

**Jožef Stefan Institute (JSI)** is the leading research institution for natural sciences in Slovenia with over 900 researchers within 25 departments working in the areas of computer science, physics, and chemistry and biology.

The **Artificial Intelligence Laboratory**, with approximately 40 researchers, is one of the largest European research groups working in the areas of machine learning, data mining, language technologies, semantic technologies and sensor networks. Its key research direction is combining modern statistical data analytic techniques with more semantic/logic based knowledge representations and reasoning techniques with the purpose to make progress in solving complex problems such as text understanding, large scale probabilistic reasoning, building broad coverage knowledge bases, and dealing with scale.

The team is dynamic, young and international with the Institute located at a walking distance to the city centre of Ljubljana. We are looking for bright, well-motivated and self-driven individuals and look forward to welcoming you to our team!

We are looking for **two Early Stage Researchers (ESR) PhD Studentship in Marie Skłodowska-Curie ITN BigDataFinance**

BigDataFinance, a Marie Skłodowska-Curie Innovative Training Network “Training for Big Data in Financial Research and Risk Management”, provides doctoral training in sophisticated data-driven risk management and research at the crossroads of Finance and Big Data for 13 researchers. The main objectives are i) to meet an increasing commercial demand for well-trained researchers experienced in both Big Data techniques and Finance and ii) to develop and implement new quantitative and econometric methods for empirical finance and risk management with large and complex datasets. To achieve the objectives, the emphasis is put on exploiting big data analysis techniques to manage and use datasets that are too large and complex to process with conventional methods. Banks and other financial institutions must be able to manage, process, and use massive heterogeneous data sets in a fast and robust manner for successful risk management; nonetheless, financial research and training has been slow to address the data revolution. Compared to the USA, Europe is still at an early stage of adopting Big Data technologies and services. Immediate action is required to seize opportunities to exploit the huge potential of Big Data within the European financial world. This world-class network consists of eight academic participants and six companies, representing banks, asset management companies, and data and solution providers. The proposed research is relevant both academically and practically, because the program is built around real challenges faced both by the academic and private sector partners. To bridge research and practice, all researchers contribute to the private sector via secondments. BigDataFinance provides the European financial community with specialists with state-of-the-art skills in finance and data-analysis to facilitate the adoption of reliable and realistic methods in the industry. This contributes to increasing the financial strength of banks and other financial institutions in Europe.

### **Beneficiaries**

Tampere University of Technology (Coordinator), Finland: <http://www.tut.fi/en/home>

Aarhus University, Denmark <http://www.au.dk/en/>

University of Zurich, Switzerland: [http://www.uzh.ch/index\\_en.html](http://www.uzh.ch/index_en.html)

Jozef Stefan Institute, Slovenia: <http://www.ijs.si/ijsw/JSI>

University of Manchester, UK: <http://www.manchester.ac.uk/>

Alliance-Bernstein Ltd, UK: <https://www.abglobal.com/>

ING Bank, Netherlands: <http://www.ing.com/en.htm>

### **Partner organisations**

Aalto University, Finland: <http://www.aalto.fi/en/>

University of Amsterdam, Netherlands: <http://www.uva.nl/en/home>

Numerical Algorithms Group, UK: <http://www.nag.co.uk/>  
Jožef Stefan International Postgraduate School, Slovenia: <http://www.mps.si/splet/index.asp?lang=eng>  
Olsen Ltd, Switzerland: <https://www.olseninvest.com/customer/>  
Techila Technologies, Finland: <http://www.techilatechnologies.com/>  
Bloomberg UK Limited, UK: <http://www.bloomberg.com/europe>

## **Job description:**

Two positions available (each 36 months) at Jožef Stefan Institute in the following research projects

### **Position 1**

Complex Networks in Finance

Research project: **Deep Knowledge Extraction from Financial, Business and Social Text**

Objectives: This RP aims to transform unstructured textual content in multiple languages and formats into a structured form suitable for traditional analytic techniques in financial decision-making. The challenge is to extract semantically annotated facts in the form of relationships between concepts and entities mentioned in a stream of documents and social media. The task fits nicely into the framework of Machine Reading (or micro-reading) and represents a new direction at the intersection of natural language, semantics, and knowledge-driven reasoning. The knowledge extraction methods developed in this RP will be tested and employed in other WPs. Particularly the projects in WP3 (on financial econometrics with news announcements) directly depend on this RP to augment econometric models with news arrivals.

Expected Results: The final outcome will be both relational (for light weight representation) and reasoning-capable logical relationships (for deep representation). Current practical work in this area relies heavily on curated event types and declarative extraction techniques, leading to a sharp trade-off between precision and recall, a lack of transparency in market behaviours, and an assumed independence between extracted structures. Instead, this project will propose new frameworks for incorporating a deeper context to further the understanding of the relative value of extracted knowledge. Two journal submissions (Machine Learning) and a PhD submission are expected.

Planned secondments: 1. UMA, 3 Months, Real-Time Machine Learning for Financial Data; 2. AB, 3 Months, Application of Deep Learning in Risk Management

### **Position 2**

Financial Econometrics with High-Frequency Data and News Announcements

Research project: **Characterising Financial Markets from Event-driven Perspective**

Objectives: When things happen, knowledge about the event and understanding of its importance in context propagates through a variety of world models, leading to patterns of behaviour that in turn affect the system. This task is to build representations and novel modelling techniques that allow these interactions to be instantiated, observed, and leveraged. The current work in this area concentrates on analysis among a restricted set of time-series and flattened event signals, using approaches such as Canonical Correlation Analysis (CCA) to identify potential dependencies. These approaches are prone to weak and conflicting signals and offer little transparency to study the underlying phenomena. Our objective is to look at naturally hierarchical, recurring, dependent structures such as graphs, trees, and a variety of clustering and dimensionality reduction techniques to quantify events, relationships, and allow for more natural exploration of the dynamic financial landscape.

Expected Results: We will provide frameworks for representation that bring transparency and understanding to interactions among events and a deep understanding of the state of the financial universe. This project will produce two working papers (journal submissions to Machine Learning and/or Economics) and a PhD manuscript.

Planned secondments: 1. AU, 2 Months, High-Frequency Financial Econometrics with News Arrivals; 2. Bloomberg, 5 Months, Understanding the Evolution of Financial Markets

### **Requirements:**

We are looking for talented, creative and highly motivated researchers. A suitable background for these open position includes **Data Engineering, Knowledge Engineering, Statistics, Signal Processing, Artificial Intelligence, Machine Learning** and other related areas. Fluent written and spoken English and solid programming (**C/C++/Python/R/Matlab**) and sufficient data engineering skills (e.g. **SQL databases, Spark or similar data analytic tools**) are required. Excellent skills in **statistics, applied mathematics and data science** are essential. Skills in financial analysis are acknowledged.

If separately asked from a candidate, a suitable English language proficiency test may be required.

- Candidates applying for the doctoral student position must hold Master's degree in a relevant field and the recruited candidate is expected to enrol as a PhD student at Jožef Stefan International Postgraduate School.
- Applicants shall, at the time of recruitment by the host organization, be in the first four years (full-time equivalent research experience) of their research careers and not yet have been awarded a doctoral degree. Full-Time Equivalent Research Experience is measured from the date when a researcher obtained the degree that would formally entitle him/her to embark on a doctorate.
- H2020 MSCA Mobility Rule: at the time of recruitment by the host organization,

researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of their host organization (Slovenia) for more than 12 months in the 3 years immediately prior to the recruitment date. Compulsory national service and/or short stays such as holidays are not taken into account.

---

**Salary:** The salary will be set in accordance with MSCA ESR rates including mobility and family allowance depending on the ESR's personal situation.

**Trial period:** Trial period of 4 months applies. Job interview will include a pre-check of programming skills.

**For more information, please contact:** Dr. Polona Škraba Stanič  
Artificial Intelligence Laboratory, Jožef Stefan Institute  
[polona.skraba@ijs.si](mailto:polona.skraba@ijs.si)  
++386-1-477-3778

**How to apply:** Applications can be submitted **via email by the 19th of August 2016. The subject of the email MUST read: *Application - BigDataFinance***

In case no suitable candidates are found in this application round, the call will be re-opened.

The application should include the following annexes :

- Contact details of the candidate and personal details, including citizenship
- Letter of motivation
- CV with picture (including names and contact details of at least two references, one of which is preferably the MSc or current PhD thesis supervisor)
- Copy of MSc degree certificate
- List of publications