
Fujitsu Research of Europe

Robust Water Segmentation Researcher

TIN-FUJI-001

About the Organisation

Fujitsu is a world leading IT organisation with more than 125,000 people acting in 180 countries. As a global company, with a long history of delivering technology-based value to customers, it is our responsibility to contribute proactively to the transformation of society. We are committed to focus all our resources on making the world more sustainable by building trust in society through innovation.

In order to deliver on our commitment, we need to connect people, communities, organizations, things and data, to deliver value that's focused around people and to generate innovation that solves societal challenges. Fujitsu Research is the global research arm of the Fujitsu Group and as such is responsible with creating the technology necessary to solve these challenges.

Role Description and Responsibilities

Flooding is the most frequent and costly disaster in the world. It has been estimated that if European countries do not adapt to the increasing flood risks, they could face up to nearly \$1 trillion euros in yearly damages by 2100. Among European countries, the United Kingdom would be hardest hit, experiencing about a fifth of those damages. Predicting the occurrence of floods, monitoring key areas such as rivers and roads and assessing the damages is therefore one of our research priorities.

This project focuses on the use of Deep Learning based models that aim to recognize (i.e. segment) water in roads and rivers. While such models and small datasets that can be used to train them exist, we are currently lacking the understanding on how these models perform outside of the training data (i.e. in out-of-distribution scenarios). This understanding is essential for assessing whether the results of such models can be relied upon during rare events such as powerful storms or hurricanes.

Together with our academic partners, Fujitsu Research is at the forefront of research into the out-of-distribution behaviour in computer vision (see [1] and [2] for examples). Also, as a Japanese company, we are very focused on and a leader in Tsunami simulation and flooding caused by Tsunami (see [3] and [4] for examples). We expect interns to greatly benefit from frequent interactions with our internal and external partners.

At the core of this project is the creation of a set of scenarios and a dataset that will enable us to assess the out-of-distribution performance of AI models. We see this dataset as a combination of computer-generated data and real data. Computer generated data will be supported by another intern whose main objective will be the creation of realistic virtual environment. Real data will be obtained from open sources such as the many available watercams.

Turing Internship Network – Spring 2022

Your objectives are as follows:

- Read scientific literature and interact with experts in the fields, both internal and external, in order to generate a set of challenges that correlate highly with real world performance
- Use core research skills to find efficient ways for creating the dataset in controlled ways
- Explore SOTA models in the field and evaluate them on the created dataset
- Grow both technical and communication skills by interacting frequently with your local and overseas colleagues

[1] <https://nips.cc/media/neurips-2021/Slides/26740.pdf>

[2] <https://www.nature.com/articles/s42256-021-00437-5>

[3] <https://www.fujitsu.com/global/about/resources/news/press-releases/2021/0216-01.html>

[4] <https://www.nature.com/articles/s41467-021-22348-0>

Expected Outcomes

The expected outcome of this project is to advance our understanding on how water segmentation models perform in challenging real-world scenarios and by doing so to push forward the SOTA in the field.

Working as part of Fujitsu's Global AI Laboratory and together with a world leading university, you will be responsible for:

- The generation of a list of out-of-distribution scenarios where the performance of AI models is expected to degrade
- The creation of a controlled dataset that will make possible a quantitative analysis of model performance in the scenarios above
- A benchmark of SOTA models, both internal and from literature, using the created benchmark
- Production of or contribution to an academic paper which documents the dataset developed, results, discussion, and recommendations.

Supervision and Mentorship

You will be working together with members in Japan, US and UK under the supervision of a local Senior Researcher from the AI & Computing Group. You will take part, present your research and hear about other members' activities during our weekly group meetings.

Ideal Intern

- Proficient in the Python programming language and with experience in at least one deep learning framework (e.g. Pytorch, TensorFlow)
- Experience in applying deep learning for computer vision tasks, ideally for segmentation tasks
- Hands on attitude, with strong interest in solving real-world technical challenges
- Domain specific knowledge related to flood modelling, water/liquid detection or segmentation is a plus.

Internship Logistics

Start date: September 2022 (negotiable)

Turing Internship Network – Spring 2022

Duration: 4-6 months (6 months preferred) full time with part time option available

Location: Hybrid working from our office in Slough

Remuneration: £30,000 p/a pro rata

Point of contact for technical queries: Serban.Georgescu@fujitsu.com

Fujitsu Research of Europe Virtual City Researcher TIN-FUJI-002

About the Organisation

Fujitsu is a world leading IT organisation with more than 125,000 people acting in 180 countries. As a global company, with a long history of delivering technology-based value to customers, it is our responsibility to contribute proactively to the transformation of society. We are committed to focus all our resources on making the world more sustainable by building trust in society through innovation.

In order to deliver on our commitment, we need to connect people, communities, organizations, things and data, to deliver value that's focused around people and to generate innovation that solves societal challenges. Fujitsu Research is the global research arm of the Fujitsu Group and as such is responsible with creating the technology necessary to solve these challenges.

Role Description and Responsibilities

Flooding is the most frequent and costly disaster in the world. It has been estimated that if European countries do not adapt to the increasing flood risks, they could face up to nearly \$1 trillion euros in yearly damages by 2100. Among European countries, the United Kingdom would be hardest hit, experiencing about a fifth of those damages. Predicting the occurrence of floods, monitoring key areas such as rivers and roads and assessing the damages is therefore one of our research priorities. As such, Fujitsu is a leader in Tsunami simulation and flooding caused by Tsunami (see references [1] and [2] for more details).

Our project focuses on the use of Deep Learning based models that aim to recognize (i.e. segment) water in roads and rivers. In the longer term, we plan to integrate these data source into simulation models that can accurately forecast floods. As part of this project, your role is to create a 3D virtual city, of small to medium size, to be used for synthetic data generation and for experimenting with new ideas. The virtual city should include ground elevation information, buildings and water sources (e.g. rivers, lakes) which should be as realistic as practically possible. You will work together with another Alan Turing Institute intern, whose main goal is the use of the virtual city (together with sources of real data) to create a dataset for testing segmentation models in difficult (out-of-distribution) conditions.

Your main objective are as follows:

- Investigate both open-source and commercial tools and identify those best suitable for creating the virtual city
- Install the identified tools on our multi-GPU Linux server
- Discuss with internal and external stakeholders, gather requirements, design and implement the virtual city

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- Use the virtual city to support data generation and scenario exploration and ideally contribute to an academic publication
- Grow both technical and communication skills by interacting frequently with your local and overseas colleagues

[1] <https://www.fujitsu.com/global/about/resources/news/press-releases/2021/0216-01.html>

[2] <https://www.nature.com/articles/s41467-021-22348-0>

Expected Outcomes

The expected outcome of this project is a realistic and visually appealing virtual city that we can use to:

- generate controlled datasets for training and evaluating the behaviour AI models and in particular models for water segmentation and flooding
- prototype various data acquisition scenarios (e.g. road cameras, water cameras, drones) and assess their benefits in simulation
- communicate results to internal and external stakeholder in a visually rich and pleasing way

Working as part of Fujitsu's Global AI Laboratory, you will be responsible for:

- Creation of 3D city models of various complexities
- Developing methods (description, script or API) that can be used by other users to generate synthetic image data using the virtual city (e.g. by placing cameras at various locations, simulating drones etc.)
- Integration of water models which can be used to simulate flooding in areas of the virtual city

Supervision and Mentorship

You will be working together with members in Japan, US and UK under the supervision of a local Senior Researcher from the AI & Computing Group. You will take part, present your research and hear about other members' activities during our weekly group meetings.

Ideal Intern

- Familiarity with general purpose 3D modelling tools such as Unreal Engine, Blender, NVIDIA Omniverse, etc.
- Hands on attitude, with strong interest in solving real-world technical challenges
- Familiarity with modelling tools specialized for the design of urban environments, such as Esri CityEngine is optional but highly appreciated
- Domain specific knowledge related to climate, weather or flood modelling or fluid simulation is optional but highly appreciated

Internship Logistics

Start date: September 2022 (negotiable)

Duration: 4-6 months (6 months preferred) full time with part time option available

Location: Hybrid working from our office in Slough.

Turing Internship Network – Spring 2022

Remuneration: £30,000 p/a pro rata

Point of contact for technical queries: Serban.Georgescu@fujitsu.com

Fujitsu Research of Europe

Assimilation for large-scale digital twins

TIN-FUJI-003

About the organisation

Are you someone who enjoys using your research mindset to explore and innovate? Do you want to shape your world and change the way it works? Do you want to collaborate with committed people and achieve results together to develop truly human centric innovation? Are you someone who is interested in creating innovations to build trusted, sustainable societies using insights from big data, digital twins, and computational social science? If this is your world, here is an opportunity to shape it for the better.

At Fujitsu Research of Europe (FRE), we are combining research and industrial innovation to transform businesses and society. FRE is a multidisciplinary centre which, as part of Fujitsu's global R&D activity, conducts research and innovation – shaping our world for the better as well as supporting the constant learning of our employees.

Role Description

The Social Digital Twin project develops solutions to social issues. We create integrated technologies that combine large scale data with knowledge from a variety of fields, including data science, the humanities, and social sciences. We are developing systems that use real-world, real-time data to create digital twins that mirror the behaviour of complex systems – cities, transport, power – and enable their management.

One component of the SDT platform will be digital twins that reflect the state and behaviour of objects in the physical world. The models used by these twins will be continuously updated with real-time sensor data. These data will be noisy and gappy, so we need to ensure that they are smoothly integrated into running models.

The intern will work within our team to understand this assimilation problem for digital twins operating at scale and in real time and develop approaches that ensure smooth operation of the SDT.

Expected Outcomes

- Analysis of assimilation for the SDT
- Survey of relevant assimilation techniques
- Present the results of the work to an international audience of stakeholders throughout Fujitsu Research
- Grow skills and expertise, both in yourself and for FRE

Turing Internship Network – Spring 2022

Ideal Intern

- Familiarity with one or more of: assimilation, agent-based modelling, or large-scale modelling
- Ability to discover and assess technical information – literature review
- Experience of performing well both when working as part of a team and individually

Internship logistics

Start date: September 2022

Duration: 3 months, full time.

Location: Hybrid, office in central Slough.

Remuneration: £30000 p.a. pro rata

Please contact Sven Vandenberghe (sven.vandenberghe@fujitsu.com) for any technical enquiries.