IFN712 Research Project Form

(Submitted to [y.feng@qut.edu.au](mailto:y.feng@qut.edu.au) by 30 June 2025)

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| Project agency (School, industry, funded/HDR) | School of Computer Science |
| Industry/project supervisor and contact emails |  |
| Academic Supervisor name(s) and contact emails | Zaenab Alammar [zaenbkareemabood@hdr.qut.edu.au](mailto:zaenbkareemabood@hdr.qut.edu.au) |
| Information Technology major(s) | Computer Science and Data Science. Other majors are also fine. |
| Project title | **A Systematic Review of Deep Learning Applications in Disease Detection Using X-ray Imaging** |
| Brief description of the research problem, aims, method and expected outputs (100~200 words) | This project aims to conduct a comprehensive literature review on deep learning approaches for disease detection using medical X-ray imaging data. X-ray remains a widely used diagnostic modality for detecting various conditions such as pneumonia, fractures, dental issues, and lung abnormalities. With the rapid advancement of deep learning, numerous models have been developed to improve diagnostic accuracy, speed, and consistency in interpreting X-ray images.  The primary aim is to identify and evaluate recent studies that apply deep learning techniques to disease detection in X-ray imaging. The methodology involves a systematic search and critical review of peer-reviewed articles, focusing on model architectures (e.g., CNNs, Transformers), datasets, performance metrics, and clinical relevance.  Expected outputs include:   1. A categorized summary of existing deep learning models and their applications in X-ray diagnostics. 2. Identification of gaps in current literature, such as lack of generalizability, data limitations, or insufficient interpretability. 3. Recommendations for future research directions, including model robustness and integration into clinical workflows.   This review will provide valuable insights for researchers and practitioners seeking to advance AI-driven diagnostic tools in medical imaging. |
| Key words (4-6) | * **Deep Learning** * **Medical Imaging(X-ray)** * **Classification, Recognition, Detection** * **Multi-modal Diagnostics** * **Chest-X-ray, Bone Abnormalities, Fracture, Tooth disease** |
| Answerable research questions for 3-5 students (desirable) | * What types of X-ray imaging are most commonly used for the detection of diseases affecting different anatomical regions, such as the chest, bones, and oral cavity? * What statistical or deep learning methods have been applied to identify patterns or correlations across disease presentations in different X-ray modalities (e.g., chest vs. extremity vs. dental X-rays)? * To what extent can features extracted from one type of X-ray (e.g., chest X-ray for pneumonia) be leveraged to support the diagnosis or prediction of conditions in other regions (e.g., bone fractures or dental pathologies)? * How can deep learning models effectively integrate multi-region X-ray imaging data to support comprehensive and cross-system disease analysis, given challenges such as data heterogeneity and annotation variability? * What critical gaps exist in the current literature regarding the use of X-ray based deep learning models for multi-region or systemic disease correlation, and how can future research address these? |
| 4-5 key references (desirable) and website resources | 1. Zaenab Alammar, Laith Alzubaidi, Jinglan Zhang, Yuefeng Li, Waail Lafta,   and Yuantong Gu. [Deep transfer learning with enhanced feature fusion for](https://www.mdpi.com/2072-6694/15/15/4007)  [detection of abnormalities in x-ray images.](https://www.mdpi.com/2072-6694/15/15/4007) Cancers, 15(15):4007, 2023.   1. Zaenab Alammar, Laith Alzubaidi, Jinglan Zhang, Yuefeng Li, Ashish   Gupta, and Yuantong Gu. [Generalisable deep learning framework to over-](https://www.sciencedirect.com/science/article/pii/S2667305324000899)  [come catastrophic forgetting.](https://www.sciencedirect.com/science/article/pii/S2667305324000899) Intelligent Systems with Applications, 23:  200415, 2024.   1. Zehui Zhao, Laith Alzubaidi, Jinglan Zhang, Ye Duan, and Yuantong Gu.   [A comparison review of transfer learning and self-supervised learning:](https://www.sciencedirect.com/science/article/pii/S0957417423033092)  [Definitions, applications, advantages and limitations.](https://www.sciencedirect.com/science/article/pii/S0957417423033092) Expert Systems with  Applications, 242:122807, 2024.   1. Saeed Iqbal, Adnan N. Qureshi, Jianqiang Li, and Tariq Mahmood. [On the](https://link.springer.com/article/10.1007/s11831-023-09899-9)   [analyses of medical images using traditional machine learning techniques](https://link.springer.com/article/10.1007/s11831-023-09899-9)  [and convolutional neural networks.](https://link.springer.com/article/10.1007/s11831-023-09899-9) Archives of Computational Methods in  Engineering, 30(5):3173–3233, 2023.   1. Marut Jindal and Birmohan Singh. [Class imbalance-aware domain specific](https://www.sciencedirect.com/science/article/pii/S0952197625005834)   [transfer learning approach for medical image classification: Application on](https://www.sciencedirect.com/science/article/pii/S0952197625005834)  [covid-19 detection.](https://www.sciencedirect.com/science/article/pii/S0952197625005834) Engineering Applications of Artificial Intelligence, 150:  110583, 2025. |
| Required major of studies, desirable skill sets, knowledge, and speciality | This project is best suited for students majoring in **computer science, biomedical engineering, artificial intelligence, or data science**. However, students from other disciplines with a strong interest in medical imaging and AI applications are also encouraged to participate.  To successfully conduct a **systematic literature review** on deep learning approaches for disease detection using medical X-ray imaging, students should have — or be willing to develop — the following skills:   * **Literature Search Skills:** Ability to construct comprehensive and targeted database queries (e.g., using Boolean operators, MeSH terms, and technical keywords) in databases such as Web of Science (WOS), IEEE Xplore, Science Direct, and Scopus. * **Critical Appraisal:** Ability to evaluate peer-reviewed studies based on criteria such as model design, dataset validity, performance metrics (e.g., AUC, F1-score), and clinical relevance. * **Foundational Knowledge in Deep Learning:** Familiarity with common architectures (e.g., CNNs, Vision Transformers), training strategies (e.g., transfer learning, augmentation), and their application in X-ray image analysis. * **Data Extraction and Thematic Synthesis:** Ability to systematically extract and categorize information related to model types, datasets used, diagnostic tasks, interpretability, and identified challenges. * **Academic Writing and Visualization:** Skills in summarizing findings in well-structured tables, comparison charts, and narrative synthesis, suitable for publication or academic presentation. * **Project and Teamwork Management:** Capacity to coordinate review tasks, set milestones, and collaborate effectively with peers to ensure timely completion of different review stages. |
| **Industry-based project: Student IP Agreement.** This is the IP model agreed between the parties. Please note that it is QUT policy that where possible students should be allowed to keep their IP. If students are asked to assign their work, then please **provide a brief rationale** as additional permissions are needed by QUT to approve. | Project IP vests in the student with a license back to Industry Partner **(licence)**  OR  Project IP vests in the Industry Partner/Project owner with a licence back to the student **(assignment)**  OR  Academic project (No IP agreement needed) |
| Number of students (4-5) | 4-5 |
| The message from supervisor(s) about the acceptance for this project | This is an academic research project. All students interested are welcome. |
| Student name(s)  (Print your name and submit this form by the end of Week 2) |  |
| Date |  |
| Remarks on conditions of offer |  |