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 Vehicles,
Robot Manipulation, Sim2real Learning, Reinforcement Learning, Human Pose Estimation

─── **Professional Appointments**

Research Associate, 2021 - present
Imperial College London
Project**:** D-RISK (human pose estimation for autonomous vehicles and mobile robots)

─── **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**

The Queen Mary UK Best PhD in Robotics Award 1st place, 2020
Best Student Paper Award, IEEE International Conference on Mechatronics and Automation (ICMA), 2016
Best Msc Thesis Award**,** Harbin Institute of Technology, 2016 (<10%)

─── **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, Unreal Engine, OpenAI Gym

Reviewer Activities

Review Editor in Frontiers in Robotics and AI - Robot Learning and Evolution

IEEE Robotics and Automation Letters

IEEE Robotics and Automation Magazine

IEEE Access

IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2021)

IEEE 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 Activities

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

Intelligent Robotics, Harbin Institute of Technology, 2014-2016

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). Learning Grasping Points for Garment Manipulation in Robot-Assisted Dressing, IEEE International Conference on Robotics and Automation (ICRA 2020), France, pp: 9114-9120.
- **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.

────── **Research Projects:**

---- **Robot-Assisted Dressing for Impaired Patients**
- We present a data-efficient supervised deep neural network to learn garment grasping points.
- 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, Chinese Association Artificial Intelligence etc.
- The above works are supported in part by EPRSC 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 design 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.