RAN LIU

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RESEARCH INTERESTS

Machine Learning, Computational Neuroscience, and Computer Perception

- Low-dimensional latent representations of data
- Biological and medical information processing and analysis
- Deep learning interpretability and generalizability

EDUCATION

Georgia Institute of Technology
Ph.D. student in Machine Learning - ECE — Aug 2019 - Present

Fudan University
Bachelor of Science in Physics — Sep 2015 - Jun 2019

University of California, Berkeley
Exchange Student — Jan 2017 - May 2017

PUBLICATIONS

R. Liu, C. Subakan, A. H. Balwani, J. Whitesell, J. Harris, S. Koyejo, E. Dyer. "A generative modeling approach for interpreting population-level variability in brain structure", to appear in International Conference on Medical Image Computing and Computer Assisted Intervention (**MICCAI**) 2020.

C. Huang, B. Zhou, H. Zhang, B. Yang, **R. Liu**, et al. "Proximity-induced surface superconductivity in Dirac semimetal Cd_3As_2", **Nature Communications**, May 2019.

C. Zhang, Y. Zhang, X. Yuan, S. Lu, J. Zhang, A. Narayan, Y. Liu, H. Zhang, Z. Ni, **R. Liu**, et al. "Quantum Hall effect based on Weyl orbits in Cd_3As_2", **Nature**, Jan. 2019.

C. Huang, A. Narayan, E. Zhang, Y. Liu, X. Yan, J. Wang, C. Zhang, W. Wang, T. Zhou, C. Yi, S. Liu, J. Ling, H. Zhang, **R. Liu**, et al. "Inducing Strong Superconductivity in WTe_2 by Proximity Effect", **ACS nano**, June 2018.

SELECTED RESEARCH EXPERIENCES

Generative modeling and interpretability of brain structures — Jan 2020 - Present
Advisor: Prof. Eva Dyer, Georgia Institute of Technology

- Applied variational autoencoder (VAE) to perform generative modeling of brain imagery and fine-tuned the intensity of regularizer to improve the denoising and inpainting ability.
- Developed a bidirectional approach to interpret low-dimensional latent representation of deep generative models from both the receptive and the projective field of a neural net (see Publications).
- Proposed a multitask U-Net to perform both the fine-scale segmentation of brain's microstructure and the classification of brain areas, and analyzed biomarkers for neurodegenerative disease.

Temporal modeling and prediction of controversial posts — Aug 2019 - Dec 2019
Advisor: Prof. Diyi Yang, Georgia Institute of Technology

- Developed and applied state-of-the-art machine learning models (including BERT, BiLSTM, CRF, etc.) on a classification task of discourse acts and achieved record-high F1 score.
- Designed and extracted domain knowledge features about controversy-causing posts and employed those features on the early prediction of controversial posts on Reddit.

- Conducted temporal modeling of controversial posts' discussion structures with linguistic analysis of discourse acts and conversational interaction feature engineering results.

Link recommendation based on hierarchical graph analysis Jan 2019 - Jun 2019
Advisor: Prof. Deqing Yang, Fudan University

- Constructed a hierarchical information graph based on user connections and geo-locations obtained from a self-crawled Twitter dataset.
- Conducted community detection based on modified fast unfolding algorithm.
- Designed a heterogeneous recommendation system via link prediction algorithms including Neural Collaborative Filtering and Factorization Machine.

Characteristic analysis of complex networks Jul 2018 - Jan 2019
Advisor: Prof. Zhongzhi Zhang, Fudan University

- Analytically derived the Laplacian spectrums of several special scale-free complex networks with identical degree sequence.
- Calculated characteristic invariants including the enumeration of spanning trees of the studied complex networks, and related their properties to the consensus problem.
- Obtained the relationship between power-law degree distribution and consensus behavior on scale-free networks via the differences between fractal and non-fractal complex networks.

Investigation on physical properties of innovative nanodevices Feb 2017 - Oct 2018
Advisor: Prof. Faxian Xiu, Fudan University

- Discovered a new type of quantum Hall effect in wedge-like Cd_3As_2 thin films (see Publications).
- Explored proximity-induced Fermi-arc superconductivity in Nb/Cd_3As_2 heterostructures and supercurrent in $Nb/Cd_3As_2/Nb$ Josephson junctions (see Publications).
- Fabricated $NbSe_2/WTe_2$ hybrid structures and investigated the proximity-induced superconductivity in topological Weyl materials (see Publications).

PROFESSIONAL EXPERIENCES

Conference reviewing

- sub-reviewer of the Conference on Neural Information Processing Systems (NeurIPS 2020)
- sub-reviewer of The Association for Computational Linguistics (ACL 2019)

Graduate Teaching Assistant at Georgia Institute of Technology

- Introduction to Signal Processing at Electrical and Computer Engineering (2019 Fall)

AWARDS AND RECOGNITIONS

ICML Diversity and Inclusion Fellowship	2020
Cox Fellowship from Georgia Tech	2019 - 2020
China National Scholarship — highest undergraduate scholarship nationally	2018
Chun-Tsung Scholar — honored by Chinese Undergraduate Research Endowment (CURE) awarded to less than 400 undergraduates nationally since its foundation	2018
First Prize of Outstanding Students Scholarship from Fudan — awarded to top 5%	2016
Outstanding Leadership Awards — honored to 10 student activity organizers per year	2018

SKILLS

Programming Languages	Python, MATLAB, Java, SQL, C/C++
Open Source Libraries	PyTorch, TensorFlow, Keras, scikit-learn, OpenCV, Gensim, etc.