

Soinik Ghosh

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About Me

A PhD researcher in Biomedical Engineering at Indian Institute of Technology, Banaras Hindu University (IIT BHU), Varanasi, India, with an M.Sc. and B.Sc. in Physiology (University of Calcutta). My research integrates Computational Neuroscience, AI, BCI, and Neurorehabilitation, focusing on developing EEG-based AI for seizure forecasting, prosthetic control, neurodegenerative disorder biomarkers, and AI in medical imaging. Passionate about the brain-body interface, psychology, generative AI, and creative arts (music, film). Committed to continuous learning and interdisciplinary innovation to build a better future.

Research Interests:

Biomedical Signal & Image Processing, Neuroimaging, Biomedical Devices & Wearable Sensors, Computational Neuroscience, BCI, Neurorehabilitation, Assistive Devices, Tissue Engineering, Generative AI, Bioinformatics, Protein & Genetic Engineering, Biomaterials.

Skills & Expertise

Technical & Research:

- Signal Processing (EEG), AI/ML (Python, PyTorch, Tensorflow, AI Agents)
- Programming (Python, Matlab, C#, C++, Java, HTML, CSS)
- Biomedical Device Development, Brain-Computer Interface (BCI)
- Computational Neuroscience, Electronics & Embedded Systems
- Wet Lab Techniques, Animal Study, Experimental Design

Core Competencies: Problem Solving, Critical Thinking, Quick Learning, Leadership, Scientific Writing, Communication

Projects

Towards Reliable Seizure Forecasting Diagnosis with Non-Invasive Biosignals *IIT-BHU, IMS-BHU | 2024 – Present*
Developing advanced Epileptic Seizure Forecasting algorithms, aiming to improve Epilepsy Diagnosis and patient quality of life through timely intervention.

A Generative AI model for Patient-specific high-fidelity Synthetic EEG data Generation *IIT-BHU | 2024 – Present*
Developing a Diffusion based Generative AI model for high-fidelity Synthetic EEG data Generation, particularly for Seizure Patients.

EEG based biomarkers for early detection of Neurodegenerative Disorders *IIT-BHU, IMS-BHU | 2024 – Present*
Identifying robust EEG-derived biomarkers to facilitate early diagnosis of neurodegenerative disorders like Alzheimer's, Parkinson's & Dementia, enabling prompt treatment strategies.

Motor Imagery based Prosthetic arm control in real time with EEG BCI *IIT-BHU | 2023 – Present*
Designing a BCI system translating motor imagery EEG signals into intuitive real-time control for prosthetic arms.

VR-infused robotic exo-suit for Stroke Rehabilitation *IIT-BHU | 2023 – Present*
Creating an immersive VR environment with a robotic exoskeleton for engaging stroke patient rehabilitation. (PRAGATI Hackathon 2023 Winner)

Non-invasive Ultrasound imaging for cardiovascular disease detection *Smart India Hackathon (SIH 2024, Winner)*
Developing a non-invasive ultrasound imaging solution for improved cardiovascular disease detection methods.

Experience

Full-Time Research Scholar Teaching Assistant *School of Biomedical Engineering, IIT-BHU, Varanasi | 2023 – Present*
Doctoral research (BCI, Neuroscience, AI); Teaching Assistantship. Responsibilities: Experimental Design, Data Collection & Analysis, Algorithm Development, Scientific Writing, Teaching.

Workshop: g.tec BCI Neurotechnology Spring School 2025 *g.tec medical engineering GmbH, Austria | 2025*
Completed extensive curriculum and contributed to BR41N.IO Hackathon. Focused on recent advancements in Neuroscience, BCI, AI, Invasive/Non-invasive Neurotechnologies.

Workshop: SERB KARYASHALA *IIT Roorkee | 2024*
AI in Human Brain Computer Interaction, Machine Learning Signal Processing. Intensive workshop on advancements in AI, ML, and

signal processing for BCIs.

Skill Development Program

CSIR-IICB, Kolkata

Molecular Cloning, Protein Expression Characterization. Hands-on training in wet lab techniques for cancer biology and inflammatory disorders.

Musician, Composer, Film Maker

Freelance/Independent

Creating original music compositions and producing short films, fostering creativity and storytelling.

Education

PhD in Biomedical Engineering

Indian Institute of Technology (IIT-BHU), Varanasi | 2023 – Present

CGPA: 9.6/10. Relevant Coursework: Biomedical Signal Image Processing, Biosensors, AI, Neuroscience, Instrumentation, Mathematical Modelling.

M.Sc in Physiology (Specialization: Neuroscience)

University of Calcutta, Kolkata | 2019 – 2021

Percentage: 74.9%. Master's Thesis: "*Neuropsychophysiological Behaviour of Adenosine: Crosstalks between Neurotransmitters*"

GATE Qualified (XL - Life Sciences)

Organized by IITs | 2023

Score: 503, All India Rank (AIR): 1313.

B.Sc in Human Physiology (Honours)

Surendranath College, University of Calcutta, Kolkata | 2016 – 2019

Percentage: 58.8%.

Publications

- *Real-Time Brain Signals Monitoring System Using Single-Channel EEG for BCI Applications*
2024 2nd International Conference on Advancements and Key Challenges in Green Energy and Computing (AKGEC)
- *Development of a Haptic Exo-Suit with Tactile Feedback in Hand Rehabilitation*
2024 IEEE International Conference on Intelligent Signal Processing and Effective Communication Technologies (INSPECT)

Conferences & Presentations

- *Decoding the Neural Dynamics of Motor Imagery and Execution: An EEG-Based Investigation into Conscious Hand Movement Representation*
Mind, Brain, and Consciousness Conference (MBCC), IIT Mandi, 2025
- *Real-Time Brain Signals Monitoring System Using Single-Channel EEG for BCI Applications*
IEEE Advancements and Challenges in Green Energy and Computing (AKGEC), 2024
- *Improving Fine Motor Skills using AI-driven Robotic exo-suit with Flexible Tactile Sensors interfaced with VR-infused Biofeedback for Stroke Rehabilitation*
International Conference on Recent Advances in Fluid Mechanics and Nanoelectronics (ICRAFMN), 2024

Awards & Recognition

Winner - Smart India Hackathon (Hardware Edition)

Govt. of India | 2024

Project: "Non-invasive imaging for cardiovascular disease detection".

2nd Runner Up - PRAGATI Hackathon

TIH Dristi IHUB IIT Jodhpur | 2023

Project: "XR-infused robotic exo-suit for upper-limb Stroke Rehabilitation".

Artistic Endeavors & Other Interests

Actively engaged in music composition (multi-instrumentalist), filmmaking, photography, and painting. Other interests include storytelling, creative writing, reading, wildlife exploration, and mindfulness.

Languages

English (Fluent), Bengali (Native), Hindi (Proficient).