

# Dr Fan Zhang

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## Contact Information

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## Research Interests

Robot Manipulation, Sim-to-Real Learning, Self-Supervised learning, Visual-Language Model, Prompt Tuning, Flow Matching

## Professional Appointments

**Guest Scientist**, 2024-present

Honda Research Institute EU

Projects: Assistive Robot Manipulation using Prompt Tuning and Flow Matching

**Visiting Researcher**, 2024-present

**Eric and Wendy Schmidt AI in Science Postdoctoral Fellow**, 2023-2024

**Research Associate**, 2021-2023

Imperial College London, UK

Projects: Closed-Loop Multisensory Brain-Computer Interface for Enhanced Decision Accuracy

**UK Global Talent Visa**, sponsored by Royal Academy of Engineering

## 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

## Awards

**The Queen Mary UK Best PhD in Robotics Award 1<sup>st</sup> place**

2020

Best Student Paper Award, IEEE International Conference on Mechatronics and Automation

2016

## Highlighted Publications

**Affordance-based Manipulation with Flow Matching**

Zhang F, Gienger M.

*arXiv (paper, website)*

**Learning Garment Manipulation Policies towards Robot-Assisted Dressing**

Zhang F, Demiris Y.

*Science Robotics*, 2022. (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)

**Contrastive Self-Supervised Learning for Automated Multi-Modal Dance Performance Assessment**

Zhong Y, Zhang F, Demiris Y

*IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2023

## Selected Publications

### Visual-Tactile Learning of Garment Unfolding for Robot-Assisted Dressing

Zhang F, Demiris Y.

*IEEE Robotics and Automation Letters (RA-L)*, 2023. (paper, video)

### 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)

### 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)

### 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)

## Talks

Guest Lecture, TAMS, University of Hamburg,	2024
Talks on Assistive Robotics, King's College London,	2023
AI seminar in Statistics, Imperial College London,	2023
Tsinghua University, (video, live audience: 150,000)	2022
Apple Weekly Seminar	2022
Human Motion Analysis for Healthcare Applications, IET (video)	2019
The Hamlyn Centre, Imperial College London	2017

## In the Press

Robotic nurse can dress a mannequin in a hospital gown, <b>New Scientist</b>	2022
Baxter the nursebot to help care for ageing population, <b>The Times</b>	2019
Robotic nurse that helps you dress could aid staff shortage, <b>Bloomberg</b>	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, OpenAI Gym, Event Camera, Tensorflow, PyTorch

## Academic Service

RSS 2024 Workshop: Learning for Assistive Robotics	Organizer
Imperial-X Breaking Topics in AI conference, Schmidt Futures	Organizer
ICRA 2023 Workshop: Emerging Paradigms for Assistive Robotic Manipulation	Organizer
Frontiers in Robotics and AI-Robot Learning and Evolution	Review Editor
Scientific Reports, T-RO, ICRA, IRSO, RA-L, RSS, WACV	Reviewer
IEEE Robotics and Automation Magazine	Reviewer
UKRI Trustworthy Autonomous Systems Node in Trust	Participant
Innovate UK D-RISK: Learning Edge Cases for Autonomous Vehicles	Participant

## Research Mentorship & Teaching Activities

Amirreza Razmjoo (PhD at EPFL), research on VLM for robot manipulation	2024-present
Nikki Zhong (PhD at Imperial college London), research on human motion modeling	2021-present
Human-Centered Robotics, graduate teaching assistant, Imperial College London	2017-2022

## Selected Research Projects:

### ---- Affordance-based Assistive Robot Manipulation with VLM

- Parameter-efficient learning assistive manipulation affordance with vision-language foundational models using **prompt tuning**.
- Generative modelling for robot imitation learning with special focus on **flow matching**.
- Collection of large dataset related to assistive robot tasks with human in the loop.

### ---- Robot-Assisted Dressing for Bedridden Patients

- Deformable objects (garment) **grasping/manipulation** using imitation learning and deep Q learning from demonstration.
- **Visual-tactile** fusion for garment unfolding using a framework of model-based reinforcement learning.
- Building **real and synthetic dataset** of garment, including RGB-D and event images.
- Understanding garment configurations for garment semantic segmentation and depth estimation.
- **Sim-to-real** robot manipulation policy transfer (PyBullet, Blender engine) in **physics domain**.
- **Self-supervised learning** garment physics with event cameras.
- Real-time user posture tracking using vision and haptic information with a probabilistic particle filter.
- Personalized user impairments model using dimensionality reduction methods.
- Hierarchical multitask control for robotics relating force and velocity adaptation.
- The above works have been published in top journals and conferences: Science Robotics, IEEE Transactions on Robotics, RA-L, ICRA, IROS.
- Based on above works, I have been awarded the **UK Best PhD in Robotics Award 2020 1st place**.
- The above works have been covered by several news outlets, including The Times, Bloomberg, Daily Mail, Telegraph, TexXplore, New Scientist, etc. Live demo for NHS, ABB, Apple, MURI, etc.

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

- Optimizing preoperative robot arm positioning using Gaussian Process, for surgeons to perform efficient intervention with multi-arm surgical robot systems (ICRA, ICMA, Best Student Paper Award).

### ---- Under-Actuated In-Hand Manipulation

- An under-actuated gripper with two three-phalanx fingers for mobile robot in extreme environments, using Gaussian Processes to compensate kinematics errors (IROS 2015).