

Zhaomeng Zhang

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EDUCATION

Johns Hopkins University

Baltimore, MD

Master of Science in Engineering

Major: Medical Robotics

08/2022-Now

Cumulative GPA: 3.78/4.0

Core Courses: Computer Integrated Surgery I and II; Medical Image Analysis; Medical Robotics System Design; Augmented Reality; Computer Vision; Robot Devices, Kinematics, Dynamics, and Control; Algorithms for Sensor-Based Robotics; Haptic Interface Design for Human-Robot Interaction

Virginia Polytechnic Institute and State University

Blacksburg, VA

Bachelor of Science in Computer Engineering

Major: Control, Robotics & Autonomy

08/2017-12/2021

Cumulative GPA: 3.69/4.0 (top 18%) | Major GPA: 3.75/4.0

Core Courses: Principles of Robotic Systems; Network Application Design, Applied Software Design; Digital Image Processing; Artificial Intelligence Application; Embedded System Design; Analog Electronics; AC Circuit Analysis; Probability & Statistics

Honor: Dean's List – 2018 Spring

RESEARCH EXPERIENCE

Simulation Assisted Navigation for Skull Based Surgery

Baltimore, MD

Research Assistant, AMBF Plugin Development Supervisor: Adnan Munawar, Prof. Russell H. Taylor 01/2023-Now

Our project goal is to provide immersive, detailed, and real-time navigation for surgeons. While doing the skull base surgery, the surgeons should be able to pause the operation and load both simulated and microscopic view onto the VR headset to get surgical guidance.

- Developed an AMBF plugin code in C++ that can load the AMBF simulation and subscribe stereo microscopic videos from ROS topic, including process them so that two videos are able to display on the VR headset simultaneously.
- Integrated the digital twin project into our pipeline, which makes the poses of simulated drill and anatomy synchronizing with the real ones in the videos on the VR headset.
- Corrected the lens distortion for the VR headset.

Augmented Reality Based Tooth Preparation Training System

Baltimore, MD

Research Assistant, Project Development on Unity

Supervisor: Alejandro Martin-Gomez

04/2023-Now

The objective of this project is to develop a training system for tooth drilling while providing real-time force feedback by using haptic device and visualizing digital tooth on HoloLen2. This implementation aims to make surgeons familiarize the tooth preparation steps for the installation of a custom-made dental crown.

- Implemented kinematic chain for projecting the digital tooth onto the actual tooth base using Holographic Remoting, achieving a projection error of less than 3mm.
- Transferred frame data from NDI Optical Tracker to Unity using TCP/IP.
- Developed a tooth drilling simulation algorithm in Unity, so that users can use Phantom Omni haptic device to control a virtual tool tip to modify the mesh of a digital tooth and experience the real-time haptic forces.
- Incorporating visual cues and navigation information on HoloLens 2 to provide guidance for new surgeons.
- Plan to submit a paper to a conference.

Robust Vision-Based Soft Robot Shape Estimation

Baltimore, MD

Research Assistant, System Development

Supervisor: Jiaming Zhang, Mehran Armand

04/2023-Now

Our project goal is to obtain the 3D shape of a Transcranial Magnetic Stimulation (TMS) coil cable through the utilization of an optical tracking system. We propose a robust sorting algorithm to compute the order of the point sequence in real-time based on the 3D position of the markers. The shape of the cable is then reconstructed through spline interpolation.

- Designed and completed the experiments to validate the sorting algorithm: using Aruco tag to calibrate the RealSense D415 camera and NDI camera and projecting the sorted 3D markers' positions to a 2D colored image taken by the RealSense camera.
- Collected the experimental data and did the quantitative analysis for our proposed algorithm.
- Involved in writing a paper that was submitted to ICRA 2024 (Under Review).

Virginia Tech Learning Factory

Research Assistant, Virtual Factory Improvement

Supervisor: Prof. Zhenyu Kong

Blacksburg, VA

06/2021-09/2021

Using cameras to detect the positions of people in the factory in real time, once people appear close to the working machines, the machines will stop until the people leave the dangerous area.

- Collected 500 background images of the unoccupied factory, and some images of the factory in the occupied state.
- Utilized image processing techniques to extract the subimages with human features as the dataset of People, and those without people as the dataset of Nonpeople.
- Built different convolutional neural network architectures and made the comparison.
- Divided previous dataset into training, testing, and validation to train and test the model, and modified the batch size and epoch to better recognize human features.
- Identified people with an accuracy of over 90%, and updated the positions of people in real time as they move.

ACADEMIC PROJECT

Medical Image Analysis Project I

Supervisor: Prof. Jerry Prince

01/2023-05/2023

- Constructed and trained the U-net neural network for the 2-chamber and 4-chamber left ventricle endocardium segmentation, achieving 83% Dice coefficients for the model.
- Reconstructed the 3D shape of left ventricle in Blender based on the delineated 2-chamber and 4-chamber ultrasound image sequences.
- Estimated stroke volume and ejection fraction with the reconstructed 3D shape of left ventricle.

Medical Image Analysis Project II

Supervisor: Prof. Jerry Prince

01/2023-05/2023

- Removed skull components from MRI images of T1w and T2w using BET (brain extraction tool).
- Registered T2w, FA, ADC images to T1w by affine and deformable transformation using Ants python library, having around 0.0189 mean absolute error (MAE).
- Implemented and trained 3D conditional generative adversarial network (CGAN) to synthesize FA and ADC MRI images based on the preprocessed dataset (T1w, T2w, FA, and ADC).
- The synthesized FA and ADC MRI images have around 0.0331 and 0.11 MAE.

Embedded System Design

Supervisor: Prof. Cameron D. Patterson

01/2021-05/2021

- Designed a robot to accomplish an autonomous, robust system that can find and move a particular object in a user-defined environment.
- Took charge of the arm part and gathered experience with programming for TI microcontroller.
- Used MQTT (Message Queuing Telemetry Transport) for communicating with other parts of system and used JSON format to send the message to server and JSON parsing to process received message.

RESEARCH INTEREST

- Medical Engineering Application: Image-guided Surgical Intervention, Medical Image Analysis, Computer-Integrated Surgical Robotics, and Augmented/Virtual Reality for Surgery.
- Human Robot/Computer Interaction: Digital Twins, AR/VR applications, Haptic Interface Design, Robotic Kinematics, Robotic Motion Planning, Internet of Things (IoT), Embedded System Design

SKILLS & HOBBIES

- Computer Skills: Python (4yrs), MATLAB (3yrs), C++ (3yrs), Mathematica (2yrs), C language (1yr), C# (1yr), Verilog(1yr), Assembly language (1yr)
- Personal Values: Integrity, Courage, Self-Motivation, Dependability, Flexibility
- Languages: English (fluent), Mandarin(native)
- Hobbies: Soccer (winger of High School Soccer Team, Virginia Tech Chinese Soccer Club, and Johns Hopkins Chinese Soccer Club), Music, Investing, and Business