Shengyang Zhuang

Mechatronics in Medicine Lab
The Hamlyn Centre for Robotic Surgery
Imperial College London
London SW7 2AZ, the United Kingdom

Email: s.zhuang23@imperial.ac.uk
Phone: (+44) 755-159-4139
Web: https://shengyangzhuang.github.io/

Education

Master of Research in Medical Robotics, Imperial College London, UK 09 2023 – 09 2024

- With full scholarships: Recipient of Chiang Chen Overseas Fellowship 2023/2024 and Hamlyn bursary.
- MRes thesis: "Multi-robot system prototyping for cooperative control in robot-assisted spine surgery".
- Supervisor: Prof. Ferdinando Rodriguez y Baena, at The Mechatronics in Medicine Lab, The Hamlyn Centre.

Bachelor of Engineering in Automation, Harbin Institute of Technology, China 08 2019 – 06 2023

- Weighted Grade (154 credits): 91.28/100. With the highest honor: Top Ten Outstanding Graduates.
- Prev.: Less than Top 1% in Gaokao (China's college entrance exam) among 200,000 students.

Invited visiting student, Mechanical Engineering, **ETH Zurich**, Switzerland 06 2022 – 05 2023

- Weighted Grade (48 ECTS): 5.8/6.0 (Excellent/Ausgezeichnet). Year of study abroad. Courses about robotics.
- Bachelor's thesis (grade: 6.0/6.0): "SonoPrint: acoustically-assisted volumetric 3D printing with feedback optimization."
- Supervisor: Prof. Daniel Ahmed at Acoustic Robotics Systems Lab, located at IBM Research Zurich.

Exchange student, Computer Science, **KTH Royal Institute of Technology**, Sweden 01 2022 – 05 2022

- Weighted Grade (30 ECTS): 4.4/5.0. Semester of exchange abroad. Took master courses as an undergraduate regarding advanced control theory, embedded control systems and time series analysis.

Experience

Research assistant, Imperial College London, UK 10 2023 – 09 2024

- Worked on an individual project about dual-KUKA cooperative robotics systems for collision-aware continuous tracking. Developing ROS2 hand-eye calibration algorithms, robot arm object tracking, offline/online obstacle avoidance with GPU-accelerated motion planning. Applications in markerless tracking with depth image segmentation network. [More detail **here**] [Highlight **video**]
- Led a collaboration of 5 MRes students to develop a "soft optical tactile sensor for colorectal tumours detection". Rapid mechanical prototyping using CAD and 3D printing to pattern silicone rubber balloons. Computer vision to identify changes in these patterns and deep learning to classify the results.
- Coursework about "a probabilistic reasoning method for arrythmia detection". Deisnged a Naive Bayes classifier for a 3-class classification. Implemented ECG data processing and feature engineering. Used k-fold cross validation to evaluate performance.
- Coursework about "3D surface reconstruction from stereo images". Developed computer vision techniques, including SIFT for feature detection, FLANN for feature matching, RANSAC for fundamental matrix estimation, and StereoSGBM for disparity mapping and 3D surface reconstruction.

Python | OpenCV | ROS/ROS2 | PyTorch | Git | Docker | SolidWorks | MATLAB | Robotics | CV | ML

Research assistant, ETH Zurich, Switzerland 06 2022 – 05 2023

- Developed an acoustically-assisted volumetric 3D printer through python software development (3D reconstruction, image processing, motor control) and hands-on laboratory work (3D printing, piezoelectric transducers, microscope, and soldering).
- Derived physics equations to theoretically prove SonoPrint experiments, which was concluded in the supplementary information of the published paper in *Advanced Materials* (IF $\approx$ 30). Used MATLAB for data processing, visualization, and simulation.

MATLAB | Python | Mechatronics | Experiments | 3D Printing | SDE | Physics&Math

Research student, KTH Royal Institute of Technology, Sweden 01 2022 – 05 2022

- Studied modern control theories about H_2 & H_∞ control, LQG, Glover MacFarlane Robust Control and Model Predictive Control, etc.
- Coursework about "implementation of pre-defined behaviors of differential-drive robot". Analyzed robot kinematics, designed a finite transition system for motion planning, and implemented a hybrid controller for trajectory tracking. Tested controllers in both simulation and on a real robot in the Smart Mobility Lab.
- Coursework about "time series analysis". Applied classical decomposition, removed trend and seasonality, and verified stationarity with the Augmented Dickey-Fuller test. Fitted seasonal ARIMA models manually and automatically. Evaluated with ACF, PACF, and AICc. Forecasted with SARIMA model.

MATLAB | R | C++ | Robotics | Control theory | Time series analysis

Teaching assistant, Harbin Institute of Technology, China 08 2021 – 12 2021

- Assisted Prof. Jun Li in the course "Mathematical principles in college physics". (in Chinese)
- Compiled three chapters of the handouts and lecture slices. Lectured for 50+ students.

Lecturing | Communication | Teamwork | LaTeX | Physics&Math

Skills

- **Robotics**: Kinematics, Motion planning, Mechanical integration, Machine vision, Visual servoing
- **Programming**: Python, ROS/ROS2, MATLAB&Simulink, C++, Arduino, LaTeX
- **Software development**: VS Code, PyCharm, Git, Docker
- **Working knowledge**: Robot dynamics, Control theory, Computer vision, Machine learning
- **Design**: Solidworks, ImageJ, HTML web design, Adobe Photoshop/ Premiere Pro/ After Effect video editing.
- **Sports and music**: Alpine skiing, Surfing, Saxophone (since 2012), Scuba diving (plan for license)
- **Languages**: Mandarin Chinese (native), English (professional)

Publications

[1] Prajwal Agrawal, **Shengyang Zhuang**, Simon Dreher, Sarthak Mitter, and Daniel Ahmed, "SonoPrint: Acoustically Assisted Volumetric 3D Printing for Composites.", *Advanced Materials* (2023): 2408374.

Scholarships and Awards

- Chiang Chen Overseas Fellowship 2023/2024, $50,000. (9 winners nationwide) 07 2023
- Hamlyn Bursary, £3,000. 06 2023
- Top Ten Outstanding Graduates of HIT, ¥10,000. (10 winners among three campuses) 12 2021
- Qiming scholarship of HIT, awarded for Top 10% marks in the year, ¥7,000. 10 2021
- First Prize National Mathematical Modeling Competition, provincial award. (Top 10%) 10 2021
- 613 scholarship of HIT, awarded for Top 5% marks in the year, ¥8,000. 10 2020
- First Prize National Mathematics Competition, provincial award. (Top 10%) 10 2020

Conferences and summer school

Cambridge Ellis Unit Summer School, University of Cambridge, Cambridge, UK 07 2024
- Lectures about probabilistic machine learning: advanced probabilistic models, reinforcement learning, generative models, etc.

The 16th Hamlyn Symposium on Medical Robotics, London, UK 06 2024
- Poster "Multi-robot system prototyping for cooperative control in robot-assisted spine surgery".

AERO-TRAIN Summer School (Marie-Sklodowska-Curie Network), Chania, Crete, Greece 06 2024
- Courses & exercises about aerial robot perception (mapping, motion planning, target detection); visual servoing control; teleoperation and haptics for human-robot interaction.

References available on request

Prof. Ferdinando Rodriguez y Baena, f.rodriguez@imperial.ac.uk, Imperial College London, UK

Professor of Medical Robotics, the Engineering Co-Director of the Hamlyn Centre, and P.I. of Mechatronics in Medicine Lab.

Dr. James Avery, J.P.Avery@leeds.ac.uk, University of Leeds, UK

Lecturer (Assistant Professor) in Robotics and Embedded Computer Systems Engineering.

Prof. Daniel Ahmed, dahmed@ethz.ch, ETH Zurich, Switzerland

Assistant Professor of Acoustic Robotics for Life Sciences and Healthcare, P.I. of Acoustic Robotics Systems Lab.

Prof. Huijun Gao, hjgao@hit.edu.cn, Harbin Institute of Technology, China

Chair Professor of Control Science and Engineering, IEEE Fellow, Member of Academia Europaea.