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, Robot Perception and Manipulation, Sim2real Learning, Reinforcement Learning

Professional Appointments

Research Associate, 2021 - present
Imperial College London
Project**:** D-RISK,
Closed-Loop Multisensory Brain-Computer Interface for Enhanced Decision Accuracy,
UKRI Trustworthy Autonomous Systems Node in Trust

Education

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

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

TechBeat, Aug 2021 (video)
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

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, OpenAI Gym

Reviewer Activities

Scientific Reports
Review Editor in Frontiers in Robotics and AI - Robot Learning and Evolution
IEEE Robotics and Automation Letters
IEEE Robotics and Automation Magazine
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
IEEE International Conference on Robotics and Automation (ICRA)
Winter Conference on Applications of Computer Vision (WACV)
IEEE International Conference on Mechatronics and Automation (ICMA)

Teaching Activities

Human-Centered Robotics, Imperial College London, 2017 - 2020
Intelligent Robotics, Harbin Institute of Technology, 2014-2016

Journal Publications

- Learning Garment Manipulation Policies towards Robot-Assisted Dressing
  Zhang F and Demiris Y.
  Science Robotics.
- Probabilistic Real-Time User Posture Tracking for Personalized Robot-Assisted Dressing
  Zhang F, Cully A and Demiris Y.
  ***IEEE Transactions on Robotics**, 2019.*
- Preoperative Optimization of the Surgical Robot considering Internal Diversity of Workspace
  Yan Z, Du Z, **Zhang F**, Wang W.
- *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science, 2018.*

Conference Publications

- Learning Grasping Points for Garment Manipulation in Robot-Assisted Dressing
  Zhang F, Demiris Y.
  IEEE International Conference on Robotics and Automation (ICRA), 2020.
- Personalized Robot-Assisted Dressing using User Modeling in Latent Spaces
  Zhang F, Cully A, Demiris Y.
  IEEE International Conference on Intelligent Robots and Systems (IROS), 2017.
- Preoperative Planning for the Multi-Arm Surgical Robot using PSO-GP-based Performance Optimization
  Zhang F, Yan Z, Du Z.
  IEEE International Conference on Robotics and Automation (ICRA), 2017.
- Preoperative Setup Planning for Robotic Surgery Based on a Simulation Platform and Gaussian Process
  Zhang F, Yan Z, Du Z.
  IEEE International Conference on Mechatronics and Automation (ICMA), 2016.
  Best Student Paper Award
- An Under-Actuated Manipulation Controller Based on Workspace Analysis and Gaussian Processes
  Zhang F, Su Y, Zhang X, Dong W, Du Z.
  IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2015.

Research Projects:

---- Robot-Assisted Dressing for Bedridden Patients

- We develop a robot-assisted dressing pipeline intended for bedridden people.
- We present an active pre-grasp manipulation approach to learn garment grasping and manipulation using deep neural network.
- We propose a contrastive learning method to create a realistic garment physical simulation in a sim-to-real manner.
- 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 different upper-body impairments for personalized dressing assistance.
- The above works have been published in **Science Robotics** (impact factor: **23.748**), **IEEE Transactions on Robotics** (impact factor: 5.567), 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.
- This research is financially supported in part by a Royal Academy of Engineering Chair in Emerging Technologies to Professor Yiannis Demiris, and in part by UKRI Grant EP/V026682/1.

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

- We design a new PSO-GP-based optimization strategy, an integrated method of Particle Swarm Optimization and Gaussian Process, 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.

---- Under-Actuated In-Hand Manipulation

- We design a planar under-actuated gripper with two three-phalanx fingers and use Gaussian Processes to compensate kinematics errors.
- The above works have been published in IROS (top conference in robotics).
- The gripper has been implemented on a mobile robot in extreme environments.