

Tong Shan, M.Sc.

Biomedical Research Scientist

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I am an analytical and solutions-focused research scientist with a wealth of experience and expertise in data analysis, signal processing, statistics, and machine learning. Currently pursuing a Ph.D., I possess an aptitude for crafting innovative solutions and devising efficient strategies. Leveraging my industry insights and robust academic background, I am committed to propelling advancements in the realm of biomedical science and technology. As an innovative and tenacious professional, I take initiative and strive to foster collaboration with effective interpersonal communication skills.

KEY EXPERTISE

Biomedical Engineering | Signal Processing | Neuroscience | Neurophysiology
Electroencephalogram (EEG) & Magnetic Resonance Imaging (MRI)
Computational Modeling | Experiment Design | Data science | Statistical Analysis
Machine Learning (ML) | Artificial Intelligence (AI) | Cross-functional Communication | Scientific Writing
Languages: English (Professional), Mandarin (Native), Japanese (Elementary)

TECHNICAL & SOFTWARE SKILLS

Programming Skills: Python (NumPy, Pandas, SciPy, PyTorch, scikit-learn, MNE), MATLAB, R, SAS, Linux, Git
Office Skills: Google Suite, Microsoft Office Suite (Word, Excel, PowerPoint, Outlook)
Art Skills: Game development (Unity), audio production (Logic Pro X, Max/MSP), Graphic design (Adobe Photoshop)

EDUCATION & PROFESSIONAL DEVELOPMENT

Ph.D., Biomedical Engineering – Neuroscience/NeuroEngineering, GPA: 3.7/4.0 | University of Rochester Aug 2018 – April 2024

- **Relevant Coursework:** Ai&Deep Learning-Healthcare, Computer Audition, Machine Vision, Digital Signal Processing, Intro to Neuroengineering, Integrative Neuroscience, Intro to Augmented and Virtual Reality, Speech on the Brain, Music & the Mind

Master of Science in Biostatistics, GPA: 4.0/4.0 | Northwestern University Jun 2017 – Jun 2018

- **Relevant Coursework:** Advanced Biostatistics, Statistical Inference, Applied Statistical Programming (R/SAS)

Bachelor of Science in Medical Imaging | Sichuan University Sep 2012 – Jun 2016

PROFESSIONAL EXPERIENCE

RESEARCH SCIENTIST INTERN | Meta - Reality Labs Research, Redmond, WA, USA May 2023 – Sep 2023

- Led a research project within the audio team at Reality Labs Research, focused on improving auditory experiences in AR/VR devices through neurophysiological signal analysis on a prototype firmware (subject to NDA).
- Independently initiated, designed, and executed the entire experiment pipeline, employing Python for data collection, signal processing, data analysis, and machine learning algorithms that successfully extract meaningful insights from noisy neurophysiological data on wearable devices.
- Collaborated effectively with cross-functional teams fostering innovation and knowledge sharing in a dynamic research environment.

RESEARCH ASSISTANT | Huaxi MR Research Center (HMRR), Sichuan University, Chengdu, China Jun 2016 – Apr 2017

- Gathered, analyzed, and processed data in functional MRI & Diffusion Tensor Imaging (DTI) while managing the projects in the lab.
- Conducted a research project in quantifying white matter changes through DTI in earthquake survivors and healthy people by utilizing a computational toolbox model on MATLAB software with statistical analysis.
- Resulted in a paper publication.

TEACHING ASSISTANT | University of Rochester, Rochester, NY Oct 2020 – Dec 2020

- Provided support to courses, including **Signals, Systems & Imaging** and **Biomedical Computation & Statistics**, by supervising laboratory sessions while grading homework & lab reports, creating task works, and addressing students' questions.

PROJECT WORKS

Comparing Subcortical and Cortical Neural Responses to Natural Music and Speech in Human Listeners Sep 2019 – Present

- Applied and utilized EEG in gauging human Auditory Brainstem Response (ABR) and cortical response of continuous natural music and speech to correlate acoustical feature with the neural encoding of natural sounds using temporal response functions (TRF).
- Formulated a quick and robust human ABR to natural sounds by strategizing innovative methods with computational neural modeling. Utilized python programming in EEG data collection, acoustical signal processing, statistical analysis, and machine learning algorithms.

- Accomplished a notable recognition as the first team to derive a robust human ABR to natural music. Resulted in three conference posters, a podium talk, one peer-reviewed paper publications, and one other paper in preparation.

Chimera Music: Exploring Pitch-Timing Interaction on the Neural Encoding of Music

Sep 2022 – Present

- Engineered a novel auditory stimulus – “Chimera Music” facilitating experimental analysis of joint of pitch and timing dimensions in music cognition.
- Conducted comprehensive neurophysiological study using EEG to unravel the processing of musical rhythms, the interplay with pitch structures, and the melodic expectation from ML models, utilizing event-related potentials (ERP) and temporal response function (TRF) with machine learning frameworks.
- Resulted in a conference poster and a paper in preparation showcasing the intersection of music cognition and neuroscience.

Speech-In-Noise Comprehension is Improved When Viewing a Deep-Neural-Network Generated Talking Face

Jul 2020 – Jul 2022

- Fulfilled and developed a Human-computer interaction experiment in evaluating the augmented effectiveness of a deep-neural-network system that synthesizes video of a talking face to supplement an acoustic-only speech signal.
- Directed the procedures for completing the qualitative and quantitative analysis to measure improvement in human speech comprehension in different environment noise levels, and its interaction with the neural network-generated visual cues.
- Resulted in a conference poster and a peer-reviewed paper publication.

Neural Response to Consonant and Dissonant Musical Intervals and Chords

Sep 2018 – Dec 2018

- Examined and studied the response from the auditory nerve and inferior colliculus to various musical intervals & chords by employing a computational acoustic physiological model.
- Engineered musical stimuli and exhibited auditory neural responses to musical intervals/chords and their correlation with perceptual and behavioral data.
- Resulted in a conference poster presentation.

From Music to Semantics: Automatically Generating Time-Varying Semantic Tags from Music

Sep 2019 – Dec 2019

- Applied deep-learning and music signal processing techniques to develop a convolutional neural network (CNN) integrated with a long short-term memory (LSTM) network using *PyTorch* for predicting time-varying emotional semantic tags in diverse genres of music. Resulted in a poster presentation and a paper for the course.

SELECTED PUBLICATIONS

Journal Article: **Subcortical responses to music and speech are alike while cortical responses diverge**

Author(s): **Tong Shan**, Madeline S. Cappelloni, and Ross K. Maddox (2024)

Scientific Report 14 (2024) – <https://doi.org/10.1038/s41598-023-50438-0>

Journal Article: **Speech-In-Noise Comprehension is Improved When Viewing a Deep-Neural-Network-Generated Talking Face**

Author(s): **Tong Shan**, Chenliang Xu, Zhiyao Duan, and Ross K. Maddox (2022)

Trends in Hearing 26 (2022) – <https://journals.sagepub.com/doi/10.1177/23312165221136934>

Journal Article: **Long-Term Tract-Specific White Matter Microstructural Changes After Acute Stress**

Author(s): Meng, Linghui, **Tong Shan (co-first authored)**, Kaiming Li, and Qiyong Gong (2020)

Brain Imaging and Behavior 15, No. 4 (2021): 1868-1875 – <https://doi.org/10.1007/s11682-020-00380-w>

PROFESSIONAL CONFERENCES

Association for Research in Otolaryngology (ARO) Mid-Winter Meeting | ARO 2024

Poster Presentation: *Chimera Music: Exploring Pitch-Timing Interaction on the Neural Encoding of Music*

Association for Research in Otolaryngology (ARO) Mid-Winter Meeting | ARO 2023

Poster Presentation: *Comparing Methods for Deriving the Auditory Brainstem Response to Continuous Speech in Human Listeners*

Auditory System Gordon Research Conference/Seminar | Gordon Research Conference 2022

Poster Presentation: *Subcortical Response to Continuous Music in Human Listeners*

Association for Research in Otolaryngology (ARO) Mid-Winter Meeting | ARO 2022

Poster Presentation: *Subcortical Responses to Continuous Music in Human Listeners*

Association for Research in Otolaryngology (ARO) Mid-Winter Meeting | ARO 2021

Poster Presentation: *DNN-based Generation of Talking Faces Benefiting Speech Comprehension in Noisy Environment*

Association for Research in Otolaryngology (ARO) Mid-Winter Meeting | ARO 2020

2020 Podium talk: *Subcortical Response to Continuous Music in Human Listeners*

Association for Research in Otolaryngology (ARO) Mid-Winter Meeting | ARO 2019

Poster Presentation: *Neural Fluctuation Profiles: Yet Another Model for Pitch*

Organization for Human Brain Mapping Conference OHBM	2017
<i>Poster Presentation: Distinct Cortical Thinning Pattern in Never Treated Schizophrenia</i>	

HONORS & AWARDS

ARO Mid-Winter Meeting Travel Award Association for Research in Otolaryngology	2021
ARO Mid-Winter Meeting Travel Award Association for Research in Otolaryngology	2020
Biostatistics Program Tuition Scholarship Northwestern University	2017
Second Class Scholarship Sichuan University	2015

ORGANIZATIONAL INVOLVEMENTS

Associate for Research in Otolaryngology (ARO)

Function as member of ARO Education Committee and spARO (Trainee Chapter) Steering Committee: organize professional workshops, seminar series on different research topics and coffee hours

Organization for Women in Science for the Developing World

American Association of University Women