Sony R&D Brussels Laboratory Internship Proposals

About Sony R&D Center Brussels Laboratory

Sony R&D BRL is a software and Artificial Intelligence research & development group, focusing its activities on AI, security, and new technologies such as LLM's, human sensing and blockchain. It is wholly owned by Sony Corporation and exclusively researches and develops technology for Sony products and services.

To build up collaboration with academia, we would like to offer some internship proposals to Master students from local universities.

Sony R&D BRL's offices are located in Zaventem, near Brussels and Leuven, Belgium. It takes 41 minutes to reach by train from Brussels Midi (Eurostar / Thalys terminal), 37min from Leuven station, 50min from Antwerpen-Centraal and 5 minutes by shuttle bus from Brussels Airport.

The internship may be hybrid (partially remote); however, the candidate should be located in Belgium at the time of the internship and is expected to come to the Zaventem office regularly.

The group is international, and the working language is English.

1. Graph reasoning & LLMs in AI systems

Contact : thomas.carette@sony.com

Context: The internship proposals consist in joining the R&D team researching and building graph-based ML systems (for, e.g., recommendation, personalization, trend detection) for supporting Sony's entertainment businesses.

Requirements: For all proposals in this section, the candidate should have:

- An interest in applying machine learning and statistical methods.
- Data science fundamentals and good practices
- Programming skills in Python; Familiarity with DS ecosystem (e.g., pandas, scikit-learn)

Internship Proposal: Graph-based recommendations

Graphs offer a powerful way to represent sophisticated ecosystems, as well as user engagement with Sony media or content creation on online platforms. You'll be part of a groundbreaking team, exploring

new ways to understand and predict user preferences and behavior using Graph Neural Networks (GNNs).

Research Topics:

- Developing algorithms for graph-based recommendation systems.
- Analyzing user interaction data to improve content personalization.
- Evaluating graph-based system effectiveness in real-world scenarios.

Internship Proposal: Community detection in dynamic graphs

A key property of entertainment is its constant evolution, both in what creative artists and content creators produce, but also regarding what audiences love and their habits. In this project we would like you to explore community detection in dynamic graphs, which are important for understanding evolving patterns in connected systems.

Research Topics:

- Implementing algorithms for identifying communities in dynamic graphs.
- Applying findings to trend detection.
- Research methods for interpreting the detected trends and their evolution.

Internship Proposal: Representation learning on dynamic graphs

Beyond detecting communities and trends in dynamic graphs, we would like to be able to describe, interpret and predict trajectories of individual vertices in the graph. In this Internship you will focus on developing advanced representation learning techniques on dynamic graphs to capture temporal changes and complex relationships in data.

Research Topics:

- Enhancing graph neural networks to handle dynamic data.
- Exploring temporal embedding techniques for better data representation.
- Research methods for using and interpreting the resulting models in real-world cases

Internship Proposal: Augmenting knowledge graphs with textual data & LLMs

Graphs typically emerge from structure or semi-structured datasets. However, they rarely integrate linked information which can be contained in natural language. In this internship, you will seek to enrich knowledge graphs with textual data to make them more comprehensive and informative, possibly Large Language Models (LLMs).

Research Topics:

- Use natural language processing (e.g., LLM) to extract graph-like information.
- Improving knowledge graph completeness and accuracy using text data.
- Developing applications of enriched knowledge graphs in various domains.

Internship Proposal: Retrieval Augmented Generation (and other LLM anchoring techniques) for personalization.

Pre-trained LLMs offer a fantastic opportunity to augment personalized environment with organic interactivity. However, it is still a challenge to anchor the contribution of a LLM to concrete facts and preferences of a user. In this Internship you will delve into the integration of Retrieval Augmented Generation and other Large Language Models (LLMs) techniques to enhance personalization algorithms.

Research Topics:

- Developing LLM-based systems for personalized content generation.
- Exploring retrieval-augmented techniques for improved recommendation accuracy.
- Evaluating the impact of LLM anchoring on user experience.

Internship Proposal: LLMs for explainable graph reasoning

In general, there is a tradeoff between how advanced a model is and its interpretability. However, recent exciting advances in AI show that, in some cases, it is possible to use a sophisticated AI as an assistant to domain experts. This internship will allow you to focus on using LLMs to provide explainability in graph reasoning tasks, bridging the gap between advanced AI models and human-understandable explanations.

Research Topics:

- Integrating LLMs as interpretation layer of results of graph-based algorithms.
- Developing methods to translate complex graph reasoning into understandable narratives and conversely.
- Evaluating the effectiveness of LLM explanations and path-finding capabilities.

Internship Proposal: GNN-LLM alignment for domain translation

Integration of recommender systems, especially across domains, can be challenging. With this internship, we will support you in exploring how aligning Graph Neural Networks (GNN) with Large Language Models (LLM) can bridge this gap.

Topics for Research:

- Investigating synergies between GNNs and LLMs for advanced data analysis.

- Developing hybrid models that use the strengths of both GNNs and LLMs.
- Evaluate prompts to improve LLM profiles and domain translation.

2. Secure AI

Contact : Karin.CvetkoVah@sony.com

Could over-optimizing against adversarial perturbations result in decreased robustness against naturally occurring perturbations, such as unexpected extreme weather conditions?

In your internship, we would like you to explore whether over-optimizing for specific perturbations could impact performance for another type.

Internship Proposal: AI Robustness Interplay

We know that Classification remains a key task in all areas of machine learning, with use cases ranging from super-fast fraud detection to image classification in computer vision in new and exciting Advanced Driver-Assistance Systems (ADAS).

Evaluation metrics like accuracy, precision, or recall typically measure model's performance on unseen data from the same or similar distribution as the model was trained on. But real-life situations often require the model to handle out-of-distribution inputs. Robustness in machine learning models and AI systems refers to their ability to maintain performance and provide reliable, accurate decisions when encountering significantly different data than they were trained on.

Robustness against out-of-distribution inputs is a focus for deploying reliable AI systems in real-world environments, where data can be dynamic. This robustness is achieved through careful design, training, and evaluation of models to ensure they reliably handle variable scenarios, including those not seen during training. Typical robustness assessments measure accuracy after introducing varying perturbations to test datasets, i.e. synthetic perturbations like flip or blur, or adversarial perturbations carefully crafted by machine learning algorithms and potentially applied by malicious actors. Very exciting!

Typically, we handle each perturbation individually. It is well known that enhancing the performance for one perturbation may not boost the performance for others. However, there is still a lot of mystery regarding the full interplay among types of robustness.

Requirements

- An interest in robust adversarial and robust machine learning models
- Machine Learning fundamentals and good practices
- Internship as part of Masters Thesis (topic not suitable for very short internships)

3. Human Sensing

Contact : Anja.Pflug@sony.com

Our Human Sensing team is exploring how to predict dynamic mental health changes from data, sensed from human participants. Signals range from physiological metrics over behavioral metrics, to user's subjective feedback and psychologist labels. We believe that we can build outstanding explainable solutions for use in real conditions. For this, we are collaborating with psychologists, biologists, and data scientists.

We would love to hear from you if you are passionate about mental health and cognitive science and want to learn how to develop exciting technical solutions that can be embraced in our everyday lives.

Internship Proposal: Behavioral activation within Cognitive Behavioral Therapy

The team have collected a dataset where stressed & depressive patients followed CBT over two months. In this internship, we would like you to investigate if an improvement in depression scores is associated with increased behavioral activation. For this, you will explore research literature and learn how to create and extract behavioral activation-related metrics from wristband data, and how to use those within explainable AI solutions. We will support you to create a robust solution which considers the noisiness of real-life data.

Requirements
- Programming skills in Python (panda, numpy, sk-learn)
- An interest and curiosity to explore statistical methods and human physiology,
- Open to thinking out of the box and have good collaboration skills.

4. Blockchain
Contact : Michele.Minelli@sony.com

Blockchain technology provides an opportunity for exciting and cutting-edge improvements for businesses like Sony. The Blockchain team support Sony's interests in dynamic domains like entertainment, creative content, technology, and finance.

Internship Proposal: blockchain-related activities.

In the R&D division, our Blockchain team is investigating the applicability of this paradigm-shifting technology to Sony's multi-domain business and coming up with proof of concepts and products that illustrate blockchain's incredible potential and value.

Given the evolving and innovative context of the activities, we would like to discuss this internship closer to your joining date and explore the range of opportunities available in our exciting projects.

Requirements

- Coding skills and familiarity with collaborative development through git and GitHub.
- Blockchain knowledge would be beneficial.

5. BRL Security Team

Contact : Gert.Ceulemans@sony.com

We are living in an exciting, connected world where society is needs the safety and security of devices and services, and we see it as our mission to empower Sony to deliver.

BRL's security team ensures the safety of Sony customers by testing products before they are launched. For this purpose, our team uses similar security breaching methods that malicious hackers and attackers use.

BRL's technologies also proudly protect millions of customer accounts from fraud and account takeovers in Sony's e-commerce, gaming, and entertainment networks.

Internship Proposal: Security Tooling

We evaluate and develop tools to support Sony's businesses to keep improving security of new and updated devices. These tools can also contribute efficiency gains and coverage of penetration tests. Our Team focuses on new Sony devices with Linux or Android based software.

Currently, our tooling is implemented with file system, ELF binary, kernel configuration, and data checks. Your goal as our intern is to extend and improve coverage of the checks into different areas of device security, and to improve the usability of the reporting functionality. This can be accomplished by implementing new checks, improving the accuracy of the results, or evaluating existing tools for possible integration.

Topics

Below we propose a non-exhaustive list of topics that can be addressed during the internship based on the skill level and interests of the candidate intern.

- Development and improvements: increase the coverage of the checks performed by the tool, or the different devices supported.
- Design and implement new checks and apply them to different devices.
- Improve support for new devices by implementing and testing support for different device profiles.
- Review pen test reports for inspiration and innovation of new checks, e.g., multi-step attacks where the tooling could be used to detect one or several of the vulnerabilities that are used to compromise the device.

- Research existing (OSS) tools: We would like survey existing tools, OSS and commercial. Interesting tools can be considered for a PoC, and eventual integration in the toolkit.
- AI: since AI is has capable, we would like to explore opportunities where it could help improve the results of the tooling.
- Reporting and usability improvements: inspire change and improvements to empower our teams to increase adoption.
- Explore test techniques to reduce false positives.

Key Skills and Experience

- Enthusiasm
- Understanding of Linux and Android security
- Experience with computing hardware and software execution on embedded devices.
- Development experience in Python, C

Additionally, the following might prove very useful:

- SCM (github)
- Scrum
- An interest in AI
- Knowledge of Rust or GoLang

About Sony Europe

Bring your uniqueness to Sony

We are passionate about creating a culture that promotes equity and cultivates inclusion, diversity, and belonging. We want employees with diverse backgrounds and perspectives that will stimulate innovation and have a direct impact on our creation of social value to fulfil Sony's purpose – 'to fill the world with emotion, through the power of creativity and technology'. We want you to bring your unique self to work and help shape our culture.

We are Sony Europe

Our people collaborate in an environment of respect, integrity, and open-mindedness. Diverse teams from all over Europe are the driving force for our business, and we embrace the differences that make each of us original and unique.

With offices in 28 European countries, Sony Europe caters to consumer, professional, semiconductor and healthcare markets with innovative electronics products and solutions. Our European laboratories research and develop new technologies and capabilities that contributes to the Sony Group and important issues on a planetary scale.

Bring your passion, creativity, and ambitions to Sony Europe. Apply now, and let's create the future together.

Equal Opportunity

Sony Europe is an Equal Opportunity Employer. All qualified applicants will receive equal consideration for employment regardless of race, colour, religion, gender, citizenship, ancestry, age, physical or mental disability, sexual orientation, gender identity, medical condition, or any other protected characteristics.

Disability Accommodation for Applicants to Sony Europe

Sony Europe will provide reasonable accommodation for any qualified individuals with disabilities in the application process. For reasonable accommodation requests, please contact us by email at AccommodationRequest@eu.sony.com or by mail to: Sony Europe B.V, Human Resources Department, the Heights, Brooklands, Surrey, KT13 0XW, UK. When contacting us please indicate the position you are applying for, and the accommodation required.