Li Shen, Ph.D.
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Summary

Biomedical engineering Ph.D., experienced data scientist and neuroengineer with 10+ years of research in developing and utilizing innovative engineering and data analysis approach in multiple fields, especially in decipher brain circuits underlying sensory and emotions, published 8 research papers in leading neuroscience journals including *Nature Neuroscience* and *Neuron*; proficient in programming and data analysis.

Education

- Ph.D. in Biomedical Engineering (2010-2017), Tsinghua University, China
- Bachelor's in biomedical engineering (2006-2010), Tsinghua University, China

Skills

- **Programing languages**: Python, Matlab, C, C++, R, SQL, Java
- **Data analysis and visualization tools**: pandas, scipy, statsmodels, matplotlib, plotly, seaborn, opencv, qt, nltk, scikit-learn, keras, tensorflow
- **Statistical inference and machine learning algorithms**: GLM, SVM, PCA, K-means, decision-tree, deeo learning (CNN, YOLO, LSTM, HMM) etc.
- **Signal processing**: time-serial analysis, time-frequency analysis, audio signals, image/video processing, electroencephalogram (EEG), electromyography (EMG), high bandwidth *in vivo* neurological data, spatial data (ArcGIS)
- **Neurological experiment skills**: animal surgery, awake electrophysiological recording, optogenetics, pharmacogenetics manipulation and behavioral test, *in vivo* fiber photometry calcium imaging, histology, anatomical tracing, microscopy and optics
- **Building and programming instrumentations**: FPGA, DSP, MCU, Arduino, Zigbee, LabVIEW, 3D modeling (Maya), virtual reality(Unity)

Experience

➢ **Postdoctoral Scholar & Research Associate (2017-, University of Southern California, USA)**

- Built an awake multi-channel electrophysiology recording and processing platform for rodent, employed in all relevant studies by all lab members (data acquisition, FPGA programming, GUI design, spike sorting, and data analysis in *MATLAB* and Python)
- Developed multiple experimental instruments or toolboxes for behavior assay (e.g., self-stimulation box for addiction assessment, reward learning behavior setup, sleep-cycle auto-scoring toolbox based on EEG and EMG, automatic behavior control toolbox with video-based animal tracking, licking detection in Python, *MATLAB*, and C++/*Arduino).*
- Discovered neural pathways for sensory and emotion processing (using the recording platform, behavior setups, optogenetics/pharmacogenetics manipulation, *in vivo* imaging, anatomical tracing techniques)

➢ **Graduate Research Assistant (2010-2017, Lab of Neural Engineering, Tsinghua University)**

- Revealed the neural mechanism underlying novel sounds processing using *in vivo* multi-channel electrophysiology recording in the rat.
- Built a two-layer neural network and a neural-based mechanistic model to simulate the neuronal architecture

for novel sound processing.

- Characterized the neural mechanism for spectro-temporal processing of natural sounds using *in vivo* recording and kernel methods.
- Designed and implemented home appliances wireless controller based on Zigbee protocol for EEG Brain-Computer Interface system (EEG data acquisition and analysis, electronic circuit design, micro-controller programming with C, GUI design with *MATLAB*, system testing)

➢ **Visiting scholar (2010, 2012, CINACS International Graduate Research Group, University Medical Center Hamburg-Eppendorf, Germany)**

- Performed *in vivo* multi-sites simultaneous recording in ferret inferior colliculus and superior colliculus to study auditory and visual cross-modal processing.

➢ **Exchange student (2009, Johns Hopkins University, USA)**

- Designed and performed psychophysical experiments on human subjects and mathematical modeling of self-generated sound perception.

Publications

- Zhang G, **Shen L**, Tao C, Peng B, Jung A, Li Z, Tao HW, Zhang LI (2021). Medial Preoptic Area Antagonistically Mediates Stress-induced Anxiety and Parental Behavior. *Nature Neuroscience*. https://doi.org/10.1038/s41593-020-00784-3.
- Zhang G, **Shen L**, Li Z, Tao HW, Zhang LI. Track-Control (2019). An automatic video-based real-time closed-loop behavioral control toolbox. Preprint at *bioRxiv* DOI: 10.1101/2019.12.11.873372.
- Wang X, Chou X, Peng B, **Shen L**, Huang JJ, Zhang LI, Tao HW (2019). A cross-modality enhancement of defensive flight via parvalbumin neurons in zonal incerta. *eLife*. 8: e42728.
- Zhang G, **Shen L**, Zhong W, Xiong Y, Zhang LI, Tao HW (2018). Transforming Sensory Cues into Aversive Emotion via Septal-Habenular Pathway. *Neuron*. 99: 1016-1028.
- Chou X, Wang X, Zhang Z, **Shen L**, Zingg B, Huang J, Zhong W, Mesik L, Zhang LI, Tao HW (2018). Inhibitory gain modulation of defense behaviors by zona incerta. *Nature Communications*. 9:1151.
- Zhang G, Sun W, Zingg B, **Shen L**, He J, Xiong Y, Tao HW, Zhang LI (2018). A Non-canonical Reticular-Limbic Central Auditory Pathway via Medial Septum Contributes to Fear Conditioning. *Neuron*.97:406-417.
- **Shen L**, Zhao L, Hong B (2015). Frequency-specific adaptation and its underlying circuit model in the auditory midbrain. *Frontiers in Neural Circuits*. 9:55.
- Zhao L, Liu Y, **Shen L**, Feng L, Hong B (2011). Stimulus-specific adaptation and its dynamics in the inferior colliculus of rat. *Neuroscience*. 181(5):163-174.

Selected conference presentations

- **Shen L**, Yan Y, Guo N, Hong B. Functional connectivity for spectro-temporal processing of neighboring neurons in the inferior colliculus. Oral talk at 2015 *Advances and Perspectives in Auditory Neurophysiology (APAN)*, Chicago, USA.
- **Shen L**, Yu Z, Hong B, Rinzel J. A minimal neuromechanistic model for stimulus-specific adaptation (SSA). Poster presentation at 2014 *MidWinter Meeting of the Association for Research in Otolaryngology (ARO)*, San Diego, USA.