Dr Lei Zhang

Senior Lecturer in Computer Science, University of Lincoln, UK.
Principal AI Research Scientist
Email leizhangtech@gmail.com

Specializing in human-centric, responsible AI in healthcare to improve patient outcomes and healthcare efficiency.

Research interest: My primary research focuses on developing scalable and interpretable AI solutions that are theoretically sound, practically applicable, and beneficial to healthcare professionals and patients. My dedication lies in applying AI techniques, particularly in Multimodal, Interpretable, and Causal AI, to address complex healthcare challenges, including improving disease diagnosis and prevention, treatment selection, and advanced clinical laboratory testing. I have been pivotal in securing grants and driving development in numerous multidisciplinary projects, including those funded by EPSRC, Innovate UK, BBSRC, CRUK, etc.

Academic and Professional Appointments:

- Senior Lecturer, School of Computer Science, University of Lincoln, UK, 2020-Present
- Principal AI Research Scientist, MSK Doctors, Keep Clinic, 06.2021-Present
- Research Fellow, School of Computer Science, University of Lincoln, UK, 2014-2020
- Teaching Assistant, School of Computer Science, University of East Anglia, UK, 2011-2014

Research highlights-funded projects and Grants

- Causal Counterfactual visualisation for human causal decision making:A case study in healthcare (EPSRC, 2023-2025)----- *Led the development of an AI framework for enhancing human decision-making in disease diagnosis through causal counterfactual reasoning.*
- Biomarker Discovery for Musculoskeletal (MSK) Disorders (Innovate UK, 2023-2025)----*Led a collaborative effort to identify and validate biomarkers based on multimodal data (Text, MRIs and Motion) for the diagnosis and severity grading of MSK disorders.*
- AI-based Diagnosis for Cartilage Lesion Detection. (EPSRC DTP, 2020-2024)---- *Led a team to develop an AI-based support system for detecting knee MRI cartilage lesions and automated rehabilitation assessment with Biomarkers.*
- Predicting the location of lung nodule occurrence from low-dose CT using Deep learning (CRUK, 2019-2021).----*Led the development of a deep learning model to predict the location and likelihood of lung nodule formation based on multi-modal data low-dose CT scans and demographic data.*

- PRaVDA: AI-based Proton Radiotherapy Verification and Dosimetry Applications. (Wellcome Trust, 2018-2019).---- Collaborated with a research *team in developing deep learning based methodologies to optimize proton imaging and reconstruction.*
- PIGSustain: Predicting the Impacts of Intensification and Future Changes on UK Pig Industry Resilience. (ESRC and BBSRC, 2017-2020).----*Managed a multidisciplinary project, focusing on discovering cues to predict disease outbreaks in pig farms. Our AI-driven tools are aiding in the disease understanding and development of sustainable practices in animal wellbeing.*
- Bowel cancer: Automatic polyp detection and analysis in colonoscopy (CRUK, 2016). ----*This work has not only improved the efficiency and accuracy of polyp detection but also contributed to the early diagnosis and treatment of colorectal cancer.*
- Trainable Vision-based Anomaly Detection and Diagnosis (TADD) project. (Innovate UK, 2015-2018)---- *led the development of a trainable embed system for real-time automatic anomaly detection on labels through imaging.*

Teaching experience：

- Fellow of the Higher Education Academy (FHEA): Recognized for excellence in teaching and supporting learning in higher education.
- Module Coordinator: Led core modules including Advanced Machine Learning and Algorithm and Complexity. Improved student engagement and learning outcomes by integrating real-world AI applications.
- SSM AI Module Leader: Directed a team to deliver AI modules to medical students from Nottingham Medical School, enhancing interdisciplinary learning and application of AI in healthcare.

Degrees and Qualifications:

- PhD – Biomedical engineering and informatics, UEA, UK, 2014
- MSc – Medical image processing and analysis, UEA, UK, 2008
- BSc – Data analysis and information system, NAU, China, 2007

Selected Publications (Google Citations:2500+)

 L. PengJu and L. Zhang, "MetaUNETR: Rethinking Token Mixer Encoding for Efficient Multi-organ Segmentation," in *Proc. MICCAI 2024*, 2024, (Accepted).
 H. Qin, L. Yua, S. Tian, and L. Zhang, "SEDyConv: Spatially Enhanced Dynamic Convolution for Medical Multi-Organ Segmentation in CTs," *Knowledge-Based Systems*, 2024, (Accepted).
 J. Zhong, W. Tian, Y. Xie, Z. Liu, J. Ou, T. Tian, and L. Zhang, "PMFSNet: Polarized Multi-scale Feature Self-attention Network For Lightweight Medical Image Segmentation," *arXiv*, vol. 2401, no. 07579, 2024.
 K. Armstrong, L. Zhang, Y. Wen, A. P. Willmott, P. Lee, and X. Ye, "A Marker-less Human Motion Analysis System for Motion-based Biomarker Identification and Quantification in Knee Disorders," *Frontiers in Digital Health*, vol. 6, p. 1324511, 2024.
 K. Armstrong, L. Zhang, P. Lee, and X. Ye, "Zero-dimensional Biomarker-based Medical Action Recognition: Towards More Explainable AI in Healthcare," in *Proc. 10th Int. Conf. Bioinformatics*, 2023.

 Y. Wen, L. Zhang, X. Meng, and X. Ye, "Rethinking the Transfer Learning for FCN Based Polyp Segmentation in Colonoscopy," *IEEE Access*, vol. 11, pp. 16183-16193, 2023.

 W. Duan, L. Zhang, J. Colman, G. Gulli, and X. Ye, "MidFusNet: Mid-dense Fusion Network for Multi-modal Brain MRI Segmentation," in *Proc. Int. MICCAI Brainlesion Workshop*, pp. 102-114, 2022.

 L. Zhang and Y. Wen, "A Transformer-based Framework for Automatic COVID-19 Diagnosis in Chest CTs," in *Proc. IEEE/CVF Int. Conf. Comput. Vis. (ICCV)*, pp. 513-518, 2021.

 W. Duan, L. Zhang, J. Colman, G. Gulli, and X. Ye, "Multi-Modal Brain Segmentation Using Hyper-Fused Convolutional Neural Network," in *Proc. 4th Int. Workshop Mach. Learn. Clin. Neuroimaging, 2021 MICCAI Workshop*, Strasbourg, France, Sep. 2021.

 J. Colman, L. Zhang, W. Duan, and X. Ye, "DR-Unet104 for Multimodal MRI Brain Tumor Segmentation," in *Brainlesion: Glioma, Multiple Sclerosis, Stroke and Traumatic Brain Injuries*, Springer, Cham, pp. 410-419, 2021.

 L. Zhang, G. Yang, and X. Ye, "Automatic Skin Lesion Segmentation by Coupling Deep Fully Convolutional Networks and Shallow Network with Textons," *J. Med. Imaging*, vol. 6, no. 2, p. 1, 2019.

 L. Zhang, H. Gray, X. Ye, L. Collins, and N. Allinson, "Automatic Individual Pig Detection and Tracking in Pig Farms," *Sensors*, vol. 19, no. 5, p. 1188, 2019.

 M. Soltaninejad, L. Zhang, T. Lambrou, G. Yang, N. Allinson, and X. Ye, "MRI Brain Tumor Segmentation and Patient Survival Prediction Using Random Forests and Fully Convolutional Networks," in *Brainlesion: Glioma, Multiple Sclerosis, Stroke and Traumatic Brain Injuries*, Crimi A., Bakas S., Kuijf H., Menze B., Reyes M. (eds), BrainLes 2017. Lecture Notes in Computer Science, Springer, Cham, 2018.

 L. Zhang, N. Dudley, T. Lambrou, N. Allinson, and X. Ye, "Automatic Image Quality Assessment and Measurement of Fetal Head in Two-dimensional Ultrasound Image," *J. Med. Imaging*, vol. 4, no. 2, p. 02401, 2017.

 L. Zhang, S. Dolwani, and X. Ye, "Automated Polyp Segmentation in Colonoscopy Frames Using Fully Convolutional Neural Network and Textons," in *Proc. Medical Image Understanding and Analysis (MIUA)*, Springer, Cham, pp. 707-717, 2017.

 L. Zhang, X. Ye, T. Lambrou, W. Duan, N. Allinson, and N. Dudley, "A Supervised Texton Based Approach for Automatic Segmentation and Measurement of the Fetal Head and Femur in 2D Ultrasound Images," *Phys. Med. Biol.*, vol. 61, no. 3, p. 1095, 2016.

 L. Zhang, M. Fisher, and W. Wang, "Retinal Vessel Segmentation Using Multi-scale Textons Derived from Keypoints," *Comput. Med. Imaging Graph.*, vol. 45, 2015.