

Hasanul Bannah

AI for Healthcare | Digital Pathology | Biomedical Imaging | Quantum Machine Learning

Graduate Research Assistant, Universiti Malaya, Kuala Lumpur, Malaysia

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Website | Google Scholar | LinkedIn

Research Interests

Artificial Intelligence for Healthcare; Deep Learning; Digital Pathology; Biomedical & Medical Image Analysis; Computer Vision; Explainable AI; Clinical NLP & Large Language Models; Multimodal AI; Quantum Machine Learning; Hybrid Quantum-Classical Models; Drug Repurposing; Brain Signal Decoding & BCI.

Research Experience

Graduate Research Assistant & Ph.D. Researcher

Jun 2026 – Present

Centre of Research in System Biology, Structural Bioinformatics and Human Digital Imaging (CRYSTAL), Universiti Malaya, Kuala Lumpur, Malaysia

- Conducting research on quantum and hybrid quantum-classical machine learning for drug repurposing and drug–target interaction prediction in Alzheimer’s disease.
- Designing hybrid quantum graph neural networks and variational quantum algorithms for biomedical and bioinformatics applications.
- Developing data-efficient and interpretable AI models for computational drug discovery and precision medicine.

Graduate Research Assistant

Dec 2023 – May 2026

Centre for Image and Vision Computing (CIVC) & COE for Artificial Intelligence, Multimedia University (MMU), Cyberjaya, Malaysia.

- Collected immunohistochemistry (IHC) glass slides from Universiti Malaya Medical Centre (UMMC) and digitized them into whole-slide images (WSI) via slide scanning.
- Constructed expert-validated ground-truth annotations for ER- and PR-stained breast cancer histopathology.
- Developed an end-to-end deep-learning pipeline for automated nuclei segmentation, classification, and Allred/IHC scoring.
- Integrated explainable AI (Grad-CAM, SHAP, LIME) for clinically interpretable, real-time diagnostic support.

Education

Doctor of Philosophy (Ph.D.), Faculty of Science

Jun 2026 – Present

Universiti Malaya (UM), Kuala Lumpur, Malaysia

Research: Quantum Machine Learning for Drug Repurposing in Alzheimer’s Disease Therapeutics.

Master of Engineering Science (By Research)

Dec 2024 – May 2026

Multimedia University, Cyberjaya, Malaysia (Completed)

Research: AI-Driven Nuclei Segmentation, Classification and Scoring in Breast Cancer IHC Histopathology.

B.Sc. in Electrical and Electronic Engineering

Oct 2018 – Dec 2021

Northern University Bangladesh, Dhaka, Bangladesh

Internship: Atomic Energy Research Establishment (AERE), Bangladesh Atomic Energy Commission (BAEC), Savar, Dhaka — applications of gamma irradiation using a Cobalt-60 source for export-oriented food processing (2021).

Diploma in Electronics Engineering

Jun 2014 – Jun 2018

Khulna Polytechnic Institute, Khulna, Bangladesh

Internship: Khulna Medical College Hospital, Khulna — Biomedical Engineering; operation, calibration and maintenance of hospital diagnostic equipment (2018).

Publications

Author name in **bold**. (★ = first author)

Journal Articles

- ★ **Bannah, H.**, Ahmad Fauzi, M. F., Mansor, S., Nabi, M. S., Hossen, M. S., Chiew, S. F., Cheah, P. L., & Looi, L. M., “AI-Driven Breast Cancer Nuclei Segmentation, Classification, and Scoring in PR-IHC Images,” *Diagnostics* (MDPI) [**SCIE WoS: Q1, Scopus: Q1, Impact Factor: 3.8**], Vol. 16, No. 9, Article 1295, 2026. DOI: 10.3390/diagnostics16091295
- ★ **Bannah, H.**, Ahmad Fauzi, M. F., Mansor, S., Nabi, M. S., Wan Ahmad, W. S. H. M., Chiew, S. F., Cheah, P. L., & Looi, L. M., “PR-IHC-40X: Progesterone Receptor Immunohistochemistry Dataset for Breast Cancer Diagnosis,” *Data* (MDPI) [**ESCI WoS & Scopus indexed — Accepted**].
- Nabi, M. S., Yuden, D., Choden, T. Y., Asiful Islam Saky, S. M., **Bannah, H.**, Hossen, M. S., Fauzi, M. F. A., & Karim,

- H. B. A., "Machine Learning for Chemotherapy Decision-Making in Breast Cancer Using Large Language Model," *Frontiers in Digital Health* [SCIE WoS: Q1, Scopus: Q1, Impact Factor: 5.2], Vol. 8, Article 1738346, 2026. DOI: 10.3389/fdgth.2026.1738346
- Hossen, M. J., Haque, B. M. T., **Bannah, H.**, Rahman, M. A., Ahmed, A., & Noman, A. A., "Explainable AI in Kidney Stone Detection and Segmentation: A Mini Review," *Frontiers in Digital Health* [SCIE WoS: Q1, Scopus: Q1, Impact Factor: 5.2], Vol. 8, Article 1750411, 2026. DOI: 10.3389/fdgth.2026.1750411
 - Hossen, M. J., **Bannah, H.**, & Sadib, R. J., "Early Detection of Chronic Kidney Disease Using Deep Learning: A Mini Review," *Frontiers in Digital Health* [SCIE WoS: Q1, Scopus: Q1, Impact Factor: 5.2], Vol. 7, Article 1732175, 2026. DOI: 10.3389/fdgth.2025.1732175
 - Nabi, M. S., Tun, S. W., Alam, S., Abdullahi, M. K., **Bannah, H.**, Santo, I. A., Wadood, A. S., Md Mohiuddin, G., Rehman, Z. U., & Karim, H. B. A., "KDH-Net: Explainable Medical AI for Multiclass Kidney Disease Characterization from CT Images," *Journal of Clinical Medicine* (MDPI) [SCIE WoS: Q1, Scopus: Q1, Impact Factor: 3.3], Vol. 15, No. 8, Article 3165, 2026. DOI: 10.3390/jcm15083165
 - Hossen, M. S., Sarker, M. T., Nabi, M. S., **Bannah, H.**, Ramasamy, G., & Eng Eng, N., "Federated AI-OCPP Framework for Secure and Scalable EV Charging in Smart Cities," *Urban Science* (MDPI) [ESCI WoS: Q1, Scopus: Q1, Impact Factor: 2.9], Vol. 9, No. 9, Article 363, 2025. DOI: 10.3390/urbansci9090363
 - Santo, I. A., **Bannah, H.**, Nabi, M. S., & Abdul Karim, H. B., "Representational Efficiency and Noise Robustness in Hybrid Quantum-Classical Graph Neural Networks," *Discover Quantum Science* (Springer Nature) [Accepted / In Press].

Conference Publications

- ★ **Bannah, H.**, et al., "A Hybrid Quantum-Classical Approach for Drug–Target Interaction Prediction in Alzheimer's Disease," *International Conference on Bioinformatics (InCoB / ISCB-APAC 2026)* [Accepted].
- ★ **Bannah, H.**, Hossen, M. S., Nabi, M. S., Karim, H. A., Sarker, M. T., & Al Farid, F., "Brain-Controlled Energy Management in Renewable-Powered Smart Homes for Sustainable Assistive Living," *IEEE Int. Conf. on Energy Technologies for Future Grids (ETFG 2025)*, Wollongong, Australia, IEEE [Accepted].
- ★ **Bannah, H.**, et al., "Real-Time Nuclei Classification and Allred Scoring in PR-IHC Stained Breast Cancer Histopathology Images," *2025 9th Int. Conf. on Information Technology (InCIT)*, Phuket, Thailand, pp. 707–714, IEEE, 2025. DOI: 10.1109/InCIT66780.2025.11276080
- ★ **Bannah, H.**, et al., "Automated Nuclei Segmentation in PR-IHC Breast Cancer Images Using the Cellpose Deep Learning Model," *TENCON 2025 – IEEE Region 10 Conference*, Kota Kinabalu, Malaysia, pp. 1709–1713, IEEE, 2025. DOI: 10.1109/TENCON66050.2025.11375047
- ★ **Bannah, H.**, Ahmad Fauzi, M. F., Binti Mansor, S., Nabi, M. S., Ur Rehman, Z., & Looi, L. M., "Breast Cancer Nuclei Segmentation in ER-IHC Images Using Deep Learning," *2025 Multimedia University Engineering Conference (MECON)*, Cyberjaya, Malaysia, pp. 1–6, IEEE, 2025. DOI: 10.1109/MECON67253.2025.11277170
- Santo, I. A., Lim, S. C., Nabi, M. S., Hossen, M. S., **Bannah, H.**, & Kabir, F., "Travelling Salesman Problem in the Classical to Quantum Era: A Comparative Review of Algorithms and Computational Complexity," *2025 9th Int. Conf. on Information Technology (InCIT)*, Phuket, Thailand, pp. 243–250, IEEE, 2025. DOI: 10.1109/InCIT66780.2025.11276031
- Nabi, M. S., Islam, S., Ahmad Fauzi, M. F., **Bannah, H.**, Mohiuddin, G. M., & Abdullahi, M. K., "Adaptive Learning for Elementary Students Using AI to Support Individual Learning Styles," *2025 Multimedia University Engineering Conference (MECON)*, Cyberjaya, Malaysia, pp. 1–6, IEEE, 2025. DOI: 10.1109/MECON67253.2025.11276895
- Bari, A., Farid, F. A., Sarker, M. T., Mansor, S., Karim, H. A., Bhuiyan, M. R., & **Bannah, H.**, "Advancements in Multi-View Human Activity Recognition for Ambient Assisted Living," *2024 Multimedia University Engineering Conference (MECON)*, Cyberjaya, Malaysia, pp. 1–6, IEEE, 2024. DOI: 10.1109/MECON62796.2024.10776109
- Bari, A., Farid, F. A., Sarker, M. T., Mansor, S., Karim, H. A., Bhuiyan, M. R., & **Bannah, H.**, "Lightweight Deep Learning for Human Activity Recognition in Ambient Assisted Living," *2024 Multimedia University Engineering Conference (MECON)*, Cyberjaya, Malaysia, pp. 1–6, IEEE, 2024. DOI: 10.1109/MECON62796.2024.10776547

Publication Summary

Publications: 17

First-Author Publications: 7

Co-Author Publications: 10

Journal Articles: 8

Conference Papers: 9

Google Scholar Citations: 37

h-index: 2

i10-index: 2

Academic Service

- **Conference Reviewer** — 7th Multimedia University Engineering Conference (MECON 2026), reviewing manuscripts in artificial intelligence, biomedical imaging, and digital health.

Selected Projects

AI-Driven Breast Cancer Nuclei Segmentation, Classification & Allred Scoring (PR/ER-IHC) 2023 – 2025

- Built an end-to-end digital-pathology pipeline on whole-slide images (WSI) prepared from UMMC glass slides.
- Automated nuclei segmentation, classification, and Allred/IHC scoring with Grad-CAM interpretability.

Quantum Machine Learning for Drug Repurposing in Alzheimer's Disease 2026

- Hybrid quantum-classical graph neural networks for drug–target interaction prediction on the DAVIS kinase benchmark.
- Investigated representational efficiency and noise robustness of variational quantum circuits.

Brain Signal Decoding for Smart-Home Assistive Systems 2025

- EEG decoding models (LSTM, EEGNet) to control smart-home appliances for mobility-impaired users.

Awards & Honours

- **Gold Medal** — iNVENTX Invention Competition 2026, for “Representational Efficiency and Noise Robustness in Hybrid Quantum-Classical Graph Neural Networks.”
- **Silver Medal** — iNVENTX Invention Competition 2026, for “Decoding Human Brain Signals for Smart Living Using AI.”
- **Gold Medal & Best of the Best** — DIFCON & iNVENTX Exhibition 2025, breast cancer nuclei segmentation in ER-IHC images.
- **Gold Medal** — iNVENTX Innovation Exhibition 2024 (Poster), AI-driven breast cancer nuclei segmentation & classification.
- **Best Award for Bachelor Internship Excellence** — Atomic Energy Research Establishment (AERE), Bangladesh, 2021.
- **World Bank STEP Scholarship** — Merit-based scholarship for academic excellence, 2014.

Grants & Funding

- **Fully-Funded Graduate Research Assistantship** — Universiti Malaya (monthly stipend + tuition waiver), 2026–present.
- **Conference Travel Grant & Full Sponsorship (International)** — 9th Int. Conf. on Information Technology (InCIT 2025), Phuket, Thailand.
- **Conference Travel Grant & Full Sponsorship (Local)** — IEEE Region 10 Conference (TENCON 2025), Kota Kinabalu, Sabah, Malaysia.

Technical Skills

Programming: Python, R, SQL, MATLAB, Bash

AI & Machine Learning: TensorFlow, Keras, PyTorch, Scikit-learn, OpenCV, CNNs, LSTM/GRU, Transformers, ViT

Explainable AI: Grad-CAM, SHAP, LIME, Score-CAM, Captum

Biomedical Imaging: OpenSlide, SimpleITK, pyvips, DICOM, ImageJ, Cytomine, Cellpose

NLP & LLMs: Hugging Face, ClinicalBERT, BioGPT, DeBERTa-v3, GPT APIs, LangChain

Quantum ML: Hybrid Quantum-Classical Models, Quantum Graph Neural Networks, Variational Algorithms

Tools & Deployment: Docker, Git, GitHub, Google Cloud, Colab, Jupyter, LaTeX, Overleaf, Flask, FastAPI, Streamlit

Affiliations & Memberships

- **Student Member**, IEEE & IEEE Young Professionals (2023–Present).
- **Researcher**, Centre of Research in System Biology, Structural, Bioinformatics and Human Digital Imaging (CRYSTAL), Universiti Malaya, 50603 Kuala Lumpur, Malaysia (2026–Present).
- **Researcher**, Centre for Image and Vision Computing (CIVC) & COE for Artificial Intelligence, Multimedia University (MMU), Cyberjaya 63100, Malaysia (2023–2025).

References

Prof. Dr. Ir. Mohammad Faizal Ahmad Fauzi

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KPJ Healthcare University, Malaysia
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Supervisor

Dr. Sarina Binti Mansor

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Co-Supervisor