Hao Wang

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EDUCATION

Beijing Normal University, Beijing, China 09/2018-07/2021 (Expected)

- **M.Eng.** in Computer Science and Application, State Key Laboratory of Cognitive Neuroscience and Learning & IDG/McGovern Institute for Brain Research. Advisor: Dr. Zheng Li **GPA**: 3.6/4.0
- **Dissertation**: *Decoding Algorithms for Motor Cortical Brain Computer Interfaces Based on spikes and Phase-of-firing Encoding*

Anhui Normal University, Wuhu, China 09/2014-06/2018

- **B.Eng.** in Computer Science and Technology **GPA**: 3.5/5.0

PUBLICATIONS & COPYRIGHTS

- Zhang C., **Wang H.**, Tang S., et al. (2019) Rhesus Monkeys Learn to Control a 2D Bio-feedback Brain Machine Interface. Submitted to *Frontiers in Neuroscience*.
- **Wang H.**, Li Z., et al. (2020) Review of nonlinear decoding algorithms for motor intracortical brain-machine-interfaces. (In preparation)
- **Wang H.**, Yu Q., et al. (2017) Wuhu Intelligent Bus Information Management System (Software Copyright Sign ID: 2017SR298147).
- Zhang W., Xia Y., **Wang H.**, et al. (2018) Android-based Personal Memo (Software Copyright Sign ID: 2018SR725750).

RESEARCH / PROJECT EXPERIENCE

Decoding Algorithms of Motor Cortical Brain Computer Interfaces Based on Phase-of-firing Encoding with Rhesus Monkey 09/2018-Present

- Used CiteSpace to visualize all relevant papers of motor cortical BCI decoding algorithms in Web of Science and wrote bibliometric analysis report
- Trained the monkey to control the joystick for finishing 'center-out' behavior task
- Revised BMI3 software suite code (C++) for collecting neural data and decoding motor intention to computer screen
- Took surgeries on monkeys including implanting headpost and electrode array, took care of monkey's postoperative wound
- Summarized and optimized the preoperative preparation and operation procedure about monkey's headpost and Utah electrode implantation, documented the entire surgical procedure for future use
- Conducted Rhesus monkey electrophysiology experiments and collected neural data from implanted electrode array
- Found that Spike Triggered Average is different in different phases of Local Field Potentials (LFP) in motor cortical neural signals, selected important features such as the power value, amplitude, phase of different bands of LFP to encoding modal
- Kalman Filter (KF), Unscented KF, Stochastic State Point Process Filter, RNN, LSTM and other algorithms are used to offline decode the macaque's neural data to its motor intention. Estimate covariance of a matrix of data using shrinkage to reduce variance in the case where the number of dimensions is large versus the amount of data available
- Compared the performance of the decoders on Jupyter Notebook

Low-intensity Transcranial Ultrasound Stimulation on Rhesus Monkey 09/2019-Present

- Conducted Magnetic Resonance Imaging (MRI) scanning of a monkey for acquiring whole brain MRI image data of the monkey for preparing low-intensity transcranial ultrasound stimulation, utilized FSL-fast and BrainSight to perform segmentation of the 3D reconstruction of skull
- Configurated Transcranial Magnetic Stimulation (TMS) and Low-intensity Transcranial Ultrasound Stimulation devices and stimulated the primary motor cortex and of a rhesus monkey and tuned the parameters of devices according to the reaction of the monkey's behavior

Explore which customer characteristics are meaningful for predicting cellphone customer loss based on SVM with R language 10/2019-12/2019

- Explored descriptive statistical information of customer characteristics
- Implemented Support Vector Machine (SVM) to do data classification, chose the penalty factor of SVM and visualized the SVM model, tuned other SVM parameters

- Use ‘caret’ package to find highly correlated features and select features
- Computed the confusion matrix to evaluate the predictive performance of the model using k-fold cross-validation, drew ROC curves and compared performances of different models
- Obtained resampled data and visualized statistical information of each model, including ROC, sensitivity, specificity

Handwritten digits (MNIST dataset) recognition based on deep learning 11/2019-12/2019

- On the Google Colaboratory cloud server platform, via Keras framework, used the combination of convolutional layers and pooling layers to complete the feature extraction of digital images, and completed feature nonlinear classification through the fully connected layer. The final image recognition prediction accuracy is 99.12%
- Designed convolutional autoencoder and denoising convolutional autoencoder. Specifically, the loss function is mean squared error and SGD optimization is used to train the network. Explored the impact of the number of training iterations on image reconstruction

LEADERSHIP / SERVICE

Vice President, Graduate Student Union, Beijing Normal University 09/2018-06/2019

- Took charge of organizing campus activities, especially the badminton competitions
- Led members to publicize the activity by designing posters, prepared the activity by confirming competition site and equipment
- Wrote a program for badminton competition registration to elevate the efficiency of tackling registration information
- Undertook the competition management and order maintenance work

Student Assistant, Administrative Office of State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University 09/2018-06/2019

- Took responsible for administrative affairs in the office, such as received, delivered, and printed documents, sorted out all kinds of materials, etc.
- Recovered essential missing data while the computer crashed, repaired broken computers, helped teacher to reinstall the computer system
- Participated in organizing Graduation Ceremony, including site management and order maintenance
- Helped teachers to put thousands of exam papers in order and classified thousands of test papers

SELECTED HONORS / AWARDS

- The 2st Class Scholarship, Beijing normal University 2020
- The 1st Class Scholarship, Beijing normal University 2019
- Excellent Graduate cadres, Beijing Normal University 2019
- The Outstanding public welfare contribution award, State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University 2019
- Freshman Scholarship, Beijing Normal University 2018
- The Postgraduate Scholarship, SKL of Cognitive Neuroscience and Learning, Beijing Normal University 2018
- Outstanding Undergraduate's Dissertation, Anhui Normal University 2018
- Undergraduate Scholarships (totally 3 times), Anhui Normal University 2014-2017
- The 2nd Prize in the 4th ACM Program Design Competition, Wuhu city 2014

SKILLS & OTHER

- **Computer Skills**:
  - **Languages**: MATLAB, C++, Python, R, LaTeX, C#, Java
  - **AI & Machine Learning**: TensorFlow, Keras, Caffe, Pytorch, Scikit-learn, Google Colaboratory
  - **Data Analytics Skills**: data mining, database using SQL, machine learning both supervised (decision tree, random forest, SVM, and logistic regression) and unsupervised (clustering, visualization), deep learning models
  - **Miscellaneous**: Linux, Docker, Git, Inkscape
- **Neurobiological Technique**: Beijing laboratory animal practitioner certificate, Monkey training, Neurosurgical procedures, Electrophysiology experiment, MRI experiment qualification
- **Hobbies**: Boxing, Taekwondo, swimming, basketball, table tennis, badminton