Shengyang Zhuang

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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[1] and Hamlyn bursary[2].
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[3].
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
- Working on an eight-month individual project about "dual-KUKA cooperative robotics systems for spine surgery". Developing ROS2 hand-eye calibration algorithm, computer vision/neural network for object detection, robot arm automatic object tracking, offline/online obstacle avoidance via active constraints.
- 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. Developed manual feature extraction and selection algorithms. Used k-fold cross validation to evaluate performance.
- Coursework about "3D surface reconstruction from stereo images". Developed and implemented various 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 | ML | CV

Research assistant, ETH Zurich, Switzerland 06 2022 – 05 2023
- Innovated acoustically-assisted volumetric 3D printing with visual feedback through hands-on laboratory work (3D printing, piezoelectric transducers, microscope, and soldering) and python software development (3D reconstruction, image processing, motor control).
- Derived physics principles equations to theoretically prove SonoPrint experiments, which was concluded in the supplementary information of the published paper in *Advanced Materials*. Used MATLAB for data processing, visualization, and simulation.

MATLAB | Python | Mechatronics | Experiments | 3D Printing | Software Dev. | 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).
- **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 and the Engineering Co-Director of the Hamlyn Centre.

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

[1]In 2023, only 9 students in Mainland China received the Chiang Chen Overseas Fellowship, which supports top engineering graduates to pursue postgraduate studies in the Top Ten US or selected European institutions. The selection process begins with 15 leading engineering colleges in China nominating two students each. A preliminary panel narrows it down to 20 finalists, from whom normally about 11 recipients are chosen by the final panel each year.

[2]This limited scholarship is only provided to exceptional applicants who achieve academic excellence in their diploma programme. The scholarship is provided by the Hamlyn Centre and the Institute of Global Health Innovation.

[3]This annual award at HIT is given to outstanding students regardless of their academic level (bachelor, master, or PhD). Each department and Shenzhen, Weihai campus nominate only one student based on their academic achievements and activity involvement. The university committee then selects 10 finalists through a symposium presentation process.

[4]Full project portfolio on my personal website: https://shengyangzhuang.github.io/