



Operational AI Ethics (OpAIE) research program

Internship project

Subject: Designing a Public Recommender Systems for User-Training Program Matching

Possibility to continue as a PhD candidate: YES

About Operational AI Ethics The Operational AI Ethics program (telecom-paris.fr/ai-ethics), led by Winston Maxwell (professor of law and regulation) and Tiphaine Viard (professor of computer science), federates six scientific disciplines around finding operational solutions to AI ethical challenges, including bias, explainability, certification for critical applications, AI governance and AI in the public interest. Research is funded in part by the Groupe Caisse des Dépôts.

Description of the internship

Supervision

Valérie Beaudouin (<https://www.telecom-paris.fr/valerie-beaudouin>)

Matthieu Labeau (<https://www.telecom-paris.fr/matthieu-labeau>)

Charlotte Laclau (<https://laclauc.github.io/>)

Winston Maxwell (<https://www.telecom-paris.fr/winston-maxwell>).

Location and dates of the internship

Address: Télécom Paris, 19 Place Marguerite Perey, 91120 Palaiseau

Date of the beginning of the internship: beginning 2023

Team where the thesis will be written Department IDS, Team Signal, Statistique et Apprentissage (S2A) in conjunction with SES - social and economic sciences - department.

Keywords Sequential recommender system, Collaborative filtering, Content-based recommendation, ranking, public service recommender systems, training, education, fair and transparent AI, explainable AI

Detailed subject Recommender systems are used to facilitate the matching between users and offers. They have been massively present for several years for commercial oriented applications, such as online advertising or movie recommendation, to name a few. In this context, one seeks to match users with potential ads of products that he or she is most likely to click on; or movies that he or she is most likely to watch. These recommender systems are mainly profit driven (e.g., maximize the number of clicks, increase user engagement) and as such they tend not to take into account public service criteria. For public sector recommendation systems, public service criteria may supplement, or even replace, profit maximisation. Developing a public service recommender system [1] is the heart of this project. Our project is part of the process of lifelong learning. More precisely, the input data that we are dealing with are the learning pathways of users, in the form of a sequence of diploma, followed training and occupied position over the past years. Our goal is, based on a given user set-up goal (for instance a new position and the set of skills associated to it) to recommend the most fitted training program. Public recommender systems have very recently started to emerged in the research literature, for instance to address the problem of job recommendation on the job market [3, 2], or online education resources recommendation [5, 4], two sectors that exhibit strong commonalities which our project. Starting from these previous studies, our objective is to explore the potential of sequential recommender systems (RS) [6] in such context. RS methods are usually classified between content-based (where content refers to the users' profile information) and collaborative filtering (based on users' past interaction). Sequential RS on the other hand are aiming to understand the user input over time and model their past interaction in a sequential order. As such, these models are of particular interest to us.

The objective of this internship is threefold:

- Define the set of specifications expected for the design of a public service recommender system. The key challenge is to explore what *performance* means in such context, how public service criteria can be maximized, and this can be done while also ensuring fairness, transparency and compliance.
- Perform an in-depth study of the sequential recommendation systems that are the state of the art today.

- Define a proper mathematical object (eg. a graph) to model the users' pathways and start to develop a prototype of the public recommender system.

Candidate profile Student having master 2 research

- Statistical learning, bases of probability
- Good level of programming (Python)
- Good command of English
- Strong interest, and classes, in AI ethics, governance, and public interest

Application To send on charlotte.laclau@telecom-paris.fr:

- Curriculum Vitae
- Personalized motivation letter that explains interest of the candidate in the subject (can be directly in the body of the email)
- Grade reports for recent years
- Contact of a person willing to give recommendation

Incomplete applications will not be considered.

References

- [1] Ben Fields, Rhianne Jones, and Tim Cowlshaw. The case for public service recommender algorithms. *2nd FATREC Workshop Responsible Recommendation, in conjunction with RecSys*, 2018.
- [2] Yoosof Mashayekhi, Nan Li, Bo Kang, Jefrey Lijffijt, and Tijn De Bie. A challenge-based survey of e-recruitment recommendation systems. *CoRR*, abs/2209.05112, 2022.
- [3] Victor Alfonso Naya, Guillaume Bied, Philippe Caillou, Bruno Crépon, Christophe Gaillac, Elia Pérennes, and Michèle Sebag. Designing labor market recommender systems: the importance of job seeker preferences and competition. In *4. IDSC of IZA Workshop: Matching Workers and Jobs Online - New Developments and Opportunities for Social Science and Practice*, Online, France, 2021.
- [4] Mohammadreza Tavakoli, Abdolali Faraji, Jarno Vrolijk, Mohammadreza Molavi, Stefan T. Mol, and Gábor Kismihók. An ai-based open recommender system for personalized labor market driven education. *Advanced Engineering Informatics*, 52, 2022.
- [5] MohammadReza Tavakoli, Stefan T. Mol, and Gábor Kismihók. Labour market information driven, personalized, oer recommendation system for lifelong learners. In H. Chad Lane, Susan Zvacek, and James Uhomoihi, editors, *CSEdu, International Conference on Computer Supported Education*, pages 96–104. SCITEPRESS, 2020.
- [6] Shoujin Wang, Liang Hu, Yan Wang, Longbing Cao, Quan Z. Sheng, and Mehmet A. Orgun. Sequential recommender systems: Challenges, progress and prospects. In *Proceedings of the International Joint Conference on Artificial Intelligence, IJCAI*, pages 6332–6338, 2019.