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, Self-supervised Learning

Professional Appointments

Research Associate, 2021-present
Imperial College London
Projects: Innovate UK D-RISK;
UKRI 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)

M.Sc in Mechatronics Engineering, 2014-2016
B.Eng. in Mechanical Engineering, 2010-2014
State Key Laboratory of Robotics and System
Harbin Institute of Technology, China

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 Finalists**,** Harbin Institute of Technology, 2016 (<10%)

Journal Publications

- Learning Garment Manipulation Policies towards Robot-Assisted Dressing,
  Zhang F, Demiris Y.
  Science Robotics, 2022. *(IF=23.748, paper, video)*
- Probabilistic Real-Time User Posture Tracking for Personalized Robot-Assisted Dressing,
  Zhang F, Cully A, Demiris Y.
  IEEE Transactions on Robotics, 2019. *(paper, video)*
- 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, 2018. *(paper)*

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. *(paper, video)*
- 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. *(paper, video)*
- 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. *(paper)*
- 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. *(paper)*
  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. *(paper, video)*

Workshop Publications

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

Talks

State Key Laboratory of Intelligent Technology and Systems, Tsinghua University, 2022
Apple Weekly Seminar, 2022
Intelligent Robot Seminar, Chinese Association Artificial Intelligence, 2020 (video, live audience: 150,000)
Human Motion Analysis for Healthcare Applications, IET, 2019 (video)
The Hamlyn Centre, Imperial College London, 2017
The 2nd UK Robot Manipulation Workshop, 2017

In the Press

Robotic nurse can dress a mannequin in a hospital gown, **New Scientist**, 2022
Baxter the nursebot to help care for ageing population, **The Times**, 2019
Robotic nurse that helps you dress could aid staff shortage, **Bloomberg**, 2019
Others: Daily Mail, Telegraph, South China Morning Post, IndustryWeek, TexhXplore.

Technical Skills

Programming: MATLAB, Python, ROS, Linux,
Design: 3D Printing, ADAMS, Autodesk Fusion 360, Maya, Blender,
Others: Anaconda, Docker, 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)

Research Mentorship & Teaching Activities

Nikki Zhong (PhD at Imperial college London), research on human motion modeling, 2021-present
Stelios Kotsovolis (PhD at Imperial college London), research on assistive robotics, 2021-present
Human-Centered Robotics, graduate teaching assistant, Imperial College London, 2017-2022
Intelligent Robotics, graduate teaching assistant, Harbin Institute of Technology, 2014-2016

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 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, TexhXplore, New Scientist, etc.
- Live demo for NHS, ABB, Apple, MURI, etc
- This research is financially supported in part by a Royal Academy of Engineering Chair in Emerging Technologies to Professor Yiannis Demiris, UKRI Grant EP/V026682/1, and EPRSC Grant EP/S032398/1.

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

- We design a new PSO-GP 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 ICRA, ICMA conferences, and Proc. Inst. Mech. Eng. C journal.
- The above works have received **Best Student Paper Award** at IEEE International Conference on Mechatronics and Automation (ICMA), 2016.
- The above works have been selected as Best Msc Thesis Award Finalists at Harbin Institute of Technology, 2016.

---- Under-Actuated In-Hand Manipulation

- We design a planar under-actuated gripper with two three-phalanx fingers for mobile robot in extreme environments, and use Gaussian Processes to compensate kinematics errors.
- The above works have been published in IROS.