TIANYU HAN

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RESEARCH INTEREST

I research adversarial robustness and scalable generative modeling techniques. It covers inferring disease progression and anonymous data sharing using generative implicit models. I'm also leading a project on solving inverse problems in medical imaging using diffusion models.

EDUCATION

RWTH Aachen University - Ph.D. in Physics   2018 – Now
                                                                  Germany
- Thesis topic: generative modeling on radiological images.

RWTH Aachen University - M.Sc in Physics   2015 – 2018
                                                                  Germany
- GPA: 1.1/1.0
- Graduate with Distinction (mit Auszeichnung).
- Thesis: Sequence Optimization for Parameter Quantification in MR Fingerprinting, grade: 1.0/1.0.
- Master's degree requirements completed while working towards obtaining my Ph.D.

Nankai University - B.Sc in Physics   2010 – 2014
                                                                  China
- GPA: 3.6/4.0
- 3rd out of 60 students.

RESEARCH EXPERIENCE

Uniklinik RWTH Aachen - Research Assistant   Oct. 2018 – Now
                                                                  Germany
- Collaborator: Dr. Daniel Truhn, supervising physician.
- Leading a team working on radiological data synthesis using diffusion models.
- Research on disease progression prediction by latent space exploration on the learned manifold, published in *Nature Machine Intelligence*, and selected as the cover image of volume 4 issue 11.
- Investigated adversarial robustness on medical and pathological data, through the lens of batch normalization and attention. Both works were published in *Nature Communications*.
- Research on federated machine learning in medical imaging, work published in *Science Advances*.

The Alan Turing Institute - Data Study Group   Sep. 2021 – Oct. 2021
                                                                  UK
- Topic: Perfusion quantification of sub-lingual microcirculation.
- Performed unsupervised vessel segmentation on dark field microscopy videos.

Philips Research Hamburg & Uniklinik RWTH Aachen - Master Student   May. 2017 – May. 2018
                                                                          Germany
- Topic: Dictionary-free reconstruction of quantitative MRI.
- 12-month Master thesis project exploring robust relaxation parameter estimation from accelerated MRI measurements, with application to disease quantification in both brain and liver. I applied convex optimization and parallelized the code to scale well. This work was published as conference abstracts in the International Society for Magnetic Resonance in Medicine (ISMRM).

PUBLICATIONS, PEER-REVIEWED

1. **T. Han** ✉, et al. Image Prediction of Disease Progression for Osteoarthritis by Style-based Manifold Extrapolation. *Nature Machine Intelligence*, 4, 1029-1039 (2022).

2. F. Khader, **T. Han**, et al. Artificial Intelligence for Clinical Interpretation of Bedside Chest Radiographs. *Radiology*, 220510 (2022).

3. G. Müller-Franzes, L. Huck, ST. Arasteh, F. Khader, **T. Han**, et al. Using Machine Learning to Reduce the Need for Contrast Agents in Breast MRI through Synthetic Images. Accepted in *Radiology*, (2022).

4. NG. Laleh, D. Truhn, GP. Veldhuizen, **T. Han**, et al. Adversarial Attacks and Adversarial Robustness in Computational Pathology. *Nature Communications*, 13(1), 1-10 (2022).

5. **T. Han** ✉, et al. Advancing Diagnostic Performance and Clinical Usability of Neural Networks via Adversarial Training and Dual Batch Normalization. *Nature Communications*, 12, 4315 (2021).

6. **T. Han**, et al. Breaking Medical Data Sharing Boundaries by Using Synthesized Radiographs. *Science Advances*, 6(49), eabb7973 (2020).

TEACHING EXPERIENCE

Data Analytics, Module: Biomedical Big Data Processing - Co-instructor　　　　Fall 2021 – Now

- Graduate-level introduction to medical image analysis class 92.00046 Biomedical Big Data Processing at RWTH Aachen University.
- Taught by me, Prof. Fabian Kiessling, and Dr. Daniel Truhn.
- My lecture covers classical radiomic analysis and deep learning basics.

Medical Imaging, Module: MRI - Teaching Assistant　　　　Spring 2019 – Now

- Graduate-level medical imaging course introduces most imaging modalities such as MRI, CT, PET, and ultrasound at RWTH Aachen University (course number: 92.03221).
- Taught by Prof. Fabian Kiessling and Prof. Volkmar Schulz.
- My content covers gradient fields in MR, imaging physics, contrasts, and MR sequence parameters.

SELECTED TALKS

Predicting disease progression by using style-based latent extrapolation　　　　Jul. 2021
Umbrella Symposium　　　　Aachen, Germany

Synthesizing high-resolution medical images using GANs　　　　Aug. 2020
Uniklinik Köln　　　　Cologne, Germany

Privacy protected federated learning: a generative solution　　　　Oct. 2019
Philips Research Hamburg　　　　Hamburg, Germany

SERVICE

Journal reviewer of NPJ Precision Oncology and Journal of Controlled Release
Member of Medical Image Computing and Computer Assisted Intervention Society (MICCAI)
Member of ISMRM

SKILLS

Programming: Python (NumPy, SciPy, Pytorch, TensorFlow, Keras, Pandas, Matplotlib), C++, MATLAB
Languages: English (Professional) and German (Elementary)