Dr. Abhishek Patil

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Research statement

My research focuses on brain encoding models that map between sensory and cognitive stimuli and the neural representations they evoke, using EEG and fMRI as primary measurement modalities. I develop computational methods to characterize functional connectivity, network dynamics, and cognitive / affective biomarkers in healthy and clinical populations. Building on this foundation, I extend encoding and decoding frameworks to multimodal settings — integrating physiological signals (EEG, PPG) with language, speech, and audio representations — to support personalized human-state estimation, neuroadaptive AI systems, and digital therapeutics. My broader interests span computational neuroscience, brain–computer interfaces, and medical imaging AI.

Positions

Exebrain Co. Ltd. Taipei, Taiwan

AI Backend Engineer 27th May 2025 – 20th April 2026

- Built and deployed production-grade LLM systems for real-time text and voice interaction
- Implemented retrieval-augmented generation pipelines with embedding-based vector search and LLM-driven query rewriting
- Designed multimodal AI pipelines integrating EEG, PPG, speech/audio, and text for human-state modeling
- Developed models linking speech and text representations with EEG-derived biomarkers, including alpha-band activity and stress-related indicators
- Built cross-modal learning frameworks combining physiological signals and language embeddings for personalized AI interaction
- Implemented EEG/PPG signal-processing pipelines including preprocessing, feature extraction, and time-series modeling

MAI AI Taipei, Taiwan
AI Researcher – Medical AI Systems 5th Aug 2024 – 13th June 2025

- Developed LLM-based medical AI systems integrating indexed biomedical content and external APIs
- Developed DICOM processing pipelines for 3D model generation from CT and MRI data
- Migrated voice AI pipelines across model providers, integrating transcription and speech synthesis

Taipei Medical University Taipei, Taiwan
Assistant Research Fellow 1st Jan 2024 – 31st Jul 2024
TIRC, TMU, Taiwan

- Conducted research and development of AI and deep learning models for 3D medical imaging
- Developed Vision Transformer models for low-dose CT and related medical image processing tasks
- Implemented deep learning pipelines for medical image preprocessing, model training, and evaluation
- Utilized tools such as Python, TensorFlow, SimpleITK, and Numpy

National Yang Ming Chiao Tung University Hsinchu, Taiwan
Postdoctoral Scientist 1st Oct 2021 – 31st Dec 2023
Brain and Cognitive Science Laboratory, NYCU, Taiwan
Mentors: Dr. Chih-Mao Huang.

- Conducted research in cognitive neuroscience, EEG, and functional neuroimaging
- Investigated brain network connectivity, neurofeedback, and cognitive and mental health related biomarkers
- Applied computational methods and machine learning approaches to EEG and fMRI data analysis
- Contributed to interdisciplinary research at the interface of neuroscience and AI

Education

Vellore Institute of Technology Vellore, Tamil Nadu, India

PhD in Computational Neuroscience July 2017 – Aug 2021
Dissertation: Individual differences and alterations in functional connectivity of the aging brain
Mentors: Dr. Deepa Madathil, Dr. Chih-Mao Huang.

Vellore Institute of Technology Vellore, Tamil Nadu, India
M.Tech in Biomedical Engineering Aug 2012 – May 2014
Mentors: Dr. Deepa Madathil *GPA: 8.34*

Research funding and projects

Taipei Medical University–Taipei Medical University Hospital Special Research Project 2024–2025
Project No.: 113TMU-TMUH-29 | Awarded funding: NTD 300,000

Role: Co-PI listed on awarded project during TMU appointment, May 2024 – Jul 2024
Project title: AI-based study of pericoronary adipose tissue as a biomarker for coronary artery disease risk using low-dose CT, coronary CT angiography, and Vision Transformer models.
Contributed to the AI/deep learning and medical imaging components of the project during appointment as Assistant Research Fellow at Taipei Medical University.

Honors and scholarships

Travel Award (National Science Foundation) 2019

NYCU, Taiwan Elite Research Internship Program (NYCU) 2018-19

Journal Publications

First author on all listed publications. Citation counts and h-index available on Google Scholar.

Review of EEG-based neurofeedback as a therapeutic intervention to treat depression
Abhishek Uday Patil, Chemin Lin, Shwu-Hua Lee, Hsu-Wen Huang, Shun-Chi Wu, Deepa Madathil and Chih-Mao Huang
Psychiatry Research: Neuroimaging, 2023. *pdf*

Neurofeedback for the education of children with ADHD and specific learning disorders: A Review
Abhishek Uday Patil, Deepa Madathil, Yang-Tang Fan, Ovid JL Tzeng, Chih-Mao Huang and Hsu-Wen Huang
Brain Sciences, 2022. *pdf*

Age related and individual variations in altered pre-frontal and cerebellar connectivity associated with the tendency of developing internet addiction
Abhishek Uday Patil, Deepa Madathil, and Chih-Mao Huang
Human Brain Mapping, 2021. *pdf*

Healthy Aging Alters the Functional Connectivity of Creative Cognition in the Default Mode Network and Cerebellar Network
Abhishek Uday Patil, Deepa Madathil, and Chih-Mao Huang
Frontiers in Aging Neuroscience, 2021. *pdf*

Static and dynamic functional connectivity supports the configuration of brain networks associated with creative cognition
Abhishek Uday Patil, Sejal Ghate, Deepa Madathil, Ovid J. L. Tzeng, Hsu-Wen Huang, and Chih-Mao Huang
Scientific Reports, 2021. *pdf*

Classification and comparative analysis of control and migraine subjects using EEG signals
Abhishek Uday Patil, Amitabh Dube, R. K. Jain, G. D. Jindal, and Deepa Madathil
Information Systems Design and Intelligent Applications, 2019.

Research experience

Visiting Research Scholar Sept 2018 – Mar 2019

Brain and Cognitive Science Lab, NYCU, Taiwan
Mentor: Dr. Chih-Mao Huang. Functional connectivity analyses contributing to PhD dissertation.

Junior Research Fellow Mar 2016 – Aug 2016
SMS Medical College, Jaipur, India
Mentor: Dr. Amitabh Dube. EEG-based classification of migraine populations.

Teaching Experience

Teaching cum Research Assistant 2017 – 2020

Department of Sensor and Biomedical Technology, Vellore Institute of Technology

- Assisted in undergraduate and graduate courses in biomedical signal processing and instrumentation
- Mentored project students on EEG analysis, signal classification, and neuroimaging methods
- Supported laboratory sessions and supervised student research projects toward thesis completion

Assistant Professor 2016 – 2017
Department of Electronics and Communication, Sanjay Ghodawat University, India

- Independently taught undergraduate courses in electronics, signals and systems, and biomedical instrumentation
- Designed course content, assessments, and laboratory exercises; advised undergraduate projects

Assistant Professor 2014 – 2016
Department of Biomedical Engineering, MGM's College of Engineering and Technology, India

- Taught core undergraduate biomedical engineering courses including biomedical signal processing, medical imaging, and biomedical instrumentation
- Developed curriculum materials and supervised undergraduate capstone projects in biomedical signal analysis

Talks and tutorials

New Ideas in Computational and Network Neuroscience Apr 2021

Webinar on Cutting Edge Healthcare Technologies organised by MGM's College of Engineering and Technology, Mumbai

Static and dynamic network reconfiguration in creative brain networks
February 2020
Society for the Neuroscience of Creativity (SfNC)

Skills

Programming

Proficient in: Python, R, MATLAB
Familiar with: C, C++

AI and Computational Tools
PyTorch, TensorFlow, scikit-learn, FastAPI, NumPy, SimpleITK

LLM & GenAI
RAG pipelines, vector search, prompt engineering, function calling, ASR/TTS integration

Research Domains
EEG, fMRI, PPG, speech/audio, text modeling, multimodal AI, medical imaging, machine learning

Languages
English (fluent), Chinese (basic)

References

Dr. Chih-Mao Huang

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Department of Psychology,
The University of Hong Kong, HK
email: cmhuang@hku.hk
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Dr. Hsu-Wen Huang
Assistant Investigator,
National Center for Geriatrics and Welfare Research,
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Dr. Deepa Madathil
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