Muhammad Ridzuan

Muhammad.Ridzuan@mbzuai.ac.ae | Abu Dhabi, UAE | +971 50 951 0184
LinkedIn | Google Scholar | https://mfarnas.github.io/ridzuan-healthcare-ai/

Personal Profile

PhD graduate in Machine Learning with extensive expertise in deep learning, predictive modeling, and computer vision. My background includes a solid foundation in healthcare and geology, with proven experience applying machine learning to real-world challenges. I have a demonstrated track record of successful projects in healthcare, including peer-reviewed publications and top rankings in AI competitions, showcasing my ability to deliver impactful, data-driven solutions.

Work Experience

AI Research Assistant, *MBZUAI, Abu Dhabi, UAE* Dec 2020 – Dec 2024

- Conducted computer vision research in BioMedIA Lab
- Led and coded smart solutions in biotechnology by integrating diverse, multi-dimensional measurements including EHR, thin sections, X-rays, MRIs, and CT/PET scans
- Designed deep learning models for image classification, segmentation, and predictive modeling across large-scale medical imaging datasets
- Developed dockerized AI solutions for deployment, handled complex data pipelines, improved algorithm efficiency and accuracy; won top 5 and top 10 placements in multiple international competitions

Graduate Teaching Assistant, *MBZUAI, Abu Dhabi, UAE* Jan 2023 - Jun 2023

- Course lab assistant for HC701 Medical Imaging Physics & Analysis | *Github*
- Mentored 3 graduate students in translating medical imaging problems into practical AI applications, resulting in 3 successful Master theses

Visiting Scholar, *University of Nebraska-Lincoln, Lincoln, NE, USA* May 2023 - July 2023

- Researched causal inference and discovery methods using Python

Geological Data Science Advisor, *Curtis & Associates, Houston, TX, USA* Aug 2018 - Nov 2020

- SME in Product Management for Innovation and Data Science divisions; co-led the digital transformation team in collaboration with geologists, data scientists, and operations teams to improve operational decision-making using analytics, automation, and AI
- Enhanced data visualization techniques for contour mapping, well-log correlation and cross-sectional views, resulting in clearer insights and more efficient workflows across monitored wells

Geosteering Operations Center Intern, *Saudi Aramco, Dhahran, KSA* May 2015 - Jul 2015

- Hands-on experience in handling multiple wells for real-time geosteering; applied various well log correlation techniques for vertical wells, horizontal dipping beds, and lateral facies variations using sequence stratigraphy and sedimentation

Geology Lab Instructor & Coordinator, *Iowa State University, Ames, IA* Aug 2014 - Dec 2015

- Led 4 teaching assistants & coordinated 8 labs of 15-20 students each
- Taught *Introductory Geology* and *Geology for Engineers and Environmental Scientists*
- One of two recipients of *Outstanding Teaching Assistant Award*, Dept. of Geological and Atmospheric Sciences

Computer Vision/AI Projects

1. **Survival Analysis (Prognosis)**

Objective: Develop predictive models for survival analysis for lung and head-and-neck cancers using CT, PET & EHR

Tech: CoxPH, DeepMTLR, DeepHit, partial logistic regression (Nnet) for survival analysis, multimodal fusion techniques, custom human-in-the-loop architecture & survival algorithms

Impact: Improved prediction accuracy by 10% via human-in-the-loop intervention; this solution has potential applications in predictive maintenance for upstream production optimization in O&G. 2 papers were early accepted at top medical imaging conference (MICCAI) with 11% early acceptance rate.

Publications:

- SurvRNC: Learning Ordered Representations for Survival Prediction using Rank-N-Contrast, *MICCAI*, 2024, Springer Nature Switzerland. | *Paper* | *Github*

- HuLP: Human-in-the-Loop for Prognosis, *Medical Image Computing and Computer-Assisted Interventions (MICCAI)*, 2024, Springer Nature Switzerland. | *Paper* | *Github*

2. Magnetic Resonance Imaging (MRI) for Cancer Prediction

Objective: Predict methylation status of genetic sequence using MRI scans to save cost from using invasive and expensive biopsy
Tech: CNN, ViT, feature map visualization, Grad-CAM, t-SNE, PCA, loss landscape
Impact: Critically evaluated a scenario where deep learning prediction models should not be used as a cost-efficient alternative to traditional biopsies, contrary to common findings in literature. Highlighted the limitations of deep learning algorithms through extensive visualizations and explainable AI techniques. Work was accepted at a leading high-impact medical journal
Publication: MGMT Promoter Methylation Status Prediction Using MRI Scans: An Extensive Experimental Evaluation of Deep Learning Models. *Medical Image Analysis (MEDIA)*, 2022. | *Paper*

3. Cost-cutting Deep Learning for the Detection of COVID-19 from Chest X-rays

Objective: Develop a method to detect COVID-19 from partially annotated X-ray images, employing self-supervised learning techniques
Tech: ResNet, DenseNet, YOLO, MOCO, inpainting, self-supervised learning
Impact: Saved cost by reducing reliance on expensive & time-consuming human annotations while maintaining competitive predictive performance. Work selected as an oral presentation at the University of Cambridge (*link*).
Publication: Self-Supervision and Multi-Task Learning: Challenges in Fine-Grained COVID-19 Multi-Class Classification from Chest X-rays, *Medical Image Understanding and Analysis (MIUA)*, Spring Lecture Notes in Computer Science, 2022. | *Paper*

4. AI for Thin Section Analysis (Whole-Slide Imaging)

Objective: Build AI models for classifying and segmenting whole-slide medical images (e.g. tissues and cells; with data size up to 2TB) for prostate cancer
Tech: CNN, ViT, multiple instance learning, foundation models, docker
Impact: Reduced manual interpretation time by >60%, demonstrating the scalability of image classification algorithms in geological imaging. Implemented docker solutions to deploy foundation model and multiple-instance learning for thin section analysis.
Publications:

- MAC-MIL: Multi-head Attention-Challenging Multiple Instance Learning for Survival Analysis. *Learning Biochemical Prostate Cancer Recurrence from Histopathology Slides (LEOPARD) Challenge*, 2024.
- Color Space-based HoVer-Net for Nuclei Instance Segmentation and Classification. *Colon Nuclei Identification and Counting Challenge (CoNIC).* IEEE International Symposium on Biomedical Imaging Challenges (ISBIC), 2022. | *Paper*

5. Other Projects

- Self-supervised learning for fine-grained image classification using Jigsaw solving as a pretext task, adversarial learning (super-resolution GAN) and contrastive learning. | *Paper* | *Github*
- Explored counterfactual image generation for 3D images conditioned on tabular data using a diffusion model
- App development: Built an easy-to-use software for radiologists to annotate medical images using Streamlit

AI Competition Achievements

- 1st place at *GITEX YouthX High Flyer Individual Track Competition 2021, Dubai* | *Demo*
- 1st place at CHAIMELEON lung cancer validation challenge using a custom-developed multimodal architecture (1D tabular EHR + 3D medical images) that allows human expert intervention
- Top 10 at LEarning biOchemical Prostate cAncer Recurrence from histopathology sliDes (LEOPARD) 2024 Challenge for survival prediction using multiple instance learning, MICCAI
- Top 10 at Colon Nuclei Identification and Counting (CoNIC) Challenge 2022 for nuclei (grain) segmentation and classification from thin section images, MICCAI | *Paper*
- Top 10 at MICCAI HECKTOR 2022 for lymph & tumor segmentation from CT/PET using 3D transformers

Technical Skills

Programming and Tools: Python, PyTorch, Jupyter, Streamlit, MONAI, VSCode, Docker
AI & ML: CNNs, Transformers, UNet, YOLO, ResNet, DenseNet, Diffusion, GAN, classification, regression, segmentation, survival analysis

Data Science and Visualization: pandas, scikit-learn, scikit-image, numpy, pycox, Seaborn, Matplotlib, OpenCV, Slicer, Grad-CAM, SimpleITK

Latest Computer Vision/AI Conference Presentation

Cancer Prevention, detection and intervenTion (CaPTion) Workshop, Marrakesh, MOROCCO 6 Oct 2024
- *Survival Analysis with Conditional Ordinal Ranking Neural Network*

LEarning biOchemical Prostate cAncer Recurrence from histopathology slides (LEOPARD) Challenge, Marrakesh, MOROCCO 6 Oct 2024
- *Multi-head Attention-Challenging Multiple Instance Learning for Survival Analysis*

Medical Image Computing and Computer-Assisted Interventions (MICCAI) Conference, Marrakesh, MOROCCO 8-9 Oct 2024
- *SurvRNC: Learning Ordered Representations for Survival Prediction using Rank-N-Contrast*
- *HuLP: Human-in-the-Loop for Prognosis*

Leadership Experience

- *C-Suite Facilitator*, MBZUAI Leadership Training for Industry 2024, Abu Dhabi, UAE
- *Executive Mentor*, MBZUAI Executive Program (MEP) 2022-2023, Abu Dhabi, UAE
- *Session Chair, Computer and Information Sciences*, UAE Graduate Students Research Conference 2022, Dubai, UAE
- *Research Mentor*, MBZUAI Undergraduate Research Internship Program (UGRIP) 2023, Abu Dhabi, UAE
- *Student Advisor*, International Student Council 2014-2016, ISU, IA, USA
- *Vice President*, International Student Council 2014, ISU, IA, USA
  - Awarded *Outstanding Service as Vice President of International Student Council*
  - Awarded *Outstanding Commitment to Diversity* (university-wide award)
  - Voted as *Outstanding Student Council Leader*
- *Events Coordinator & Volunteer Coordinator*, International Student Council 2013, ISU, IA, USA

Other Awards/Achievements

- *1st Place*, GITEX YouthX High Flyer Individual Track Competition 2021, Dubai, UAE
- *2nd Place*, John Hopkins Aramco Research Symposium 2024, Dhahran, KSA
- *Critical Thinking Mentor*, MBZUAI Executive Program 2022-2023, Abu Dhabi, UAE
- *Finalist*, Wyakom Community Pitch 2022, Dept. of Community Development, Abu Dhabi, UAE
- *Champion of Student Success*, MAP-Works, recognized for promoting student success and being the most helpful individual in a student's transition to college, ISU, IA, USA
- *Best Poster Presentation Award*, 3rd Graduate and Professional Students' Research Conference (university-wide award), ISU, IA, USA
- *Outstanding Teaching Assistant Award*, ISU Dept. of Geological and Atmospheric Sciences, IA, USA
- *National Scholarship*, American Institute of Professional Geologists (AIPG), USA
- *President's Award for Competitive Excellence*, ISU, IA, USA

Education Background

Mohamed bin Zayed University of Artificial Intelligence (MBZUAI), Abu Dhabi, UAE Jan 2021 - Dec 2024
- *PhD Candidate, Machine Learning* (CGPA: 3.90/4.00)
- Thesis: *Interpretable Deep Learning for Cancer-Based Prognosis*
- First batch intake (full scholarship); world's 1st AI research university
- Advisor: Dr. Mohammad Yaqub

ML x Health, Oxford Machine Learning Summer School (OxML), University of Oxford, UK Aug 2022
- Courses: Computer Vision in Medical Imaging; Advanced Topics in Representation Learning (i.e., learning with little or no supervision, self-supervised learning, multi-modal representation learning)

Iowa State University of Science and Technology (ISU), Ames, IA, USA

- *Master of Science, Geology* (CGPA: 4.00/4.00) Aug 2014 - Dec 2016
  - Thesis: *Understanding the geological basis of the Iowa Pore Index*
  - Advisor: Dr. Franek Hasiuk, ex-ExxonMobil

- *Bachelor of Science, Geology* (CGPA: 3.98/4.00) Jan 2012 - May 2014
  - *Summa Cum Laude (Highest Distinction),* completed degree in the top 2% in 2.5 years

Selected List of Publications

1. **Ridzuan, M.*,** Saeed, N.*, Maani, F. A., Alasmawi, H., Nandakumar, K., & Yaqub, M. (2024). SurvRNC: Learning Ordered Representations for Survival Prediction using Rank-N-Contrast. International Conference on Medical Image Computing and Computer-Assisted Interventions (MICCAI). Springer Nature Switzerland.
2. **Ridzuan, M.,** Kassem, M., Saeed, N., Sobirov, I., & Yaqub, M. (2024). HuLP: Human-in-the-Loop for Prognosis. International Conference on Medical Image Computing and Computer-Assisted Interventions (MICCAI). Springer Nature Switzerland.
3. **Ridzuan, M.,** Saeed, N., Maani, F. A., Alasmawi, H., Nandakumar, K., & Yaqub, M. (2024). SurvCORN: Survival Analysis with Conditional Ordinal Ranking Neural Network. MICCAI Cancer Prevention, Detection, and Intervention (CaPTion) Workshop. Springer Nature Switzerland.
4. **Ridzuan, M.,** Hassan, S., Akaila, D., Saeed, N., & Yaqub, M. (2024). MAC-MIL: Multi-head Attention-Challenging Multiple Instance Learning for Survival Analysis. Learning Biochemical Prostate Cancer Recurrence from Histopathology Slides (LEOPARD) Challenge at MICCAI.
5. **Ridzuan, M.*,** Saeed, N.*, Majzoub, R., & Yaqub, M. (2023). Prompt-Based Tuning of Transformer Models for Multi-Center Medical Image Segmentation of Head and Neck Cancer. Bioengineering (MDPI).
6. **Ridzuan, M.,** Bawazir, A., Gollini Navarrete, I., Almakky, I., & Yaqub, M. (2022). Self-Supervision and Multi-Task Learning: Challenges in Fine-Grained COVID-19 Multi-Class Classification from Chest X-rays [Oral]. Medical Image Understanding and Analysis (MIUA).
7. Saeed, N., **Ridzuan, M.,** Alasmawi, H., Sobirov, I., & Yaqub, M. (2022). MGMT Promoter Methylation Status Prediction Using MRI Scans: An Extensive Experimental Evaluation of Deep Learning Models. Medical Image Analysis (MEDIA).
8. Azzuni, H., **Ridzuan, M.,** Xu, M., & Yaqub, M. (2022). Color Space-based HoVer-Net for Nuclei Instance Segmentation and Classification. IEEE International Symposium on Biomedical Imaging Challenges (ISBIC).
9. Matsun, A.*, Mohamed, D.*, Chokuwa, S.*, **Ridzuan, M.,** & Yaqub, M.(2023). DGM-DR: Domain Generalization with Mutual Information Regularized Diabetic Retinopathy Classification. MICCAI Workshop on Domain Adaptation and Representation Transfer. Springer Nature Switzerland.