Master 2 Research Internship Computer Science

AI Recommendation Approach for Green Software

Laboratory : LIUPPA laboratory (Laboratoire Informatique de l'Université de Pau et des Pays de l'Adour), University of Pau and Pays de l'Adour
Location : Pau, France
Funding : Master 2 internship funded by the national French ANR agency
Project : `BEHAVE!` project
Supervisor : Adel Noureddine (noureddine.org)
Applications deadline : Until position fulfilled, ideally before late December 2024
Internship starting : Winter/Spring 2025, for 6 months
Keywords : Green IT, Software Engineering, AI/Artificial Intelligence, Autonomic Computing
Contact : adel.noureddine@univ-pau.fr

1 Scientific Context

The CO2 impact of Information and Communication Technologies, or ICT, has constantly grown in the last decades. Estimates indicate an increase of ICT's greenhouse gas emissions (GHGE) from less than 2% in 2007 to more than 14% in 2040. ICT also account in 2015 for 4% of European CO2 emissions, and up to 10% of the total European's electricity consumption.

In response to the necessity of reducing the energy and CO2 footprint of ICT, computer science researchers have tried to tackle the subject by improving the energy efficiency of software systems and devices. As people are more equipped with digital and technological devices and appliances, homes that can be partially or fully defined as *smart* are increasing. End users are more often interacting with these smart devices and the software running and piloting them. Focusing on software systems optimizations without integrating users in the energy reduction strategies might lead to rebound effects, such as an increase in using software services when their energy consumption is reduced.

2 Master 2 Internship Topic

In the `BEHAVE!` project, we designed an autonomic control loop to collect user software usage and energy consumption, then provide users with feedback of their consumption to push behavioral changes.

Based on this platform, the goal of the internship is to design a recommendation approach to help end users apply energy-efficient software actions, using autonomic computing principles and AI approaches.

For example, the design would classify software according to usage and energy categories, detect and identify actions that can be applied (such as modifying software configuration or settings), and provide a user-tailed recommendation of the actions.

User interactions with the actions would then be studied, and the algorithm would learn which action is most effective and has more user adoption (by, for example, using a reinforced learning algorithm).

The recruited intern will work within this aspect of software engineering, autonomic computing and artificial intelligence, with the following tasks and goals :

- Study the state of the art of recommendation algorithms, software classifications, and software actions.
- Propose a dynamic classification of software according to their types and energy efficiency.
- Identify interaction possibilities with software (APIs, settings or configuration files, etc.).
- Identify actions per software category or per software, classify them, and provide a listing/guide for energy-efficient actions for software.
- Build a proof-of-concept implementation of the autonomic loop (for example, identify software APIs and actions, monitor user usage and consumption, propose/enforce an action, learn from user engagement and energy consumption).
- Write a scientific paper presenting the main findings of the study.

3 Candidates Requirements

We are looking for outstanding and motivated candidates for this master 2 internship position. The candidates must be in master 2 in computer science, software engineering or related area. The candidate must have good English skills, while French is highly recommended for the qualitative studies that are performed in France.

Salary : the student is paid according to the French law regarding internships (around 600€ per month).

4 Applications

Applications must be sent to **Dr. Adel Noureddine by email : adel.noureddine@univ-pau.fr**, with the following documents :

- A curriculum vitae,
- A motivation/cover letter explaining the interest in the scientific aspect of the internship,
- Master's grades and ranking (M1 and available ones of M2, if any), and proof the student is a master 2 student at a recognized university,
- Examples of your scientific or project writings (publications, internship report, project reports),
- Contact details of one or two references, and optionally any recommendation letters.
- Any other documents the candidate seems fit to enrich his/her application,

Applications will be reviewed and selected candidates will be invited for interviews (in person for local candidates or by videoconference) that will take place all along the application period, until the position is fulfilled. It is recommended to submit your application before late December 2024.