Saugat BHATTACHARYYA

Lecturer in Computer Science| School of Computing, Engineering & Intelligent Systems

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My research interests are in the area of Cognitive Neuroscience, Artificial Intelligence and Machine Learning and its application in Human-Machine Interaction and Neuro-Rehabilitation. I have experience in developing intelligent neurotechnologies to improve rehabilitation and decision making. My research is primarily focussed on developing brain-computer interfacing systems based on robust signal processing, quantitative and machine learning algorithms to draw inference into an users' state of mind through their neural and other physiological signals.

Education

January 2012 – August 2015 | Ph.D. in Engineering, Jadavpur University, Kolkata, India
- Thesis title : *Human-Computer Interface for Motion Control of Artificial Limb(s)*
- Supervisors : Prof. Amit Konar and Prof. D.N. Tibarewala

July 2009 – June 2011 | Master of Engineering in Biomedical Engineering, Jadavpur University, Kolkata, India
- Percentage of Marks : 80.00%
- Thesis title : *Motor Execution and Imagery Classifications from Electroencephalography Signals for Neuroprosthetic Applications*
- Supervisors : Prof. Amit Konar and Prof. D.N. Tibarewala

July 2005 – May 2009 | Bachelor of Technology in Biomedical Engineering, West Bengal University of Technology, India
- DGPA : 8.6
- Thesis title : *Characterization of Heart Rate Variability among the Tea Garden Workers in the North Eastern Hilly Region of West Bengal*
- Supervisors : Dr. Ankur Ganguly

Research Experience

June 2019 – April 2020 | Senior Research Officer, School of CSEE, University of Essex, UK
- Project : **Bilateral Academic Research Initiative Pilot Program**
- Title : *Adaptive joint cognitive systems for complex and strategic decision making : building trust in human-machine teams through brain-computer-interface augmentation, social interaction and mutual learning*
- PI : Prof. Riccardo Poli
- Role : Research and develop explainable Artificial Intelligence decision-making systems using Reinforcement, Deep, Transfer and interpretable machine learning that can assess the likelihood of being correct in its own decisions; develop BCI-assisted decision-making systems for real time prediction of decision confidence and identification neural and behavioural correlates of the user related to metacognition, trust, conformity, errors, confidences, attentional lapse, cognitive load and fatigue and finally, build and test prototypes of joint cognitive systems (including BCIs) between human and machine for a variety of decision tasks of increasing complexity.

January 2019 – May 2019

Senior Research Officer, Institute for Analytics and Data Science, University of Essex, UK

- Project : **ESNEFT Project with Colchester General Hospital**
- Title : *AI-Assisted Decision Making System for Cancer Pathways*
- PI : Dr. Haider Raza
- Role : Built the essential theoretical foundations of an AI-assisted Decision-Making System for Cancer Pathways; Developed data wrappers in SQL and python environment to connect data sources on different computer/database systems to a centralised system.

July 2017 – May 2019

Senior Research Officer, School of CSEE, University of Essex, UK

- Project : **TIN 2.093 Defence Science and Technology Laboratory Project**
- Title : *Brain-computer-interface-assisted confidence estimation for group decision making, group selection and personnel training*
- PI : Prof. Riccardo Poli
- Role : Developed practical Brain-Computer Interfacing systems using machine learning algorithms such as Logistic Regression and Random Forest and implemented various signal processing algorithms to infer into an user's mental state/processes to augment group decision making; Developed different game environment for experimentation using Pygame and Unity; Visualised distribution of user mental states and behaviour during decision-making tasks using scipy, numpy and scikit-learn.

November 2015 – July 2017

Post-Doctoral Researcher, INRIA Sophia-Antipolis Méditerranée, France

- Project : **Brain Computer Interfaces : Learning, Interaction, Feedback, Training Project**
- Title : *Study of the effect and integration of Functional Electrical Stimulation as neuro-feedback on Brain-machine Interfacing for motor learning*
- PI : Dr. Mitsuhiro Hayashibe and Dr. Maureen Clerc
- Role : Developed multi-class Brain-Computer Interfacing systems using Support Vector Machines to infer an user's mental state/processes during hand and foot movement; Implemented time-frequency analysis like Wavelet Transforms to investigate the non-stationary brain signals; Controlled activation of a Functional Electrical Stimulation using our developed BCI system.

October 2014 – June 2015

Post-Doctoral Researcher, Université de Montpellier II, France

- Project : **Erasmus Mundus-Svaagata Fellowship**
- Title : *Study of the probabilistic nature of Motor Imagery Electroencephalography signals and its correlation with Electromyography signals for closed loop control of a robotic manipulator*
- PI : Dr. Mitsuhiro Hayashibe
- Role : Developed a binary Brain-Computer Interfacing systems using Support Vector Machines to infer an user's mental state/processes during hand movement; Used Tacit Learning to develop a synergetic motor controller capable of adapting the angle of robotic joints based on the weight it is carrying; Developed a tri-lateral BCI system using the above-mentioned algorithms to control the movement of a robotic arm situated in a remote location.

Teaching Experience

Autumn 2019

Graduate Laboratory Assistant, University of Essex, United Kingdom

- CE151 : Introduction to Programming
- CE320 : Large Scale Software Systems and Extreme Programming

Autumn 2016

Visiting Lecturer, Université de Montpellier II, France

- HMESN321 : Introduction to Brain-computer Interfacing, Neuroprostheses II
- Master STIC (Equivalent to Master of Engineering course)

2012 – 2015 | Mentor, Jadavpur University, Kolkata, India
- Mentored numerous under-graduate and post-graduate students on the methodologies and experimental protocols prevalent in Brain-computer Interfacing.

2012 – 2014 | Visiting Lecturer, M.Tech Course in Intelligent Automation and Robotics, Department of Electronics & Telecommunication Engineering, Jadavpur University, Kolkata, India
- Advanced Digital Signal Processing
- Digital Image and Speech Processing

Spring 2014 | Teaching Assistant, M.E. Course in Biomedical Engineering, School of Bioscience & Engineering, Jadavpur University, Kolkata, India
- Medical Imaging and Image Processing

2013 – 2014 | Lab Instructor, M.Tech Course in Intelligent Automation and Robotics, Department of Electronics & Telecommunication Engineering, Jadavpur University, Kolkata, India
- Digital Control Lab
- A.I. and Robotics Lab

2012 – 2014 | Lab Instructor, M.E. Course in Biomedical Engineering, School of Bioscience & Engineering, Jadavpur University, Kolkata, India
- Bio-instrumentation & Programming Lab

Research Grant Awards

2019 Co-Investigator, GCRF@Essex Research Pump Priming, University of Essex, UK
2014 Investigator, Erasmus Mundus-Svaagata Project Fellowship, Université de Montpellier II, France
2012 Fellow, Council of Scientific and Industrial Research Senior Research Fellowship, India

Editorial Duties

May 2020 Associate editor : Medtech Data Analytics, Frontiers in Medical Technology
March 2020 Associate editor : International Conference on Intelligent Robots and Systems.
September 2019 Guest associate editor : Brain-Computer Interfaces for Perception, Learning, and Motor Control, Frontiers in Neuroscience.
August 2019 Review editor : Frontiers in Neuroprosthesis.
August 2019 Guest editor : Special Issue on Computational Advances in Bio-Sensing and Bio-Imaging, Journal of Sensing and Bio-Sensing Research, Elsevier.
July 2019 Guest editor : Soft Computing Techniques for Bio-signal Analysis, SN Applied Science, Springer.
March 2018 Guest Editor : Special Issue on Medical Signal Processing in Biomedical and Clinical Applications, Journal of Healthcare Engineering.
Since 2019 Reviewer : Journal of Neural Engineering, IOPScience.
Since 2018 Reviewer : Journal of Biomedical and Health Informatics, IEEE.
Since 2018 Reviewer : Computers in Medicine and Biology, Elsevier.
Since 2016 Reviewer : IEEE Transaction on Neural Systems & Rehabilitation Engineering.
Since 2016 Reviewer : IEEE Transaction on Systems, Man & Cybernetics : Systems.
Since 2016 Reviewer : IEEE Transaction on Biomedical Engineering.
Since 2016 Reviewer : IEEE Access.
Since 2013 Reviewer : Neurocomputing, Elsevier.

Other Administrative Role

September 2019	**Lead Member** in Cyber Essential Certification for BCI-NE Lab, University of Essex, UK
June 2019	**Team Member** for Cybathlon 2020, University of Essex, UK
February 2019	**Team Member**, Self-Assessment team for the application off the Athena Swan award of School of CSEE, University of Essex, UK
April 2016	**Volunteer**, 20th Conference of International Functional Electrical Stimulation Society (IFESS), Inria Sophia-Antipolis, Montpellier, France
April 2015	**Volunteer**, IEEE Neural Engineering (NER) Conference, Inria Sophia-Antipolis, Montpellier, France
2011-2015	**Ph.D. Student Representative**, Bio-Signal Processing and HCI Lab, Jadavpur University, Kolkata, India
2008	**Editor**, University Annual Magazine, Siliguri Institute of Technology, Siliguri, India

Skills

Programming	Python, Matlab, R, Microsoft .Net, (C/C++/C#), Java, PHP, HTML/CSS
Database	Microsoft SQL Server, MySQL, PostgreSQL
Development tools	Pycharm, Visual Studio Code, Microsoft Azure, SVN, git
Operating Systems	Windows XP/Vista/7/8/10, Linux Fedora, Ubuntu
Language Spoken	English, Hindi, Bengali, Assamese, French (Basic)

Presentations

July 2019	*41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, Berlin, Germany
July 2019	*Neuro-adaptive Technology Conference NAT'19*, Liverpool, UK
March 2019	*International IEEE EMBS on Neural Engineering*, San Francisco, USA
November 2018	*POTRA/Strategic Edge Through People (SETP) 2040 Symposium*, Tidworth, UK
November 2017	*Strategic Edge Through People (SETP) 2040 Symposium*, Tidworth, UK
October 2016	*IEEE International Conference on Systems, Man, and Cybernetics*, Budapest, Hungary
June 2016	*20th Conference of International Functional Electrical Stimulation Society (IFESS)*, Montpellier, France
April 2015	*7th International IEEE EMBS Neural Engineering Conference*, Montpellier, France
February 2014	*2014 International Conference on Control, Instrumentation, Energy and Communication*, Kolkata, India
December 2011	*International Conference on Recent Trends in Information Systems*, Kolkata, India
January 2011	*National Conference on Instrumentation and Control*, Kolkata, India
December 2010	*International Conference on Biomedical Engineering and Assistive Technologies*, Jalandhar, India
August 2009	*International Conference on Biomedical Instrumentation and Healthcare Engineering*, Chennai, India
October 2007	*National Conference on Biomedical Engineering*, Manipal, India

Outreach

September 2019	*Collaborative Brain Computer Interfacing for Augmentation of Group Cognition*, Indian Institute of Technology, Guwahati, India
February 2018	*Brain-Computer Interfacing : An Introduction*, National Institute of Technology, Rourkela, India
February 2018	*Motor Imagery and Error Related Potential Induced Position Control of a Robotic Arm*, University of Essex
March 2017	*Natural user feedback in BCI with peripheral sensory stimulation toward efficient motor learning*, Laboratoire Informatique, Robotique, Microelectronique Montpellier, Montpellier, France
July 2015	*Bio-potential Signals : conditioning, analysis and Applications*, Narula Institute of Techology, Kolkata, India
June 2015	*A Synergetic Brain-computer Interfacing Paradigm for Multi-DOF Robot Control*, University of Montpellier, France

Certifications

April 2019	Member, IEEE
April 2019	Member, IEEE-EMBS
March 2019	Post-doctoral Member, IEEE Brain Community
May 2018	Post-doctoral Member, The Brain Computer Interface Society
2014	Associate Member, The Institute of Engineers (India)

Relevant Publications

Peer-reviewed Journals Total : 14

Note : For full list of publications refer to my website.

1. Pal, M., S. Bandyopadhyay and **S. Bhattacharyya**. *An evolutionary framework for the interdependent sub-problems in motor imagery EEG transference*, *Under review in IEEE Transaction on Emerging Topics in Computational Intelligence*.
2. **S. Bhattacharyya**, M. Clerc and M. Hayashibe. *Augmenting Motor Imagery Learning for Brain-Computer Interfacing using Electrical Stimulation as Feedback*, IEEE Transaction on Medical Robotics and Bionics, 1(4) : 247-255.
3. **Bhattacharyya, S.**, A. Konar, D.N. Tibarewala and M. Hayashibe. (2017) *A Generic Transferable EEG Decoder for Online Detection of Error Potential in Target Selection*, Frontiers in Neuroscience, 11 : 226.
4. **Bhattacharyya, S.**, A. Konar and D.N. Tibarewala. (2017) *Motor Imagery and Error Related Potential Induced Position Control of a Robotic Arm*, IEEE/CAA Journal of Automatica Sinica, 4 (4) : 639-650.
5. **S. Bhattacharyya**, M. Clerc and M. Hayashibe (2016) *A study on the effect of electrical stimulation as a user stimuli for motor imagery classification in Brain-Machine Interface*, Presented in : 20th Conference of International Functional Electrical Stimulation Society (IFESS) 2016, Montpellier, France. Published in : European Journal of Translational Myology, 26 (2) : 165-168.
6. **Bhattacharyya, S.**, S. Shimoda and M. Hayashibe. (2016) *A Synergetic Brain-machine Interfacing Paradigm for Multi-DOF Robot Control*, IEEE Transactions on Systems, Man and Cybernetics : Systems, 46 (7) : 957-968.
7. **Bhattacharyya, S.**, M. Pal, A. Konar, and D.N.Tibarewala. (2015) *An interval type-2 fuzzy approach for real-time EEG-based control of wrist and finger movement*, Biomedical Signal Processing and Control, 21 : 90-98.
8. **Bhattacharyya, S.**, D. Basu, A. Konar, and D.N. Tibarewala. (2015) *Interval Type-2 Fuzzy Logic based Multiclass ANFIS Algorithm for Real-Time EEG based Movement Control of a Robot Arm*, Robotics and Autonomous Systems, 68 : 104-115.
9. **Bhattacharyya, S.**, A. Konar, and D.N.Tibarewala. (2014) *Motor Imagery, P300 and Error Related EEG Based Robot Arm Movement Control for Rehabilitation Purpose*, Medical and Biological Engineering and Computing, 52(12) : 1007-1017.
10. **Bhattacharyya, S.**, A. Konar, and D.N.Tibarewala. (2014) *A Differential Evolution Based Energy Trajectory Planner for Artificial Limb Control Using Motor Imagery EEG Signal*, Biomedical Signal Processing and Control, 11 : 107-113.
11. **Bhattacharyya, S.**, A. Sengupta, T. Chakraborti, A. Konar, and D.N. Tibarewala. (2014) *Automatic Feature Selection of Motor Imagery EEG Signals using Differential Evolution and Learning Automata*, Medical and Biological Engineering and Computing, 52 (2) : 131-139.

Recent Book Chapters Total : 11

1. **S. Bhattacharyya**, and M. Hayashibe. *Brain-Computer Interface-Functional Electrical Stimulation : From control to neurofeedback in rehabilitation*, K. Pal (eds.), Bioelectronics and Medical Devices-From Materials to Devices - Fabrication, Applications and Reliability, Elsevier, 2019.
2. R. Bose, K. Samanta, A. Khasnobish, S. Chatterjee, and **S. Bhattacharyya**. *Lower limb motor imagery recognition using EEG-BCI*, K. Pal (eds.), Bioelectronics and Medical Devices-From Materials to Devices - Fabrication, Applications and Reliability, Elsevier, 2019.
3. K.K Tarafdar, B.K Pradhan, S.K Nayak, A. Khasnobish, **S. Bhattacharyya**, K. Pal. *Electroencephalogram-based brain–computer interface systems for controlling rehabilitative devices*, K. Pal (eds.), Bioelectronics and Medical Devices- From Materials to Devices - Fabrication, Applications and Reliability, Elsevier, 2019.

Relevant Publications

Relevant Conference Publications Total : 32

1. H. Raza, A. Chowdhury, and **S. Bhattacharyya** (2020) *Deep Learning based Prediction of EEG Motor Imagery of Stroke Patients' for Neuro-Rehabilitation Application*, Accepted in : IEEE World Congress on Computational Intelligence (WCCI) 2020, Glasgow, UK.
2. H. Raza, A. Chowdhury, **S. Bhattacharyya**, and Spyros Samothrakis (2019) *Single-Trial EEG Classification with EEGNet and Neural Structured Learning for Improving BCI Performance*, Accepted in : IEEE World Congress on Computational Intelligence (WCCI) 2020, Glasgow, UK.
3. **S. Bhattacharyya**, D. Valeriani, C. Cinel, L.Citi and R. Poli (2019) *Collaborative Brain-Computer Interfaces to Enhance Group Decisions in an Outpost Surveillance Task*, In : 2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Berlin, Germany. DOI : 10.1109/EMBC.2019.8856309.
4. **S. Bhattacharyya**, C. Cinel, L.Citi, D. Valeriani and R. Poli (2019) *Walking Improves the Performance of a Brain-Computer Interface for Group Decision Making*, In : Second Biannual Neuroadaptive Technology Conference (NAT'19), Liverpool, UK.
5. **S. Bhattacharyya**, D. Valeriani, C. Cinel, L.Citi and R. Poli (2019) *Target Detection in Video Feeds with Selected Dyads and Groups Assisted by Collaborative Brain-Computer Interfaces*, In : 9th International IEEE/EMBS Conference on Neural Engineering (NER), San Francisco, USA, DOI : 10.1109/NER.2019.8717146.
6. D. Valeriani, **S. Bhattacharyya**, C. Cinel, L. Citi and R. Poli. (2018) *Augmenting group decision making accuracy in a realistic environment using collaborative brain-computer interfaces based on error-related potentials*, In : 7th International BCI Meeting : "BCIs : Not Getting Lost in Translation", Asilomar, USA.
7. **S. Bhattacharyya**, M. Clerc and M. Hayashibe (2016) *A Study on the Effect of Electrical Stimulation During Motor Imagery Learning in Brain-Computer Interfacing*, In : IEEE International Conference on Systems, Man, and Cybernetics, Budapest, Hungary, DOI : 10.1109/SMC.2016.7844670 .
8. P. Ghosh, A. Mazumder, **S. Bhattacharyya**, D.N. Tibarewala, and M. Hayashibe. (2015) *Functional Connectivity Analysis of Motor Imagery EEG signal for Brain-computer Interfacing Application*, In : 7th International IEEE EMBS Neural Engineering Conference, Montpellier, France, pp. 210-213.
9. D. Basu, **S. Bhattacharyya**, D. Sardar, A. Konar, D.N. Tibarewala, and A. Nagar. (2014) *A Differential Evolution based Adaptive Neural Type-2 Fuzzy Inference System for Classification of Motor Imagery EEG Signals*, In : 2014 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE'14), Beijing, China, pp. 1253-1260.
10. **S. Bhattacharyya**, P. Rakshit, A. Konar, D.N. Tibarewala, S. Das and A.K. Nagar. (2013) *Differential Evolution with Temporal Difference Q-Learning Based Feature Selection for Motor Imagery EEG Data*, In : IEEE Symposium on Computational Intelligence, Cognitive Algorithms, Mind, and Brain (CCMB 2013), Singapore, pp. 138-145.
11. A. Khasnobish, A. Jati, G. Singh, **S. Bhattacharyya**, A. Konar, D.N. Tibarewala, E. Kim, and A.K. Nagar. (2012) *Object-shape recognition from tactile images using a feed-forward neural network*, In : International Joint Conference on Neural Network (IJCNN 2012), Brisbane, Australia, pp. 1-8.
12. A. Khasnobish, **S. Bhattacharyya**, A. Konar, D.N. Tibarewala, and A.K. Nagar. (2011) *A two-fold classification for composite decision about localized arm movement from EEG by SVM and QDA techniques*, In : International Joint Conference on Neural Network (IJCNN 2011), California, USA, pp. 1344-1351.
13. **S. Bhattacharyya**, A. Khasnobish, A. Konar, D.N. Tibarewala, and A.K. Nagar. (2011) *Performance analysis of Left/Right Hand movement classification from EEG signal by intelligent algorithm*, In : IEEE Symposium on Computational Intelligence, Cognitive Algorithms, Mind, and Brain (CCMB 2011), Paris, pp. 1-8.

Personal Information

Date of Birth : 16^{th} June 1987
Nationality : INDIA
VISA status : UK, Tier-2, valid till July 2023

References

References provided on request.