Department	School of Computing
Supervisors	Professor Ashkan Sami
Project Title	Software Engineering for Atrificail Intelligence (SE4AI)

PROJECT DESCRIPTION

There is growing interest today in use of artificial intelligence (AI), machine-learning (ML) and/or Deep Learning (DL) components into software systems. This trend resulted in increasing availability of frameworks and tools for developing ML or DL components to get us closer to the promise of improved solutions for data-driven decision systems. However, these software systems are more prone to complicated problems and errors in various aspects from their development all the way to maintenance. Each model must be tested for production readiness, integrated into larger systems, monitored at run time, and then evolved as data changes and redeployed. Due to complexity of software engineering for machine learning (SE4ML) is an emerging field of interest [1].

This research involves assessing ML and DL components in built system from Software Engineering points of view. The researcher is supposed to tackle the quality of these systems and propose novel methodology and techniques to make improvements. For this purpose, AI engineering—an emergent discipline is maturing and focuses on developing tools, systems, and processes to enable the application of artificial intelligence in real-world contexts. MLOps has been developed to address the unique challenges AI-based systems and applications face. However these practices and techniques that ensure development and adoption of transformative AI solutions that are human-cantered, robust, secure, and scalable are far from maturity. The researcher is supposed to become involve in Software Engineering data and tools of AI-based systems and explore them from Software Engineering perspective. Assessing functional and non-functional aspects of these tools and systems are the main objective of this Ph.D. work. It has been shown that majority of Question and Answer forums for programmers have non-functional requirement problems [2]. The research may involve qualitative tasks similar to [3].

Academic qualifications

A first degree (at least a 2.1) ideally in Computer Science, Software Engineering, Cyber Security or related fields with a good fundamental knowledge of computer programming and machine learning.

English language requirement

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.

Essential attributes:

- Experience of fundamental machine learning, software engineering and cyber security
- Competent in computer programming
- Knowledge of deep learning
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

Working knowledge of advanced deep learning models

Indicative Bibliography	[1] Giray, G. (2021). A software engineering perspective on engineering machine learning systems: State of the art and challenges. Journal of Systems and Software, 180, 111031. [2] M. Verdi, A. Sami, J. Akhondali, F. Khomh, G. Uddin and A. K. Motlagh, "An Empirical Study of C++ Vulnerabilities in Crowd-Sourced Code Examples," in IEEE Transactions on Software Engineering, vol. 48, no. 5, pp. 1497-1514, 1 May 2022, doi: 10.1109/TSE.2020.3023664. [3] Naghashzadeh, M., Haghshenas, A., Sami, A., & Lo, D. (2021, March). How Do Users Answer MATLAB Questions on Q&A Sites? A Case Study on Stack Overflow and MathWorks. In 2021 IEEE International Conference on Software Analysis, Evolution and Reengineering (SANER) (pp. 526-530). IEEE.
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