

HAOYUE DAI

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AREAS OF INTERESTS

Explainable AI, Causality, Machine Learning, Computer Vision

EDUCATION

School of Electrical Information and Electrical Engineering, Shanghai Jiao Tong University 09/2017 to present

- B.Eng. in Computer Science
- Overall GPA: **3.81/4.3**, Rank: **19/109**. Junior year GPA: **4.09/4.3**, Rank: **5/109** in IEEE Honor Class

Zhiyuan College, Shanghai Jiao Tong University 03/2018 to present

- Zhiyuan Honor Program of Engineering (an elite program for top 5% students in SJTU)

Department of Electrical Engineering, University of Washington 07/2018 to 08/2018

- Courses Completed: C Programming, Embedded Systems Design and Circuit Theory

RESEARCH EXPERIENCE

From Ambient Dependency to Causal Discovery | Microsoft Research Asia (MSRA)

Advisor: [Justin Ding](#) (Senior Researcher at Data, Knowledge, Intelligence (DKI) group, MSRA) 07/2020 to present

- Proposed feature engineering method with completeness and soundness proof on structural causal model, which makes it possible to fully leverage ambient variables data sample distribution for cause-effect orientation
- Integrated constraint-based approach with machine learning to boost performance while not sacrificing interpretability
- Optimized approximation in conditional independence test and trigger condition strategy based on all-round empirical studies
- Driven by our state-of-the-art skeleton learning algorithm, anytime/ local/ global scenarios and reliability were also considered

What do CNN neurons learn: Visualization & Clustering | Shanghai Jiao Tong University

Advisor: [John Hopcroft](#) (A.M. Turing Award, Professor of Cornell University) 11/2019 to 02/2020

- Focused on interpreting CNN from aspects of adversarial samples visualization and attention path clustering
- Created an effective method to figure out what neurons learn in CNN, by visualizing the input image's focus and reception regions, as well as its feature map spanning vectors in affine subspaces for category prediction
- Designed an unsupervised clustering algorithm to distribute image categories into lower dimension with hierarchy defined
- Extended the clustering algorithm to construct a filter-wise prediction tree, explicitly indicating which neurons are highly activated in a concrete prediction, and ulteriorly generating the corresponding semantic path

Interpretation of Speech Recognition ConvNets | Shanghai Jiao Tong University

Advisor: [Quanshi Zhang](#) (Associate Professor of John Hopcroft Center for Computer Science) 03/2019 to 11/2019

- Aimed to propose a method to quantitatively characterize a voice sample's significance on different speech recognition models
- Constructed a novel method of interpretation analysis: to disperse voice spectrum along frequency domain
- Worked out the differentiable version of dispersion method and implemented the accelerated parallel algorithm in ArrayFire
- Reconstructed the letter-based gated ConvNets wav2letter frame to validate it in interpretation analysis
- Conducted experiments and developed a series of well-packaged utilities like IFFT speech regeneration, noise coverage, mask separation, intermediate layers parameter visualization, etc.

Explain Mid-Layers in Convolutional Neural Networks | Shanghai Jiao Tong University

Advisor: [Quanshi Zhang](#) (Associate Professor of John Hopcroft Center for Computer Science) 09/2018 to 03/2019

- Learned e2e interpretable models and built measurement method for the semantic information of intermediate layers
- Implemented statistical description in evaluation metric to distinguish different saliency visual patterns (e.g., part, texture), which are memorized/ co-activated in the filters at middle layers
- Comprehensively learned the operation of machine learning frameworks like TensorFlow, MatConvNet. Especially skilled in using PyTorch to construct deep neural networks and do further interpretation analysis

Automatic Paper Illustration Figures Generator | University of California San Diego

Advisor: [Pengtao Xie](#) (Assistant Professor of Electrical and Computer Engineering Department) 03/2020 to 06/2020

- Investigated the feasibility of automatically/ semi-automatically generating paper figures from view of contrastive learning
- Designed diagrams dataset and the corresponding algorithms to analyze graph vectors in a semantic level
- Studied models on text2image synthesis, improving their adaptation in various domains using neural architecture search

SELECTED COURSE PROJECTS

Multi-category Classification: Basic Methods & Implementation from Scratch

03/2020 to 06/2020

Course Project of Machine Learning (Offered by [Quanshi Zhang](#))

- Implemented and optimized four different techniques (logistic regression, support vector machine, linear discriminant analysis and neural networks) from scratch, with effectiveness almost reaching mainstream machine learning packages
- Collected observations based on numerous trials on MNIST handwritten digits dataset to testify algorithm principles
- Compared the performances between different models, different scaled datasets and different optimizer scheme with analysis on feature maps by using PCA, visualization methods, grad-CAM, etc.

dHealth: A Decentralized Health Code Application

03/2020 to 06/2020

Course Project of Computer Network (Offered by [Na Ruan](#))

- Background: Under the COVID-19 pandemic, health code systems are carried out. Despite the effectiveness to control the public contagion risk, its transparency, confidentiality, and privacy abuse for digital surveillance issues are questioned
- Developed a decentralized health code system, enabling assessments on public areas without a centralized management
- Designed smart contract and easy-to-plug API which makes score evaluation process transparent to everyone
- Deployed blockchain protocol to distributedly store users' data with extreme fault tolerance

Poem Inspire: An Image-Poem Coupled Search & Generation Engine

09/2018 to 12/2018

Course Project of Introduction to Electrical Engineering C (Offered by [Ya Zhang](#) and [Dazhi He](#))

- Provided lexical semantic prediction & expansion model to give synonym clustering between classical and modern Chinese
- Conducted a Recurrent Neural Network model independently, which generates classical Chinese quatrain from images with widely expanded options from ancient keywords to phonologic features
- Fine-tuned a deep coupled visual-poetic embedding model by multi-adversarial training, which can generate Chinese modern poems from image. A pipeline from image feature to poetic clues is built from two discriminative networks

Flappy Bird on Arduino

07/2018 to 08/2018

Course Project of C Programming & Embedded Systems Design, 3.9/4.0 (Offered by [James Peckol](#))

- Transplanted the mobile game to LED display driven by single chip micro-processor independently
- Applied stochastic oscillator to promote the game's playability

Acemap-Lite: A Powerful Academic Search Engine

03/2018 to 07/2018

Course Project of Introduction to Electrical Engineering B, 93/100 (Offered by [Xinbing Wang](#))

- Implement the clustered academic database using techniques of web crawler and data-mining
- Determined semantic analysis methods to build academic portrait for scholars and predict the possible relationship between scholars, with Naive Bayesian Classifier applied
- Developed the recommendation system based on Neural Collaborative Filtering

HONORS & AWARDS

Chenhao Alumni Scholarship (5 among 800)

2019

Arawana Scholarship (1 among 110)

2018

Zhiyuan College Honor Scholarship (Top 5%)

2018-2020

SJTU Academic Excellence Scholarship (Top 10%)

2018-2020

SKILLS

50k+ LoC: Python (PyTorch, TensorFlow, Numpy)

10k+ LoC: C#, C, C++ (Flashlight, ArrayFire)

1k+ LoC: Coq, Matlab (MatConvNet), Java, PHP, Verilog HDL, Web Development (HTML, CSS, JavaScript), LaTeX

ENGLISH PROFICIENCY

College English Test 4: 621 College English Test 6: 636

GRE: Verbal - 155 Quantitative - 170 Analytical Writing - 3.5

TOEFL: Not taken yet