



ERCIM "ALAIN BENSOUSSAN"  
FELLOWSHIP PROGRAMME



## Scientific Report

First name / Family name	Enislay/Ramentol
Nationality	Cuban
Name of the <i>Host Organisation</i>	RISE SICS Västerås
First Name / family name of the <i>Scientific Coordinator</i>	Tomas/Olsson
Period of the fellowship	31/10/2018 to 31/10/2019

### I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

During my period in RISE SICS Västerås I worked in 3 projects. My main task on these projects consisted on the use of Machine Learning to improve industrial activities. Another important task in these projects was the interaction with partners in the industry.

A very important activity of the RISE in which I participated was to transform the requirements of the industry partners in functionalities, as well as documenting each task performed.

The first project is **Smart Automation Living Lab for Process Industry (SALLPI)**. In SALLPI, I worked in the use case #3 “*Decision support for material selection and production methods in the steel industry*”. In this project I worked with Mr. Mats Tallfords and with 2 industrial partners from Tata Steel in Surahammar, Vastmanland Country. My task in project consisted on predicting the magnetic properties of the steel, using chemical and processes variables. Another important task I did in this project was to build possible

recipes using decision trees to obtain a steel with the properties required by the client. The results obtained so far are satisfactory. Partners from Tata Steel are pleased by the results.

The second project in which I worked is **Future Directions of Production Planning and Optimized Energy and Process Industries (FUDIPO)**. In this project I worked on developing data-driven models for predicting variables of an oil and gas refinery process, especially for controlling the process. I worked with Dr. Tomas Olsson in creating a Machine Learning model to predict the ranges for the manipulated variables in order to achieve the diesel quality required by costumers. We designed an ensemble solution based on decision trees and some regressor methods. In our experimental study we got good results using historical data. The designed model is under deployment now in Turkish refinery Tüpras.

The third project I worked is **TESTOMAT** in Bombardier transportation. TESTOMAT creates the next level of advanced test automation. The idea of the project was to determine the dependent and independent test cases (TC) at an early stage of a testing process, in this way we can help testers rank the TC for execution in a more efficient way. As the ratio between dependent and independent TC are very imbalanced, we solved the problem using IFROWANN, a classifier designed for imbalanced learning. IFROWANN is an algorithm that I designed during my doctoral research. In this project we also applied deep learning techniques for Natural Language Processing, with the aim to turn the “hand writing test cases description” into vectors that can be used to train a classifier. We got good results and now we are preparing a journal paper with the applied methodology.

## **II – PUBLICATION(S) DURING YOUR FELLOWSHIP**

1. Enislay Ramentol, Tomas Olsson, Mats Tallfors and Shaibal Barua. Machine Learning models from industrial applications. Applications of Artificial Intelligence in Process Industry Automation, Heat and Power Generation and Smart Manufacturing. 2019 (Submitted to a book chapter)
2. Chongsheng Zhang, Jingjun Bi, Shixin Xu, Enislay Ramentol, Gaojuan Fan, Baojun Qiao and Hamido Fujita. Multi-Imbalance: An open-source software for

multi-class imbalance learning. Knowledge-Based Systems. 1016/j.knosys.2019.03.001. (2019) (Q1 journal)

3. Enislay Ramentol. Ifrow-multi: An Ensemble Classifier for Multiclass Imbalance Learning. In proceeding of International Conference on Advances in Signal Processing and Artificial Intelligence (ASPAI '2019). ISBN: 978-84-09-10127-6. (Conference Proceeding)
4. Enislay Ramentol, Julio Madera and Abdel Rodríguez. Early Detection of Possible Undergraduate Drop Out Using a New Method Based on Probabilistic Rough Set Theory. Uncertainty Management with Fuzzy and Rough Sets, Recent Advances and Applications (2019). Springer. (Book chapter)

-We are working on 2 papers that we must submit to the journal before December.

### **III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES**

Due to budget constraints, I only attended to one international conference:

- International Conference on Advances in Signal Processing and Artificial Intelligence ASPAI 2019. Barcelona, Spain.

I also attend to a conference in RISE:

- RISE AI Day. Stockholm. Nov 2018.

During my REP in Fraunhofer ITWM I was invited to give a conference for PhD students of the Department of Financial Mathematics.

- The Conference title is “Imbalanced learning, current challenges”.

### **IV – RESEARCH EXCHANGE PROGRAMME (REP)**

During my 4 weeks REP period at Fraunhofer ITWM I had the opportunity to exchange with some researchers. The main activities I did in Fraunhofer can be summarized as:

- I was invited to 3 project meetings, where I had the opportunity to exchange ideas with industry researchers and suggest possible solutions.
- I exchanged ideas with one PhD student and established future collaborations with him.

- I was invited to give a conference for PhD students of the Department of Financial Mathematics. The Conference title is “Imbalanced learning, current challenges”.
- I had a meeting with a professor from the University of Kaiserslautern and we started a collaboration. We are now organizing a consortium to apply for funding together. We are planning to apply Artificial Intelligence techniques in distance education and high education level with the aim of preventing dropout and reduce inequities.
- In addition to the above, the time in the Fraunhofer allowed me to know the institute, the work system, the researchers, the current projects. Considering that my second grant will be there, was of utmost importance to me.