Ce ZHANG

Personal Homepage: https://zhangce.netlify.app/
+86 150-7127-4102 zhangce.sustech@gmail.com 2001-12-03

Education Background and Academic Performance

- **Southern University of Science and Technology (SUSTech), Shenzhen** **2019.9 - 2023.6**
- **Communication Engineering** **GPA:** 3.91/4.00 **Percentage Grade:** 94.27/100 **Major Ranking:** 1/31
- **Some Major Courses(scores given)**: Artificial Intelligence(96), Linear Algebra(100), Probability and Statistics(96), Data Structure and Algorithm Analysis(100), Introduction to Computer Programming(98)

Personal Projects

Research Experiences:

#1. (ML - Time Series) Development of Multi-Scale Self-Referential Correction Networks (MSRCN) for robust time series forecasting. **2022.5 - 2022.9**

- Propose to characterize the prediction error by a self-referential error evaluated on a forward-backward prediction loop and adaptively adjust the prediction for each test series based on the self-referential error.
- Extend self-referential correction to multiple time scales to enable better capture of correlation and patterns of change in time series data.
- Fuse the error vectors obtained from the multi-scale error correction networks and the differential vector information together for joint error correction.
- **Research Output: The MSRCN algorithm achieves state-of-the-art results on several publicly available datasets (e.g. ETT and PeMS); a third-author paper is submitted to *AAAI 2023*.**

#2. (CV - Pose Estimation) Development of Self-Correctable and Adaptable Inference (SCAI) network with prediction error characterization and correction in pose estimation task. **2022.3 - 2022.7**

- Develop novel ways to address the performance degradation or generalization problem occurring as a well-trained prediction network model is used for new test samples.
- Partition the body keypoints into 6 structural groups, each corresponding to a body part, inside which the group of keypoints are connected during motion.
- Design and learn a fitness feedback network that maps the prediction result of the prediction network back to the input sample, which collaborates with the existing forward prediction network. Build a prediction error correction network (the 3rd network) to adjust the prediction results using the self-matching error, formed during by the loop prediction of forward prediction and fitness feedback networks.
- **Research Output: The SCAI approach makes the model learnable at the inference stage; on MS COCO-testdev dataset, our method improves upon the current best method by up to 1.4%; a third-author paper is submitted to *AAAI 2023*.**

#3. (AI - Differential Equations) Research on data-driven AI automated scientific exploration topics, using a small amount of observational data to learn evolution operators with neural networks. **2021.9 - 2022.5**

- Use experimental observational data to learn the physical equations (ODE & PDE) behind them by a neural network approach.
- Introduce a joint spatial-temporal evolution network which incorporates spatial dynamics modeling into the temporal evolution prediction for robust learning the evolution operator with very few samples.
- Discover new locations to collect more critical samples based on multi-step reciprocal prediction error generated by a prediction loop of forward and backward networks.
- **Research Output: The proposed method can dramatically reduce the numbers of samples needed for effective learning and accurate prediction of evolution behaviors of unknown dynamic systems by up to 100 times; a first-author paper is under peer review in *NeurIPS 2022*.**

#4. (CV - Semantic Segmentation) Brain tumor segmentation task using U-Net, an Imperial College London's data science summer school. [Codes] **2021.7 - 2021.9**

- Load datasets via Keras, preprocess and augment data on images, build U-Net, Res-UNet and U^2-Net networks, and use dice loss for optimization.
- The network built performed well in the final evaluation and received the highest grade of A.

Course Projects:

#1. (Application Design) Calculator and music player applications design and implementation with Google Android Studio. [Report] [Video] **2022.2 - 2022.6**

- Design numerical and operational buttons and implement the basic mathematical operations (addition, subtraction, multiplication and division) for the calculator application. Support advanced mathematical operations like square root, reciprocal and factorial.
- Design seek bar, song list and functional buttons, implement start, pause, continue and exit functions and support page jumping for the music player application.
- Develop light and dark mode user interfaces for both applications and all the functions work properly on real mobile devices.

#2. (Artificial Intelligence) Dimensionality reduction, feature clustering, image classification and performance evaluation on MNIST dataset. [Codes] [Report] [Slides] **2021.11 - 2022.1**

- Implement unsupervised Principal Component Analysis (PCA) and supervised Linear Discriminator Analysis (LDA) to project images on 784-dimensional pixel space to vectors on 2-dimensional feature plane.
- Cluster the data points on the 2-dimensional plane based on centroid-based K-means, connectivity-based hierarchical clustering and distribution-based Gaussian mixture model algorithms.
- Adopt Support Vector Machine (SVM) with Radial Basis Function (RBF) kernel and neural network classifiers, evaluate the classification performance based on Receiver Operator Characteristic (ROC) curves and Area Under Curve (AUC) values.

#3. (Computer Networks) P2P file transfer system protocol design, implementation and performance comparison with Server-Client model in Python. [Codes] [Slides] **2021.9 - 2021.12**

- Build the file transfer protocol between tracker and multiple clients, and implement the register, download, cancel and close functions of clients. Prioritize high uplink bandwidth nodes and actively choke nodes with sudden drops in uplink bandwidth. Accelerate file transfer efficiency while ensuring reliable data transfer.
- Design the specific information stored on the tracker, the API provided by the tracker to the clients and the communication rules and message formats between the tracker and the clients.
- The file transfer efficiency of the designed P2P protocol outperforms the traditional Server-Client model by 176% in benchmarking test scenarios.

#4. (Software Development) Halma (checker) game development in Java. [Codes] [Slides] **2020.3 - 2020.6**

- Support all basic rules of Halma (including valid move judgement and anomaly detection, etc.), and can initialize the game and automatically detect the winning status in a match.
- Support match saving on JSON files and develop on-line mode in Local Area Network (LAN).
- Develop multiple graphical user interface (GUI) themes using Java Swing, add sound effects and background music and play smooth animations on every chess movement.
- Design Human vs. Machine mode and implement minimax and advanced alpha-beta pruning algorithm for intelligent machine decision-making.

Publications and Preprints

- **Ce Zhang**, Siqi Wu, Kailiang Wu, Zhihai He (2022). Critical Sampling for Robust Evolution Behavior Learning of Unknown Dynamical Systems. In *NeurIPS 2022* (under peer review).
- Zhehan Kan, Shuoshuo Chen, **Ce Zhang**, Yi Zhang, Zhihai He (2022). Multi-Scale Self-Referential Correction Networks for Time Series Forecasting. In *AAAI 2023* (submitted).
- Zhehan Kan, Shuoshuo Chen, **Ce Zhang**, Zihan Liao, Zhihai He (2022). Self-Correctable and Adaptable Inference for Generalizable Human Pose Estimation. In *AAAI 2023* (submitted).

Honors and Awards

- The First Prize of Outstanding Student Scholarship for the academic year 2019-2020, 2020-2021 (top 5%).
- Academic Star of Shuli College of SUSTech for the academic year of 2020-2021, 2021-2022 (top 2%).
- Meritorious Winner in Mathematical Contest in Modeling 2022 (Top 9.5%).
- National Second Prize in Contemporary Undergraduate Mathematical Contest in Modeling 2021 (Top 2%).
- Successful Participants in Mathematical Contest in Modeling 2021.
- Member of the Innovative Experimental Class of the Department of Electronic and Electrical Engineering.
- Outstanding Tutor of SUSTech 8th & 9th Peer-Supporting Class Project (Linear Algebra Course).

Computer Skills

Languages	Python, Java, C/C++, MATLAB, LaTeX
Data Analysis	PyTorch, Keras, Numpy, Scikit-learn, Pandas, Matplotlib, Seaborn, SPSS
Other Skills	Application design: Android Studio, STM32 development: Keil/STM32CubeIDE