Siyuan Shan

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Research Interests: Meta Learning, Set Modeling, Reinforcement Learning, Time Series Analysis

Education

University of North Carolina at Chapel Hill — Chapel Hill, NC
PhD in Computer Science — *Aug. 2018 – May 2023*

Beihang University — Beijing, China
Bachelor in Biomedical Engineering — *Aug. 2013 – May 2017*

Czech Technical University in Prague — Prague, Czech Republic
Exchange Student — *Aug. 2015 – Jan 2016*

Publication

Siyuan Shan, Vishal Baskaran, Haidong Yi, Jolene Ranek, Natalie Stanley and Junier Oliva. "Interpretable Single-Cell Set Classification with Kernel Mean Embeddings," in submission to *ISMB 2022*.

Vishal Baskaran, Jolene Ranek, **Siyuan Shan**, Natalie Stanley and Junier Oliva. "Rethinking Sketching of Multi-Sample Single-Cell Datasets," in submission to *ISMB 2022*.

Siyuan Shan, Lamtharn Hantrakul, Jitong Chen, Matt Avent, David Trevelyan. "Differentiable Wavetable Synthesis," in *ICASSP 2022*.

Siyuan Shan, Junier Oliva. "NRTSI: Non-Recurrent Time Series Imputation," in *Arxiv*.

Yang Li, **Siyuan Shan**, Qin Liu, Junier Oliva. "Towards Robust Active Feature Acquisition," in *Arxiv*.

Siyuan Shan, Yang Li, Junier Oliva. "Meta-Neighborhoods," in *Neural Information Processing Systems (NeurIPS)* 2020.

Yang Li, Haidong Yi, Christopher M Bender, **Siyuan Shan**, Junier Oliva. "Exchangeable Neural ODE for Set Modeling," in *Neural Information Processing Systems (NeurIPS)* 2020.

Meijun Liu, Jicong Zhang, Wenxiao Jia, Qi Chang, **Siyuan Shan**, Yegang Hu, Dangxiao Wang. "Enhanced executive attention efficiency after adaptive force control training: behavioural and physiological results," in *Behavioural Brain Research* 2019.

Siyuan Shan, Yi Ren. "Automatic Audio Tagging with 1D and 2D Convolutional Neural Networks" in *Detection and Classification of Acoustic Scenes and Events* 2018.

Yan Xu, **Siyuan Shan**, Ziming Qiu, Zhipeng Jia, Zhengyang Shen, Yipei Wang, Mengfei Shi, I Eric, Chao Chang. "End-to-end subtitle detection and recognition for videos in East Asian languages via CNN ensemble," in *Signal Processing: Image Communication* 2018.

Siyuan Shan, Wen Yan, Xiaoqing Guo, Eric I-Chao Chang, Yubo Fan, Yan Xu. "Unsupervised end-to-end learning for deformable medical image registration," in *Arxiv* 2017.

Experience

Graduate Researcher Aug 2018 – now

Advisor: Junier Oliva *Chapel Hill, NC*

- Developing a instance-wise feature selection algorithm based on Proximal Policy Optimization. We aim at improving the interpretability of machine learning models.
- Develop a multi-resolution time series imputation model NRTSI that is based on the attention mechanisms. Thanks to the non-recurrent nature, NRTSI does not suffer from the error componuding problem of previous works (e.g. NAOMI, LatentODE, NeuralCDE). NRTSI is inspired by the permutation-equivariant modeling of sets and achieves SOTA performance across 8 time series imputation benchmarks
- Develop a meta learning approach called Meta-Neighborhoods that learns a set of neighbors along with the model parameters and flexibly adapt the model using these neighbors at inference time. Better discriminative learning performance is achieved across a wide range of image classification datasets (e.g. CIFAR, CINIC, ImageNet, MNIST, SVHN) and regression datasets from the UCI machine learning repository
- Work on a set modeling model called ExNODE that adds beneficial inductive bias (e.g. permutation invariance and equivariance) to Neural Ordinary Differential Equation (NODE) to model sets. SOTA performance is achieved for point cloud classification, generation and temporal point cloud modeling

Graduate Researcher Mar 2021 – now

Advisor: Junier Oliva and Natalie Stanley *Chapel Hill, NC*

- Developing an interpretable single cell classification model. Our model achieves better performance than STOA methods Set Transformer and provides a better interpretability.
- Develop a single cell clustering model that is build on Gaussian Mixture Model. The model has n cluster centers and each center only has a subset of foreground features selected. L_0 regularization is applied to encourage the selected features to be sparse. There is another cluster center that handles background features.

Research Intern at ByteDance AI Lab May 2021 – Aug 2021

Advisor: Jitong Chen, Hanoi Hantrakul *Mountain View, CA*

- We propose a neural audio synthesize technique that learns a dictionary of one-period waveforms (i.e. wavetables).
- The waveforms are learned end-to-end with a neural network that uses an attention mechanism to combine the waveforms.
- We achieve high-fidelity audio synthesis with as little as 10 to 20 wavetables and demonstrate how a data-driven dictionary of waveforms opens up unprecedented one-shot learning paradigms on short audio clips. Our method is also fast enough for realtime and interactive audio synthesis.

Research Intern at ByteDance AI Lab May 2020 – Aug 2020

Advisor: Jitong Chen *Mountain View, CA*

- Extending GANSynth for flexible instrument sound generation by interpreting the latent space of GAN
- Our model can control several key aspects of the generated sounds, such as velocity, duration, distortion and reverb

Kaggle Freesound General-Purpose Audio Tagging Challenge Mar 2018 – May 2018

Advisor: Yi Ren *Beijing, China*

- Combine 1D ConvNets to process raw audio and 2D ConvNets to process Mel Spectrogram for audio classification
- Our team ranked 16/558 (top 3%) among all participants

Undergraduate Research Assistant May 2016 – July 2017

Advisor: Yan Xu *Beijing, China*

- Work on unsupervised medical image registration using U-Net and Spatial Transformer Network
- Work on video subtitle detection based on color histogram and recognition using CNNs

Undergraduate Research Assistant Feb 2016 – Apr 2016

Advisor: Jicong Zhang *Beijing, China*

- Work on a project of exploiting patterns that are indicative of sustained attention from EEG data

Technical Skills

Languages: Python, C/C++, MATLAB, Latex
Deep Learning Frameworks: Pytorch, TensorFlow, Keras, Caffe

Activities

Reviewer for ICML 2021, NeurIPS 2021, ICLR 2022
Ranked 16/558 (top 3%) Kaggle Freesound General-Purpose Audio Tagging Challenge

Awards

Outstanding Graduates of Beihang University, 2017
National Scholarship, 2015