Business Systems and Operations PhD Research Topic

Project Title:

Generative AI driven Knowledge Reasoner for Simulating Job-Skill Assessment

Supervisors:

Principal Supervisor: Professor Jianxin (Kevin) Li, PhD

Associate Supervisor: Dr Ahmad Khanfar, PhD

Abstract:

The aim of this project is to address the increasing demand for dynamic reskilling assessment of job applicants in the rapid evolution of workforce market. Traditional matching systems rely heavily on keyword-based parsing or rigid rule-based approaches, which often lack contextual understanding and fail to assess nuanced capabilities. The significance is to innovate a new framework of a Generative AI-driven Knowledge Reasoner (GKR) to simulate human-like assessment of job-skill compatibility by leveraging structured knowledge and generative models. Its impact is to help educators aligning training programs with emerging job skill demanded by workforce expectations, students enabling adaptive course recommendation for their goals, prior knowledge and job market trends, and lifelong learners facilitating modular, micro-credential-based learning tailored to career transitions.

Background and research gap:

The rapid transformation of the global workforce—driven by automation, digitalisation, and shifting industry demands—has created an urgent need for dynamic and intelligent assessment of job-skill compatibility (Alonso et al., 2025; Wang et al., 2025). Existing systems for evaluating candidates' suitability for roles are typically built upon static taxonomies or keyword-based matching algorithms or human judgement, which often overlook the complexity of transferable skills, contextual relevance, evolving occupational standards, and personal bias (Alonso et al., 2025). These traditional methods lack the ability to reason about nuanced capabilities such as problem-solving, adaptability, or cross-disciplinary expertise, resulting in poor alignment between job applicants, training pathways, and workforce needs (Alonso et al., 2025; Chen et al., 2025; Qin et al., 2024). As economies increasingly rely on agile reskilling and upskilling strategies, especially in sectors undergoing digital transformation, there is a growing demand for advanced, scalable tools that can simulate expert-level assessments and provide interpretable recommendations for learners, educators, and employers (Chen et al., 2024; Sun et al., 2025).

Research significance:

To fill in the above research gap and meet the marketing needs, this project will propose and develop a Generative AI-driven Knowledge Reasoner (GKR), a novel framework that integrates structured knowledge (e.g., job-skill graphs) with generative language models to replicate human-like assessment reasoning. With the support of recently developed large language models AI technologies like ChatGPT, the GKR system will be capable of understanding contextual dependencies between roles and competencies, inferring latent skills from candidate profiles, and generating actionable, personalised recommendations. This enables a more flexible and transparent assessment process, adaptable to new roles and skill demands as they emerge. The integration of neuro-symbolic reasoning with generative AI also offers significant research innovation, opening new pathways in explainable AI, human-centric evaluation, and knowledge-based simulation. By advancing this capability, the project will contribute to the development of more equitable and efficient learning ecosystems, where education providers, students, and lifelong learners are better equipped to navigate the dynamic realities of the modern labour market.

Research aims of this PhD project:

1. To design and develop a hybrid knowledge representation framework that integrates structured job-skill taxonomies (e.g., ESCO, O*NET) with dynamic, context-aware embeddings derived from generative AI models, enabling accurate and flexible modelling of job-role-skill relationships.
2. To build a Generative AI-driven Knowledge Reasoner (GKR) that simulates expert-level assessment of job-skill compatibility by combining symbolic reasoning with large language model capabilities, supporting contextual inference, latent skill recognition, and explainable decision-making.
3. To evaluate the effectiveness of the GKR framework in real-world job matching and skill assessment scenarios, including its ability to support adaptive course recommendations for students, personalized upskilling paths for lifelong learners, and curriculum alignment for educators.

Preferred applicants should have the required capabilities:

1. Completed at least one of the relevant courses in Business analytics, data science, computer science or IT;
2. The good programming skills like Python;
3. The basic knowledge about deep learning models like GCN, GNN, Transformer;
4. The evidenced ability of good writing and communication.

Selected publications for further reading

Alonso, R., Dessí, D., Meloni, A., & Reforgiato Recupero, D. (2025). A novel approach for job matching and skill recommendation using transformers and the O*NET database. *Big Data Research*, *39*, 100509. https://doi.org/10.1016/j.bdr.2025.100509

Chen, A., Han, F., Zhang, X., & Lu, Y. (2025). Cracking the AI recruitment code: Striving for transparency in finding the right person–job fit. *Information & Management*, *62*(5), 104156. https://doi.org/10.1016/j.im.2025.104156

Chen, X., Qin, C., Fang, C., Wang, C., Zhu, C., Zhuang, F., Zhu, H., & Xiong, H. (2024). Job-SDF: A Multi-Granularity Dataset for Job Skill Demand Forecasting and Benchmarking. In A. Globerson, L. Mackey, D. Belgrave, A. Fan, U. Paquet, J. Tomczak, & C. Zhang (Eds.), *Advances in Neural Information Processing Systems* (Vol. 37, pp. 129329–129356). Curran Associates, Inc. https://proceedings.neurips.cc/paper_files/paper/2024/file/e997325c6f4045aa646c81e674076297-Paper-Datasets_and_Benchmarks_Track.pdf

Qin, C., Zhu, H., Shen, D., Sun, Y., Yao, K., Wang, P., & Xiong, H. (2024). Automatic Skill-Oriented Question Generation and Recommendation for Intelligent Job Interviews. *ACM Transactions on Information Systems*, *42*(1), 1–32. https://doi.org/10.1145/3604552

Sun, Y., Ji, Y., Zhu, H., Zhuang, F., He, Q., & Xiong, H. (2025). Market-aware Long-term Job Skill Recommendation with Explainable Deep Reinforcement Learning. *ACM Transactions on Information Systems*, *43*(2), 1–35. https://doi.org/10.1145/3704998

Wang, W., Hackett, R. D., Archer, N., Xu, Z., & Yuan, Y. (2025). Will AI-enabled conversational agents acting as digital employees enhance employee job identity? *Information & Management*, *62*(2), 104099. https://doi.org/10.1016/j.im.2025.104099