais@cea.fr).
- ATOS co-supervision Laurent Clergue (laurent.clergue@atos.net)

The main work location will be the Unit "Applied mathematics and computer science" (unit MIA AgroParisTech INRAE), currently located at AgroParisTech rue Claude Bernard in Paris and then at the University Paris-Saclay (Saclay) after mid-2022. The PhD student will have strong interaction with Atos.

Profil required and selection criteria

- Either
 - a M2 in data science and computer science, with strong interest in environmental science,
 - a M2 in environmental science, with a good training in data science.
- Good knowledge of R and Python.
- Strong interest on global issues related to food security, climate and the environment.
- Experience in handling large datasets is an asset (e.g. satellite data, global climate datasets).
- Experience in writing scientific papers is an asset.

Contract and application procedure

- **Permanent contract after of test period.**
- Starting date: The position is available from mid-2021 and will remain open until filled.
- Salary: Competitive salary with full social and health benefits, commensurate with work experience.
- How to apply: Applicants should submit a complete application package by email to the supervisors (see above). The application package should include (1) a curriculum vitae, (2) statement of motivation (3) answers to the selection criteria above (4) names, addresses, phone numbers, and email addresses of at least two references.