ZHEN BIAN

School of Microelectronics Science and Technology, Sun Yat-Sen University, P.R. China
+86 18910507413 | bianzh5@mail2.sysu.edu.cn | Personal Website

EDUCATION

Sun Yat-sen University Guangdong, China
Bachelor's Degree of Engineering, Microelectronics Science and Engineering September 2020 – Present

- GPA: 3.8/4.0
- Selected courses: Discrete Mathematics (100 1/82), Numerical Analysis (97 1/79), Physics (92 9/74), Advanced Mathematics (97 5/88), Micro-fabrication Technology (97 4/77), Analog IC (90 14/85)

SELECTED HONORS AND PUBLICATIONS

- First Author, "EEG-based PD Classification Model Coupled with Machine Learning" accepted by 2023 3rd International Conference on Biomedicine and Bioinformatics Engineering (ICBBE) 2023
- The 2nd Prize Award of Asia and Pacific Mathematical Contest in Modeling (Provincial) 2022
- The 3rd Excellent Students' Prize Scholarship (Intramural) 2022
- The 3rd Prize Award of Contemporary Undergraduate Mathematical Contest in Modeling (Provincial) 2021
- The Progress Scholarship (Intramural) 2021

SELECTED RESEARCH AND PROJECT EXPERIENCE

A*STAR, Institute for Infocomm Research (I2R) Singapore
Research Assistant to Senior Principal Scientist Kai Keng Ang August 2023 – Now

HCCSP: combining Histogram based Contrast with Common Spatial Patterns (CSP) for interpretable quality evaluation algorithm on motor imagery EEG data

- Reviewed literature regarding popular clustering algorithms, re-constructed the models in Python;
- Built Python codes to perform Source Estimate on EEG signals and projected the results on the cortical surface in 3D view for convenient analysis;
- Worked on combining the Self-Organizing Maps (SOM) and Kullback-Leibler Divergence to make CSP-based interpretable clustering of different EEG sessions;
- Proposed a novel and efficacious evaluation algorithm implanting the Histogram based Contrast(HC) from the Computer Vision Field to execute CSP recognition to measure the data quality and predict its performance before classification;
- In preparation for the Manuscript.

Research Assistant to Senior Principal Scientist Kai Keng Ang September 2023 – Now

Enhancing Session-to-Session Stability in Large Motor Imagery EEG Datasets through an Interpretable Clustering Adaptive Strategy

- Reviewed literature regarding FBCSP and FBNet, re-constructed the models in Python;
- Ran the classic MI EEG classification models on several large datasets;
- Proposed a novel classification strategy for a large MI EEG dataset based on clustering to improve the transfer learning method on large datasets;
- Working on combining the strategy with the Spiking Neural Network (SNN) to improve the session-to-session non-stationary problem.

Sun Yat-sen University Guangdong, China
Independent Research Project January 2023 – April 2023

An EEG-based Parkinson's Disease Classification Model Coupled with Machine Learning

- Created a novel system for computer-aided diagnosis that is capable of extracting features from EEG signals and identifying patients affected by Parkinson's disease;
- Used Butterworth filter to decompose the signals into four frequency sub-bands, then extracted Welch's PSD features;
- Set Welch's PSD features as the input of k-Nearest Neighbor (KNN) to classify EEG features into Parkinson's disease (PD) and healthy controls (HC);
- Employed the 10-fold cross-validation to validate the performance of this model, and the results achieved 98.82% accuracy, 99.19% sensitivity, and 91.77% specificity;
- The Paper "EEG-based PD Classification Model Coupled with Machine Learning" was accepted by the 2023 3rd International Conference on Biomedicine and Bioinformatics Engineering (ICBBE)

Research Assistant to Associate Professor MingYu Wang September 2022 – April 2023

A Self-Driving Robot based on ZYNQ-7000

- Built ROS environment for the robot and got the Point Cloud Data and RGB Infrared Visual Data from the binocular camera;
- Applied the SLAM algorithm with the binocular camera to the robot;
- Implanted Ubuntu18.04 LST system on the development board ZYNQ-7000.

Research Assistant to Associate Professor Shuyan Zhu and Assistant Professor Yao Liu April 2022 – July 2022

A Small circuit footprint and compact S-Box architecture over Finite Field applied in AES

- Reviewed literature about inverters over Finite Field, Affine Transformation, and Field Extension;
- Built the AES S-Box with the Tower Field architecture with optimal parameters to lower its compactness;
- Worked to find a general algorithm of field transformation to explore all the possibilities of the field extension to find a faster field transformation architecture for AES S-Box generating.

Research Assistant to Associate Professor Shuyan Zhu January 2022 – April 2022

A Low Complexity Polynomial Multiplier applied in the AES Algorithm over GF(2^{128})

- Reviewed literature about the AES Algorithm, Finite Field Multiplier, and Faster Multiplication Algorithm;
- Reproduced the AES algorithm by Python, Cpp, and Verilog, and tested the algorithm on FPGA;
- Tested the complexity of the SBM multiplier, M-term Karatsuba-like multiplier, Toom-Cook's algorithm, and LCBA multiplier while applied in AES;
- Implanted Toom-Cook's algorithm for the multiplier in AES.

Asia and Pacific Mathematical Contest in Modeling November 2021

An Automatic Measurement System for Industrial Products' Contour Monitor

- Built the measurement system using OpenCV and used the Laplacian algorithm to detect the edge of images;
- Combined the Camera calibration methods with the Sub-pixel interpolation methods to increase the precision;
- Achieved high accuracy in products' contour segmentation and measurement;
- Won the 2nd Prize in the contest.

Course MST210 under the instruction of Assistant Professor Jun Wang May 2021

A MIPS 5-Stage Pipeline CPU Architecture with Hazard Handling

- Built a 5-stage pipeline MIPS CPU architecture using Verilog, and tested it on FPGA with Vivado;
- Used Harvard architecture and Pipeline Stalling to handle the structure hazard and control hazard;
- Combined the Pipeline Stalling with Data Push Forward to handle the data hazard.

COMPUTER AND LANGUAGE SKILLS

- Programming skills: Python, Verilog, MATLAB, C&Cpp, Assembly Language, LaTeX, MarkDown;
- Electric circuit simulation tools: Vivado, Virtuoso, Proteus, AutoCAD;
- Languages: Chinese (native), English (fluent)
- TOEFL Best Score: 107 (Reading: 30 Listening: 29 Speaking: 23 Writing: 25)
- GRE: 322 (Verbal: 152 Quantitative: 170)

RESEARCH INTERESTS

- Brain-Computer Interface, Neural Prosthesis
- Human-Computer Interface
- Applications of Machine Learning

LEADERSHIP AND EXTRACURRICULARS

- MST Department Student Council October 2020 – July 2022
- Excellent Student Cadre of Sun Yat-sen University October 2022
- Interests: Fitness, Photography, Cycling, Sketch.