

Dr Fan Zhang

Contact Information

Personal Robotics Lab
Department of Electrical and Electronic Engineering
Imperial College of Science, Technology and Medicine
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Research Interests

Assistive Robots, Autonomous Driving, Surgical Robot,
Perception and Manipulation, Sim2real Learning, Reinforcement Learning

Professional Appointments

Research Associate, 2021 - present
Imperial College London
Project: D-RISK (maximizing autonomous vehicle safety)

Education

Ph.D. in Robotics, 2016 – 2020
Imperial College London
Thesis: Perception and manipulation in Robotic-Assisted Dressing
Supervisor: Prof. Yiannis Demiris (Royal Academy of Engineering Chair in Emerging Technologies)

M.Sc in Mechatronics Engineering, 2014 - 2016
State Key Laboratory of Robotics and System
Harbin Institute of Technology
Thesis: Preoperative Planning for Multi-Arm Surgical Robots
Supervisor: Prof. Zhijiang Du

B.Eng. in Mechanical Engineering, 2010 - 2014
Harbin Institute of Technology
Thesis: Mechanical Analysis of Scissor Lifts Considering Friction
Supervisor: Prof. Yuan Xue

Awards

Conference Awards:
Best Student Paper Award, IEEE International Conference on Mechatronics and Automation (ICMA), 2016

Harbin Institute of Technology:
Best Msc Thesis Award, 2016 (<10%)
Outstanding Master's Graduates, 2016 (<10%)
Vice President, Students' Union, 2012 - 2013

National Basic Foreign Language Teaching Research Centre
National English Contest for College Students, First Prize, 2013 (0.6%)

— Talks

Intelligent Robot Seminar, Chinese Association Artificial Intelligence, Jun 2020 (video, live audience: 150,000)
[Shenzhou Forum for International Young Scholars Plenary Talk](#), HIT, Dec 2019
Human Motion Analysis for Healthcare Applications, IET, Jun 2019 (video)
The Hamlyn Centre, Imperial College London, Nov 2017
The 2nd UK Robot Manipulation Workshop, Jul 2017

— In the Press

Posture Tracking for Robotic Dressing, Chinese Association Artificial Intelligence, May 2020
Baxter the nursebot to help care for ageing population, [The Times](#), Aug 2019
Robotic nurse that helps you dress could aid staff shortage, [Bloomberg](#), Aug 2019
Others: Daily Mail, Telegraph, South China Morning Post, IndustryWeek.

— Technical Skills

MATLAB, Python, ROS, Linux, 3D Printing, ADAMS, Autodesk Fusion 360, Maya, Blender

— Reviewer Activities

IEEE Robotics and Automation Magazine
IEEE Access
International Conference on Robotics and Automation (ICRA 2020)
Winter Conference on Applications of Computer Vision (WACV 2020)
IEEE International Conference on Mechatronics and Automation (ICMA 2016)

— Teaching Experience

Human-Centered Robotics, Imperial College London, 2017 - 2020

— Journal Publications

- **Zhang F**, Cully A and Demiris Y (2019). Probabilistic Real-Time User Posture Tracking for Personalized Robot-Assisted Dressing, [IEEE Transactions on Robotics](#), 35.4 (2019): 873-888
- Yan Z, Du Z, **Zhang F**, Wang W (2018). Preoperative Optimization of the Surgical Robot considering Internal Diversity of Workspace, Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science, 232(6), pp: 1091-1107
- Chen J, Xue Y, **Zhang F** (2016). Mechanical Analysis and Finite Element Simulation of Scissor Transmission Mechanism under Partial Load, Key Engineering Materials, vol. 667, pp: 518-523.
- **Zhang F**, Chen J, Xue Y (2013). Mechanical Analysis of Scissor Transmission Mechanism Considering Friction, Applied Mechanics and Materials, vol. 419, pp: 74-80.

— Conference Publications

- **Zhang F**, Demiris Y (2020). Data-Efficient Garment Grasping and Manipulation for Robot-Assisted Dressing, IEEE International Conference on Robotics and Automation (ICRA 2020), France.
- **Zhang F**, Cully A, Demiris Y (2017). Personalized Robot-Assisted Dressing using User Modeling in Latent Spaces, IEEE International Conference on Intelligent Robots and Systems (IROS 2017), Canada, pp: 3603-3610.
- **Zhang F**, Yan Z, Du Z (2017). Preoperative Planning for the Multi-Arm Surgical Robot using PSO-GP-based Performance Optimization, IEEE International Conference on Robotics and Automation (ICRA 2017), Singapore, pp: 5629-5635.
- **Zhang F**, Yan Z, Du Z (2016). Preoperative Setup Planning for Robotic Surgery Based on a Simulation Platform and Gaussian Process, IEEE International Conference on Mechatronics and Automation

(ICMA 2016), China, pp: 902-907. --- **Best Student Paper Award**

- **Zhang F**, Su Y, Zhang X, Dong W, Du Z (2015). An Under-Actuated Manipulation Controller Based on Workspace Analysis and Gaussian Processes, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2015), Germany, pp: 5629-5635.

Workshop Publications

- **Zhang F**, Cully A and Demiris Y (2019), Probabilistic Real-Time User Posture Tracking using Visual and Haptic Information for Robot-Assisted Dressing, IET Human Motion Analysis for Healthcare Applications.
- **Zhang F**, Cully A and Demiris Y (2017), Personalized Robot-Assisted Dressing using Hierarchical Multi-Task Control and User Modeling, The 2nd UK Robot Manipulation Workshop.

Research Projects:

---- Robot-Assisted Dressing for Impaired Patients

- We present a data-efficient supervised deep neural network to learn garment grasping points. The proposed work enables the Baxter robot to autonomously grasp a hospital gown hung on a rail, bring it close to the user and successfully dress the upper-body.
- We introduce a precise, real-time, user posture tracking method based on a probabilistic filter using multi-modal (vision and haptic) information.
- We propose a low-dimensional user model that captures the specificities of upper-body impairments, which enables the Baxter humanoid robot to provide personalized dressing assistance for users with different upper-body movement impairments.
- The above works have been published in IEEE Transactions on Robotics (**top journal in robotics, impact factor: 6.483**), ICRA, IROS (top conferences in robotics).
- The above works have been covered by several news outlets, including **The Times, Bloomberg, Daily Mail, Telegraph, South China Morning Post, IndustryWeek**, etc.
- The above works are supported in part by EPSRC Grant EP/S032398/1 (Interactive Perception-Action-Learning for Modelling Objects), and a Royal Academy of Engineering Chair in Emerging Technologies.

---- Preoperative Planning for Multi-Arm Surgical Robots

- We address the problem of preoperative planning for the multi-arm surgical robot by designing a new PSO-GP-based optimization strategy, an integrated method of Particle Swarm Optimization (PSO) and Gaussian Process (GP), to optimize the preoperative port position and robot arm positioning.
- This method provides guidelines for surgeons to perform an efficient intervention with the use of the multi-arm surgical robot system.
- The above works have been accepted to several conferences and journals (ICRA, ICMA, Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science).
- The above works have received **Best Student Paper Award** at IEEE International Conference on Mechatronics and Automation (ICMA), 2016.
- The above works have received **Best Msc Thesis Award** at Harbin Institute of Technology, 2016.
- The above works are supported by the National Natural Science Foundation of China (Grant No.61403107).

---- Under-Actuated In-Hand Manipulation

- We design a planar under-actuated gripper with two three-phalanx fingers.
- We use Gaussian Processes to compensate the kinematics error of the under-actuated planar gripper.

- The above works have been published in IROS (top conference in robotics).
- The gripper has been implemented on a mobile robot in extreme environments.