

IPID4all Doctorate Research Exchange with Carl von Ossietzky Universität Oldenburg

Feedback report

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Exchange period: From **01 June 2015** till **28 June 2015**

Exchange topic: Stochastic evolution of non-stationary time series

Host University: Carl von Ossietzky Universität Oldenburg

Host research group: ForWind - Zentrum für Windenergieforschung
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1 INTRODUCTION

The purpose of this report is to describe my experience under the exchange program IPID4all Doctorate Research Exchange with Carl von Ossietzky Universität Oldenburg. The exchange program had the duration of four weeks (starting at 01/06/2015 and ending at 28/06/2015). I established two main objectives for this exchange. Firstly, I wanted to know the research group of Prof. Peinke and study possibilities for applying a PhD project and secondly, I wanted to apply the framework developed in my master thesis to data series available at ForWind.

This report is structured as follows: section 2 covers the research undertaken during the exchange program, section 3 covers my personal experience, and finally section 4 concludes the report.

2 RESEARCH UNDERTAKEN

During the exchange program we focus our research on the study of non-stationary time series. We used data extracted from around 2000 companies having listed shares in the New York Stock Exchange, with a sampling frequency of ten minutes, during a period of approximately four years. The data was composed by the volume and price of each share and we define the stochastic variable volume-price (s) as been the product of this two quantities.

In order to find the most suitable model to characterize the evolution of s , we evaluate the fit of four bi-parametric distributions: the Γ -distribution, the inverse Γ -distribution, the log-normal distribution and the Weibull distribution. We fitted the set of data s during different time frames, each one composed of 24 hours. This yield a collection of eight different time series composed by the fitting parameters of each distribution. Next we tested the goodness of the fit using the Kullback-Leibler divergence. We came to the conclusion that when considering the full range of the distribution of values of s , most of the time, the log-normal delivered the best fit. However, when considering just the range composed of the largest values of s the inverse Γ -distribution emerged as the best model to characterized the dynamic of this region.

We then focus on the study of the stochastic evolution of the fitting parameters describing the evolution of s . In order to do that, we applied a methodology known as the Langevin approach (described in Physics Reports 506 (2011)) originally developed by Prof. Peinke and his research group, which is most commonly applied to wind data series. As a result of our work, we were able to finish a paper untitled: "Uncovering the evolution of non-stationary stochastic variables: the example of asset volume-price fluctuations", which will be submitted for peers review at Physics Review E.

3 PERSONAL EXPERIENCE

This was my first time in an exchange program and I am pleased to say that the overall experience was very good! I found Oldenburg to be a great place to live since it has many features that I admire. It is a very quiet place full of green nature and joyful people. I was able to visit the all town and possibly the place that I most enjoyed was the Schlossgarten, since it reminds me of my home back in Azores. During the weekends I had the opportunity to visit Bremen and Hamburg, which are also quite nice cities. While I was in Oldenburg, I stayed in a family house at Am Bahndanm. To go to the University I just took the bus from Bahnhof Osternburg to Lapan and then another one to the University. I had no trouble with the language, since most of the people I met also spoke English. However, I am considering to learn German for the next time I come to Germany.

From the experience I had at the University I can say that it is quite pleasant to work there. In particular, the library is a great place to study. I was also surprised by the way that the buildings are in such harmony with the surrounding nature. I not attended any classes at the University, since the objective of my visit was mainly to work at ForWind. However, I had the opportunity to attend some interesting seminars.

Since I was a master student and applied form just a month, I receive from IPID4all 1000€ plus 225€ for travel. This was enough to cover all my expenses with the flight ticket,

bus tickets and the rented room. I used the rest of the money to buy some food and to travel by train.

Possibly, the most problematic issue I had was trying to find a room to stay for just a month. This was a problem simply because most of the rooms I found in the web were only available for periods of more than one month. Probably I was just very unlucky but I would suggest, if possible, to have some rooms available at the University only dedicated for students associated to exchange programs like IPID4all.

4 CONCLUSIONS

I would like to thank IPID4all for giving me the opportunity to visit a different University in a foreign Country and to work with new people in a different environment. One month in Oldenburg was enough time to know the town and I also had the chance to meet some professors and students at the University who share with me the same research interests. This will definitely facilitate my decision when I decide where to apply for my PhD.

I was able to accomplish most of my objectives for this exchange program. Also, I think that us been able to conclude a paper based on the work developed at ForWind is a very good indicator that this was successful exchange.

For future exchange students I would suggest the website <http://n8chthaus.de/>. This is a good place to find accommodation for short periods of time for a relative cheap price.

A co-supervision of a thesis is not yet planed, but I am considering the submission of a proposal for one of the PhD programs currently available in DAAD (<https://www.daad.de/en/>). For now, no further exchange is planned between the two research groups. However, since I learned so much with this exchange program, I would like to exchange again with a new research topic, if given the opportunity.

As I mentioned, for me this was a great experience and I am looking forward to come back to Germany.