PhD position at IFP Energies nouvelles (IFPEN)
in *Mathematics*

Smart Adaptative Analytics

One of IFPEN 's core business is to design catalysts for production of renewable fuels, clean fossil fuels and petrochemicals. Catalyst speed up chemical reactions by several orders of magnitude and are mandatory to achieve economical operation. Putting on the market a new catalyst requires a prediction model to convince customers. The models can be either statistical or based on physical equations.

Some of the analytical properties are quite expensive to measure, and we are seeking ways to measure them only on a reduced subset of samples. An innovative proposition that we call "Smart Adaptative Analytics" is to predict these expensive properties for a new catalyst by learning the "shape of relations" on all the available information for older catalysts, and "deforming and anchoring" the relations based on some lab results on this new catalyst. A key step in "Smart Adaptative Analytics" is thus the capability to transfer prediction models, core of this thesis.

This problem is a state of the art data science problem. The thesis will focus a specific properties whose dependence on input variables can be linear, moderately non-linear or highly non-linear, with explicit or implicit dependences (black box models). For each property, the thesis will identify the regression models that correctly describe the "old" catalysts performance, then work on model transfer and new model prediction capability, including evaluation of the confidence level in the prediction, and on the optimal experimental design to speed-up new model learning curve.

Keywords: Smart predictive analytics, data science, machine learning, transfer learning, regression

Academic supervisor	Professeur, JACQUES Julien, Labo ERIC – Lyon 2
Doctoral School	ED 512 – InfoMaths – http://edinfomaths.universite-lyon.fr/
IFPEN supervisor	Dr, ROLLAND Matthieu, Research Engineer, Experimentation Intensification dept, Matthieu.rolland@ifpen.fr , ORCID : 0000-0002-7260-4335
PhD location	IFP Energies nouvelles, Lyon, France Laboratoire ERIC, Lyon, France
Duration and start date	3 years, starting preferably on October 1, 2018
Employer	IFP Energies nouvelles, Lyon, France
Academic requirements	Master 2 / BS in Mathematics, Statistics or Process Engineering
Language requirements	Fluency in French or English, willingness to learn French
Other requirements	Strong interest in machine learning, mathematics and computer science

For more information or to submit an application, see theses.ifpen.fr or contact the IFPEN supervisor.

About IFP Energies nouvelles
IFP Energies nouvelles is a French public-sector research, innovation and training center. Its mission is to develop efficient, economical, clean and sustainable technologies in the fields of energy, transport and the environment. For more information, see www.ifpen.fr.
IFPEN offers a stimulating research environment, with access to first class laboratory infrastructures and computing facilities. Gross wage : ~ 2100 €. University fees to be paid by student. All PhD students have access to dedicated seminars and training sessions.