Dingzhong Zhang

Algorithm Engineer

Redwood City, CA   +1 (503) 610-3143   dingzhong.zhang@mail.mcgill.ca   Dzzhang96.github.io

Profile

Algorithm Engineer with expertise in medical image processing, surgical navigation and robotics. Specializing in the design, implementation, and testing of biomedical devices and robotic systems. Capable of enhancing software through implementing deep learning and algorithm optimization.

Work Experience

Medical Imaging Algorithm Engineer   Jan 2024 – Present

Johnson & Johnson MedTech, Surgery – Monarch Platform | Algorithms & AI Team: Redwood City, CA

- Development of an automatic scope pose estimation algorithm using deep learning model for C-arm integrated electromagnetic navigation in the Monarch robotic-assisted bronchoscopy system. [Patent filed.]
  a. Trained a scope tip segmentation model using an original annotation method and achieved 92%+ Dice score.
  b. Designed a robust algorithm to calculate the scope tip position & orientation in CBCT.
- Optimized the model inference performance using TensorRT C++ and wrote the GTest.
- Dockerization of the nodule segmentation algorithm and metrics to calculate nodule size in Physician Portal 2.0.
- Model development for kidney stone segmentation in support of the stone burden estimation.

R&D Leadership Development Program Engineer   Aug 2022 – Dec 2023

Johnson & Johnson MedTech, Surgery – Monarch Platform | Algorithms & AI Team: Redwood City, CA

- End-to-end development of "one-click" lung nodule segmentation in Monarch Pre-Operative Planning Software. [Patent filed.]
  a. Trained several SOTA lung nodule segmentation models and test the actual performance on Auris datasets.
  b. Modified a transformer-based deep learning structure to improve the nodule segmentation accuracy by 10%.
  c. Accelerated the inference speed by integrating TensorRT C++ into Pre-Op planning software.
  d. Other works include setting up the visualization framework using VTK/ITK, and corner case solutions.
- Gateway data mining to validate the hypothesis of a near-infrared fluorescence visualization system using Query languages for statistical analysis of case metrics. [Results published in conference of CHEST 2023.]
- Collaborated with RSIP on next gen airway segmentation model to ensure the quality of training datasets.

Algorithm Development Intern   June 2021 – Aug 2021

Medtronic, MTC – Visualization | Robotics Team

- Distortion correction and calibration of intra-operative spine X-ray images using DLT algorithm.
- 2D-3D image registration between X-ray and DRR images for C-Arm image-assisted surgical navigation system.
- Implemented an iterative UNet for automatic vertebra segmentation, including the first and last partially visible vertebrae.

Robotics Engineer Intern   June 2020 – Aug 2020

Shanghai Genius Education & Technology Co. Ltd (UBTECH Robotics): Shanghai, China

- Designed and assembled first-person-view drones and applied control theory to improve flight stability.
- Developed a line-following-vehicle project for students to gain hands-on experience with MicroBit and Python.
- Taught classes of up to 15 students in flight regulation, Python programming, and using Arduino hardware.

Research Assistant   Dec 2018 – July 2019

Orthotek Laboratory: Shanghai, China

- Established a universal test platform for replicating different movement/load scenarios for prosthetic knee joints.
  a. Simulated and analysed loading conditions with kinematics tests using an ABB IRB6700 robotic arm.
  b. Improved prosthesis control methods by analysing load conditions using a multidimensional force sensor, Beckhoff embedded PC, and secondary developed software based on TwinCat.
  c. Developed a dynamic optical measuring system to observe knee-joint kinematics in gait by sticking markers on the surface of prosthesis.

Academic Research

Augmented Reality based Spine Surgical Navigation System using Polaris & HoloLens   Oct 2020 – Feb 2022

McGill University

- Developed an AR based surgical navigation software for high-quality visualization during spine surgery.
- Proposed a quick and accurate workflow for calibration of surgical instruments and registration of models.
- Segmented the vertebra automatically from DICOM using an iterative U-net neural network and designed experiments to evaluate the accuracy by using FaroArm coordinate measurement.

Orbital Rim Registration Software Jan 2020 – June 2020

Shanghai Jiao Tong University, Shanghai Ninth People's Hospital

- Developed a software in QT using C++ that allows doctors to register points along different orbital rims for ocular surgery procedures.
- Applied the iterative-closest-point algorithm for surface registration in drafted 3D models from CT-scan data.

Medical Image Segmentation via Deep Learning Sept 2019 – Nov 2019

Shanghai Jiao Tong University

- Reduced calculation time by 80% for a medical image computation software by integrating deep learning.
- Compiled the TensorFlow C++ library and converted Python image segmentation programs to C++.
- Developed semi-automatic labelling algorithms to segment the bone graft from maxillary sinus for training models.

Design of a Medical Rehabilitation Robotic Arm Jan 2018 – Jun 2018

Shanghai University

- Earned First Prize in the Chinese Service Robot Competition.
- Prototyped a robotic arm with four degrees of freedom which can predict patient arm movement to aid in rehabilitation exercises and adjust its sensitivity for different patients.
- Developed a robotic arm system equipped with multiple sensors, a windows forms application, and servo controls.
- Conducted force analysis in ANSYS to increase stiffness and strength as needed for various situations.

Design of a Novel First-Person-View Racing Drone May 2018 – June 2018

Shanghai University

- Developed a first-person-view drone to win First Prize in China's Aerial Robotics Competition.
- Built a drone with 4x 4800kv brushless motors, carbon fibre frame, 4 in 1 electronic speed controller, F3 flight controller, altimeter, barometer, video transmitter, etc.
- Actively calibrated the drone's PID to adjust for various match requirements and conditions.

Programming and Design of a PCB Layout of an Automated Guided Vehicle Nov 2017 – Mar 2018

Shanghai University

- Won Third Prize in China's Robot Match for Travel and Security.
- Programmed a vehicle to pass different terrains and execute corresponding actions after scanning QR codes.
- Improved system reliability by designing an expansion PCB to replace multiple parts connected with Dupont cables.
- Optimized vehicle response by installing an automatic steering system featuring 16 gray-scale sensors, 4 ultrasonic sensors and a control algorithm.

Publications (Selected)

- **Dingzhong Zhang**, Lauren Friend, Babak Matinfar, Siobhan Carroll, Samaan Rafeq, Matthew Krever*. (2023). Achievable Distance to Nodule Measurement in Real-world Robotic-assisted Bronchoscopy Data. CHEST 2023 [Poster Presentation].
- Jiangchang Xu, **Dingzhong Zhang**, Chunliang Wang, Huifang Zhou, Yinwei Li, and Xiaojun Chen*. (2023). Automatic Segmentation of Orbital Wall from CT Images Via a Thin Wall Region Supervision-Based Multi-scale Feature Search Network. International Journal of Computer Assisted Radiology and Surgery [Link]; 2023 CARS [Poster Presentation].
- Yuwei Gu, **Dingzhong Zhang**, Baoxin Tao, Feng Wang, Xiaojun Chen*, Yiqun Wu*. (2023). A novel technique to quantify radiographic bone-to-implant contact of zygomatic implants based on three-dimensional image registration and segmentation. Dentomaxillofacial Radiology. [Link]
- **Dingzhong Zhang**, Ahmed Aoude, Mark Driscoll*. (2022). Development and Model Form Assessment of an Automatic Subject-specific Vertebra Reconstruction Method. Computers in Biology and Medicine. [Link]
- Jiangchang Xu[#], Jiannan Liu[#], **Dingzhong Zhang**, Zijie Zhou, Chenping Zhang, Xiaojun Chen*. (2021). A 3D Segmentation Network of Mandible from CT Scan with Combination of Multiple Convolutional Modules and Edge Supervision in Mandibular Reconstruction. Computers in Biology and Medicine. [Link]

- Haitao Li[#], Jiangchang Xu[#], **Dingzhong Zhang**, Yaohua He, Xiaojun Chen*. (2022). An Automatic Surgical Planning Combining Bone Density Assessment and Path Integral in Cone Area for Reverse Shoulder Arthroplasty. International Journal of Computer Assisted Radiology and Surgery. [Link]
- Jiangchang Xu[#], Jiannan Liu[#], **Dingzhong Zhang**, Zijie Zhou, Xiaoyi Jiang, Chenping Zhang, Xiaojun Chen*. (2021). Automatic Mandible Segmentation from CT Image Using 3D Fully Convolutional Neural Network Based on DenseASPP and Attention Gates. International Journal of Computer Assisted Radiology and Surgery. [Link]

Education

McGill University   Sept 2020 – Oct 2022
- Master of Science – Mechanical Engineering (GPA: 4.00 / 4.00)

Shanghai Jiao Tong University   Sept 2019 – Sept 2021
- Master of Science – Mechanical Engineering (GPA: 3.64 / 4.00)

Shanghai University   Sept 2014 – June 2019
- Bachelor of Engineering – Mechanical Engineering (GPA: 3.72 / 4.00 RANK: 1/277)

Core Competencies

Specialization
- Medical Image Processing
- AR/VR Surgical Navigation
- Robotics
- Programming

Technical Skills
- ANSYS
- C++
- MATLAB
- OpenCV
- PySpark
- Python
- PyTorch
- Qt
- ROS
- Solidworks
- TensorRT
- VTK, ITK

Soft Skills
- Adaptable
- Analytical
- Communication
- Optimization Oriented

Awards & Honors

- Grad Excellence Award - McGill University   2021
- Academic Excellence Scholarship - Shanghai Jiao Tong University   2019 - 2020
- Graduated with Honors of Shanghai   2019
- Academic Scholarship - Shanghai University   2015 - 2018
- First Prize - Chinese Service Robot Competition (Innovative Design of Rehabilitation Robot)   2018
- First Prize - China Aerial Robotics Competition   2018

Languages

- English (Fluent)   • French (B1)   • Chinese (Fluent)