Zhikai Li

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Education

- **Johns Hopkins University** — Baltimore, US
  Master of Science in Security Informatics; GPA: 3.81 — *Sep 2022 - Dec 2023*
- **Shanghai University** — Shanghai, China
  Bachelor Degree of Engineering in Computer Science and Technology; GPA: 3.52 (87.65/100.00) — *Sep 2018 - Jun 2022*

Publications

- **Joint Synthesis and Registration of MRI and Cone-Beam CT Images Using Deep Evidential Uncertainty Estimation of Deformation Fields**, Murong Yi, Ruxiao Duan, Zhikai Li, Jeff Siewerdsen, Ali Uneri, Junghoon Lee, and Craig Jones, SPIE Medical Imaging 2024 early accepted
- **RTA-Former: Reverse Transformer Attention for Medical Image Segmentation**, Zhikai Li, Murong Yi, Ali Uneri, Sihan Niu, and Craig Jones, EMBC 2024 submitted
- **An Improved Grey Wolf Optimization Algorithm for Heart Disease Prediction**, Sihan Niu, Yifan Zhou, Zhikai Li, Shuyao Huang, and Yujun Zhou, ICAIT 2023 accepted

Project Experience

- **Intraoperative Multimodal Brain Electrode Localization** — Baltimore, US
  I-STAR Lab, Johns Hopkins University, advised by Ali Uneri — *Oct 2023 - Now*
  - Utilized a B-spline model to perform distance-reserved modeling of strip electrodes, incorporating a deformation field, and constructed a dataset containing CT images with strip electrodes for training deep learning models.
  - Employed an efficient registration network for intraoperative cross-modal electrode localization.
- **Reverse Transformer Attention for Medical Image Segmentation** — Baltimore, US
  I-STAR Lab, Johns Hopkins University, advised by Craig Jones — *July 2023 - Aug 2023*
  - Designed the RTA-Former, which utilizes hierarchical features generated by the transformer encoder. By integrating the transformer structure into the reverse attention mechanism of the decoder and excluding the prominent region of the current prediction from the output features, the network can focus on the blurred edge regions of the image.
  - Proposed a decoder architecture that can be combined with different sizes of Pyramid Vision Transformer backbones, to meet the different needs on the balance between computation time and performance.
  - Reached the state-of-the-art performance on the polyp segmentation task, skin lesion segmentation task, and multi-organ segmentation task.
- **Deformable MR-CBCT Image Registration for Neurosurgical Guidance** — Baltimore, US
  I-STAR Lab, Johns Hopkins University, advised by Craig Jones — *Oct 2022 - Now*
  - Designed a joint image synthesis and alignment network to register preoperative MR images to intraoperatively acquired deformed Cone Beam CT images of brain tissue for guiding Neurosurgical procedures .
  - Created a simulated dataset to simulate deformations to train the model. The model was refined on 19 clinical cases by transfer learning to attain high-accuracy registration for lateral ventricles in the brain.
- **Defending Medical Image Segmentation Against Adversarial Attacks** — Baltimore, US
  Johns Hopkins University, advised by Xiangyang Li — *Jan 2023 - May 2023*
  - evaluated the robustness of five different medical segmentation models against targeted Iterative Fast Gradient Sign Method (I-FGSM) attacks.
  - Investigated various defense mechanisms to enhance the resilience of these models against adversarial attacks
  - Deployed the Non-local context encoder and a channel-wise feature attention mechanism into the segmentation models to improve their performance and robustness against adversarial attacks.
- **Deep Learning Based Platform for Tracking the Skin Lesion** — Shanghai, China
  Shanghai University and Shanghai Sixth People's Hospital, advised by Xuehai Ding — *Mar 2021 - Aug 2021*
  - Designed an image segmentation back end called D-TransUnet model. Added transformer modules and used deformable convolution layers to the Unet, improving the dice coefficient by 0.017.
  - Enabled real-time forward inference and calculation of scar area with the back-end. Users could get the results back from the model within 0.5 seconds.

- Collaborated to build a WeChat APP with Vue, Django, and MySql, serving physicians and over 300 patients with scar growths.

- **Deep Learning Based Medical Imaging Diagnosis System for Femoral Head Necrosis** Shanghai, China
  Shanghai University and Shanghai Sixth People's Hospital, advised by Xuehai Ding *Mar 2021 - Jun 2022*
  - Processed and labeled over 3,000 patients' data with the disease accumulated at the hospital over the past five years for model training. Communicated the model results to the physicians weekly to evaluate model performance.
  - Created a new neural network model to handle unbalanced data better and focus on lesion areas with 82% classification accuracy.
  - Deployed the Grad-Cam method to visualize the classification model results, reflecting the lesion areas suspected by the model. Patients could upload images to the platform and get results in less than a second.

Work Experience

- **I-STAR Lab, Johns Hopkins University** Baltimore, US
  Part-time Research Assistant *Oct 2022 - Now*
  - Focused on the application of deep learning in medical imaging. Utilize intra-operation rapid CT to assist surgery, and perform disease region segmentation based on computer vision.

- **Deep Leopard Intelligence Inc** Shanghai, China
  Computer Vision Software Engineer Intern *Jun 2022 - Aug 2022*
  - Implemented object detection algorithm for the "Smart Container" project and coordinated with three parties to determine project requirements and completed delivery.
  - Established a deep learning based system for real-time counting of more than 150 parts on multi carrier tables. Realized 99+% accuracy deploying the anchor-based YOLO model and the anchor-free CenterNet model.
  - Deployed the system on a high-performance computer with GPU for edge computing and achieved 50+ FPS.

- **Alibaba Group, Qianxun Spatial Intelligence Inc** Shanghai, China
  Computer Vision Software Engineer Intern *Jul 2021 - Nov 2021*
  - Participated in the intelligent road disease detection project and urban high-precision map construction project to support the autonomous driving department.
  - Accelerated the forward inference time of detection models with the TersorRT quantization tool and model pruning, reducing inference time by 50% on YoloV5.
  - Collaborated to optimize the entire detection system, involving modules for object detection, image classification, multi-object tracking, and lane line detection to achieve a 92%+ target accuracy rate.

- **High-Performance Computing Center, Shanghai University** Shanghai, China
  Part-time Research Assistant *Mar 2021 - Jun 2022*
  - Focused on the application of deep learning in medical imaging, including classification and segmentation tasks.

Skills Summary

- **Tools, and Libraries**: Python, C++, JavaScript, Pytorch, TensorRT, OpenCV, SciPy, Pandas, NumPy, Matplotlib, Tableau, Vue, Nodejs, Django, Flask, MySql, Git, Linux, Docker
- **Fields**: Machine Learning, Deep Learning, Object Detection, Segmentation, Databases, SQL, Big Data, Software Employment, Data Analytics, Inference Acceleration, Model Compression, Data Visualization, Software Development, Camera, LIDAR