Saugat Bhattacharyya

CONTACT INFORMATION

Apt 58 Bat D,
833 Avenue des Moulins,
34080 Montpellier, France

Mobile: +33-683540674
E-mail: saugatbhattacharyya@gmail.com
www: https://bhattacharyyasaugat.wordpress.com

RESEARCH INTERESTS

Human-computer Interfacing, Biomedical Signal Processing, Pattern Recognition and Computational Intelligence, Rehabilitative Engineering, Rehabilitative Robotics, Biomedical Image Processing, Medical Imaging Devices, Biomedical Instrumentation, Biomedical Control Systems.

CURRENT POSITION

BCI-LIFT project, INRIA-CAMIN, Laboratoire Informatique, Robotique, Microelectronique Montpellier, Montpellier, France

Post-Doctoral Researcher **November, 2015 onwards**

Objective: Study of the effect and integration of Functional Electrical Stimulation as neurofeedback on Brain-machine Interfacing for motor learning.
Supervisor: Dr. Mitsuhiro Hayashibe

EDUCATION

Jadavpur University, Kolkata, India

Ph.D., Engineering, **Date of submission:** 23rd August, 2014; **Date of Defence:** 21st August, 2015.

- Dissertation Topic: "Human-Computer Interface for Motion Control of Artificial Limb(s)"
- Advisor: Amit Konar, D.N.Tibarewala
- Percentage of Marks in Course-work: 87.5%

M.E., Biomedical Engineering, June, 2011, Percentage of Marks: 80.00%

Siliguri Institute of Technology, Siliguri, West Bengal, India

B.Tech., Biomedical Engineering, May, 2009, DGPA: 8.63

Delhi Public School, Digboi, India

All India Senior School Certficate Examination (Class XII), May, 2005, Percentage of Marks: 81.40%

All India Secondary School Examination (Class X), May, 2003, Percentage of Marks: 81.60%

HONORS AND AWARDS

- Erasmus Mundus-Svaagata Project Fellowship, Universite Montpellier, Montpellier, France under Dr. Mitsuhiro Hayashibe, October 2014-June 2015.
- Associate Member, The Institute of Engineers (India), March 2014-present.
- Council of Scientific and Industrial Research Senior Research Fellowship, April 2012 - April 2015.

ACADEMIC EXPERIENCE

University of Montpellier, INRIA-DEMAR, Laboratoire Informatique, Robotique, Microelectronique Montpellier, Montpellier, France

Ph.D. Internship **October, 2014 - June 2015**

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
Supervisor: Dr. Mitsuhiro Hayashibe

Jadavpur University, School of Bioscience & Engineering, Kolkata, India

Teaching Assistant **August, 2011 - September, 2014**

Co-taught post-graduate level courses. Shared responsibility for lectures, exams, homework assign-

ments, and grades. Duties included shared administrative responsibilities with faculty instructor, fielding of student inquiries, and oversight of post-graduate students.

Courses Taught:

- Medical Imaging and Image Processing, M.E. Course in Biomedical Engineering.
- Bio-instrumentation & Programming Lab, M.E. Course in Biomedical Engineering.

Jadavpur University, Department of Electronics & Telecommunication Engineering, Kolkata, India

Teaching Assistant **August, 2011 - September, 2014**

Co-taught post-graduate level courses. Shared responsibility for lectures, exams, homework assignments, and grades. Duties included shared administrative responsibilities with faculty instructor, fielding of student inquiries, and oversight of graduate and post-graduate students.

Courses Taught:

- Digital Image and Speech Processing, M.Tech Course in Intelligent Automation and Robotics.
- Advanced Digital Signal Processing, M.Tech Course in Intelligent Automation and Robotics.
- A.I. and Robotics Lab, M.Tech Course in Intelligent Automation and Robotics.
- Digital Control Lab, M.Tech Course in Intelligent Automation and Robotics.
- Control Lab, M.Tech Course in Intelligent Automation and Robotics.

Books and book chapters

Konar, A., D.N. Tibarewala, **S. Bhattacharyya**, and A. Khasnobish. *Non-Invasive Human-Computer Interface for Rehabilitative Applications*, Biosystems and Biorobotics, Springer, Heidelberg, Germany, *under construction.*

Bhattacharyya, S., A. Khasnobish, P. Ghosh, A. Mazumder, and D.N. Tibarewala. *A Review on Brain Imaging Techniques for BCI applications*, N. Dey (eds.), Biomedical Image Analysis and Mining Techniques for Improved Health Outcomes, IGI Global, 2015, pp. 39-70.

A. Mazumder, P. Ghosh, A. Khasnobish, **S. Bhattacharyya**, and D.N. Tibarewala. (2015) *Selection of Relevant Features from Cognitive EEG Signals Using ReliefF and MRMR Algorithm*, S. Gupta, S. Bag, K. Ganguly, I. Sarkar, P. Biswas (eds.) Advancements of Medical Electronics Lecture Notes in Bioengineering, Springer India, 2015, pp. 125-136.

A. Khasnobish, **S. Bhattacharyya**, A. Konar and D.N. Tibarewala. (2015) *Performance Analysis of Feature Extractors for Object Recognition from EEG Signals*, S. Gupta, S. Bag, K. Ganguly, I. Sarkar, P. Biswas (eds.) Advancements of Medical Electronics Lecture Notes in Bioengineering, Springer India, 2015, pp. 249-261.

Bhattacharyya, S., M.A. Hossain, A. Konar, D.N. Tibarewala, and R. Janarthanan. *Detection of fast and slow hand movements from motor imagery EEG signals*, M.K. Kundu, D.P. Mohapatra, A. Konar, A. Chakraborty (eds.), Advanced Computing, Networking, and Informatics Vol.1, Smart Innovation, Systems and Technologies Vol. 27,Springer International Publishing, Switzerland, 2014, pp. 645-652.

Bhattacharyya, S., P. Rakshit, A. Konar, D.N.Tibarewala, and R. Janarthanan. *Feature Selection of Motor Imagery EEG Signals Using Firefly Temporal Difference Q-Learning and Support Vector Machine*, B. Panigrahi, P.N. Suganthan, S. Das, and S.S. Dash (eds.) Swarm, Evolutionary, and Memetic, Computing, Lecture Notes in Computer Science Vol. 8298, Springer International Publishing, Switzerland, 2013, pp. 534-545.

Chatterjee, S., **S. Bhattacharyya**, A. Konar, A. Khasnobish, D.N.Tibarewala, and R. Janarthanan. *Performance Analysis of Multiclass Common Spatial Patterns in Brain-Computer Interface*, P. Maji,

A. Ghosh, M. Narasimha Murty, K. Ghosh, and S.K. Pal (eds.) Pattern Recognition and Machine Intelligence, Lecture Notes in Computer Science Vol. 8251, Springer Berlin Hiedelberg, 2013, pp. 115-120.

Khasnobish, A., A. Konar, D.N.Tibarewala, **S. Bhattacharyya**, and R. Janarthanan. *Object Shape Recognition from EEG Signals during Tactile and Visual Exploration*, P. Maji, A. Ghosh, M. Narasimha Murty, K. Ghosh, and S.K. Pal (eds.) Pattern Recognition and Machine Intelligence, Lecture Notes in Computer Science Vol. 8251, Springer Berlin Hiedelberg, 2013, pp. 459-464.

Rakshit, P., **S. Bhattacharyya**, A. Konar, A. Khasnobish, D.N.Tibarewala, and R. Janarthanan. *Artificial Bee Colony Based Feature Selection for Motor Imagery EEG Data*, J.C. Bansal, P. Singh, K. Deep, M. Pant, and A. Nagar (eds.) Proceedings of Seventh International Conference on Bio-Inspired Computing: Theories and Applications (BIC-TA 2012), Advances in Intelligent Systems and Computing Vol. 202, Springer India, 2012, pp. 127-138.

Journal Publications

Bhattacharyya, S., A. Konar, D.N. Tibarewala and M. Hayashibe. *A Generic Transferable EEG Decoder for Online Detection of Error Potential in Target Selection*, Journal of Neural Engineering, *Under Review.*

Bhattacharyya, S., S. Shimoda and M. Hayashibe. *A Synergetic Brain-machine Interfacing Paradigm for Multi-DOF Robot Control*, IEEE Transactions on Systems, Man and Cybernetics: Systems, *Early Access Published*, DOI: 10.1109/TSMC.2016.2560532.

Mazumder, A., P. Ghosh, **S. Bhattacharyya**, P. Das, and D.N. Tibarewala. (2015) *Performance Analysis of Memory-Recollection and Problem Solving Cognitive Processes Using EEG Signals*, International Journal of Biomedical Engineering and Technology, Vol. 19, No. 4, pp. 316-334, DOI: http://dx.doi.org/10.1504/IJBET.2015.073423.

Bhattacharyya, S., M. Pal, A. Konar, and D.N.Tibarewala. (2015) *EEG-based Control of Wrist and Finger Movement using an Interval Type-2 Fuzzy Approach*, Biomedical Signal Processing and Control, 21: 90-98, DOI: 10.1016/j.bspc.2015.05.004.

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, DOI:10.1016/j.robot.2015.01.007.

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, DOI: 10.1007/s11517-014-1204-4.

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, http://dx.doi.org/10.1016/j.bspc.2014.03.001.

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, DOI: 10.1007/s11517-013-1123-9.

Chatterjee, S., A. Ganguly, and **S. Bhattacharyya**. (2010) *Characterization of HRV by Poincare Plot Analysis among the Female Tea Garden Workers of Northern Hilly Regions of West Bengal*, International Journal Healtcare Informatic System and Informatics, 5 (2): 49-59.

Conference Publications

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, *Accepted for presentation.*

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*, In: 20th Conference of International Functional Electrical Stimulation Society (IFESS) 2016, France, *Accepted for presentation.*

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.

P. Ghosh, A. Mazumder, **S. Bhattacharyya**, and D.N. Tibarewala. (2015) *An EEG Study on Working Memory and Cognition*, In: 2nd International Conference on Perception and Machine Intelligence (PerMIn 2015), Kolkata, India, pp. 21-26.

M. Pal, **S. Bhattacharyya**, S. Roy, A. Konar, D.N. Tibarewala, and R. Janarthanan. (2014) *A Bacterial Foraging Optimization and Learning Automata Based Feature Selection for Motor Imagery EEG Classification*, In: 2014 International Conference on Signal Processing and Control (SPCOM-2014), Bangalore, India, pp. 1-5.

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.

S. Bhattacharyya, A. Konar, D.N. Tibarewala, A. Khasnobish, and R. Janarthanan. (2014) *Performance Analysis of Ensemble Methods for Multi-class Classification of Motor Imagery EEG Signal*, In: 2014 International Conference on Control, Instrumentation, Energy and Communication (CIEC14), Kolkata, India, pp. 797-801.

D. Sardar, D. Basu, **S. Bhattacharyya**, A. Konar, A. Khasnobish, D.N. Tibarewala, and R. Janarthanan. (2014) *Embedded Realisation of Amplitude-Phase Adaptive Filter for Bio-Potential Signals*, In: 2014 International Conference on Control, Instrumentation, Energy and Communication (CIEC14), Kolkata, India, pp. 668-672.

M. Pal, **S. Bhattacharyya**, A. Konar, D.N. Tibarewala, and R. Janarthanan. (2014) *Decoding of Wrist and Finger Movement from Electroencephalography Signal*, 2014 IEEE International Conference on Electronics, Computing, Communication Technologies (IEEE CONECCT 2014), Bangalore, India.

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.

S. Chatterjee, **S. Bhattacharyya**, A. Khasnobish, A. Konar, D.N. Tibarewala, and R. Janarthanan. (2012) *Study of inter-session variability of long term memory and complexity of EEG signals*, In: 3rd International Conference on Emerging Applications of Information Technology (EAIT 2012), Kolkata, India, pp. 106-109.

G. Singh, A. Khasnobish, A. Jati, **S. Bhattacharyya**, A. Konar, D.N. Tibarewala, and R. Ja-

narthanan. (2012) *Object-shape classification and reconstruction from tactile images using image gradient*, In: 3rd International Conference on Emerging Applications of Information Technology (EAIT 2012), Kolkata, India, pp. 93-96.

G. Singh, A. Jati, A. Khasnobish, **S. Bhattacharyya**, A. Konar, D.N. Tibarewala, and A.K. Nagar. (2012) *Object-shape recognition from tactile images using regional descriptors*, In: 4th World Congress on Nature and Biologically Inspired Computing (NABIC 2012), Mexico City, Mexico, pp. 53-58.

S. Bhattacharyya, A. Sengupta, T. Chakraborti, D. Banerjee, A. Khasnobish, A. Konar, D.N. Tibarewala, and R. Janarthanan. (2012) *EEG controlled remote robotic system from motor imagery classification*, In: 3rd International Conference on Computing, Commmunication and Networking Technologies (ICCCNT 2012), Coimbatore, India, pp. 1-8.

G. Singh, A. Jati, A. Khasnobish, **S. Bhattacharyya**, A. Konar, D.N. Tibarewala, and R. Janarthanan. (2012) *Negative emotion recognition from stimulated EEG signals*, In: 3rd International Conference on Computing, Commmunication and Networking Technologies (ICCCNT 2012), Coimbatore, India, pp. 1-8.

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.

T. Chakraborti, A. Sengupta, D. Banerjee, A. Konar, **S. Bhattacharyya**, A. Khasnobish, and R. Janarthanan. (2011) *Implementation of EEG Based Control of Remote Robotic Systems*, In: International Conference on Recent Trends in Information Systems (RETIS 2011), Kolkata, India, pp. 203-208.

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.

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.

S. Chandra, **S. Bhattacharyya**, D. Srivastava, A. Kaur, and D.N. Tibarewala. (2011) *Heart Rate Variability Data Mining to Study the Effect of Fun-Themed Audio-Visual Stimulus on Autonomous Nervous System*, In: National Conference on Instrumentation and Control (NATCONIC 2011), Kolkata, India, pp. 158-160.

K. Bakshi, A. Tibarewala, A. Khasnobish, **S. Bhattacharyya**, and A. Konar. (2011) *Development of a Compact Multimodal Data Acquisition and Signal Processing Module for Interfacing Bio-Potentials to Brain-Computer Interface System*, In: National Conference on Instrumentation and Control (NATCONIC 2011), Kolkata, India, pp. 154-157.

S. Bhattacharyya, A. Khasnobish, S. Chatterjee, A. Konar, and D.N. Tibarewala. (2010) *Performance Analysis of LDA, QDA and KNN algorithms in left-right limb movement classification from EEG data*, In: 2010 International Conference on Systems in Medicine and Biology (ICSMB), Kharagpur, India, pp. 126-131.

A. Khasnobish, **S. Bhattacharyya**, A. Konar, and D.N. Tibarewala. (2010) *K-Nearest Neighbor*

classification of left-right limb movement using EEG data, In: International Conference on Biomedical Engineering and Assistive Technology (BEATS), Jalandhar, India, pp. 50.

S. Chatterjee, A. Ganguly, and **S. Bhattacharyya**. (2009) *Poincare plot Analysis and Characterization of HRV among the tea garden workers of Northern part of West Bengal*, In: National Conference on Recent Development in Applied Mathematical Science and Engineering, Jalpaiguri, India.

S. Chatterjee, **S. Bhattacharyya**, and S. Roy. (2007) *Latest Irradiation Treatment of Carcinoma: Review of Antiproton Therapy*, In: National Conference on Bio-Medical Engineering, Manipal, India.

Conferences and Workshops Attended

7th International IEEE EMBS Neural Engineering Conference, April 22-24, 2015, Montpellier, France.

2014 International Conference on Control, Instrumentation, Energy and Communication, January 31- February 2, 2014, Calcutta University, Kolkata, India.

National Conference on Brain and Consciousness, September 20-21, 2013, Indian Statistical Institute, Kolkata, India.

National Workshop on Medical Signal & Image Processing, December 19-20, 2012, National Institute of Technology, Rourkela, India.

International Conference on Recent Trends in Information Systems, December 21-23, 2011, Jadavpur University, Kolkata, India.

National Conference on Instrumentation and Control, Jan 6-7, 2011, Heritage Institute of Technology, Kolkata, India.

International Conference on Biomedical Engineering and Assistive Technologies, December 17-19, 2010, Dr. B.R. Ambedkar National Institute of Technology, Jalandhar, India.

International Conference on Biomedical Instrumentation and Healthcare Engineering, August 6-8, 2009, Meenakshi Sundararajan Engineering College, Chennai, India.

National Conference on Biomedical Engineering, October 5-6, 2007, Manipal Institute of Technology, Manipal, India.

National Workshop on Biomechanics, October 4, 2007, Manipal Institute of Technology, Manipal, India.

Seminars Attended

Biopolymers in Biomedical Engineering, November, 2013, Jadavpur University, Kolkata, India.

IEEE Seminar on Computational Intelligence in Information Systems, Imaging and Security, August 3-4, 2012, St. Thomas College of Engineering and Technology, Kolkata, India.

National Technical Symposium on Biomedical Engineering, April 7-8, 2006, Siliguri Institute of Technology, Siliguri, India.

Industrial Training

Undertaken training in the form of **Observership** in Department of Biomedical Engineering at Rabindranath Tagore International Institute of Cardiac Sciences, Kolkata. Duration- 3 weeks.

Undertaken a training programme on **Medical Equipments and Hospital Management Soft-**

ware organized by Electrocare Services, Kolkata. Duration- 2 weeks.

COMPUTER SKILLS
- Languages: C, C++, C#, Python, Matlab, Labview.
- Application Softwares: Matlab, Labview, Openvibe, Microsoft Visual Studio 2010, LaTeX, common Windows database, spreadsheet, and presentation software
- Operating Systems: Linux (Ubuntu), Windows.

LANGUAGE KNOWN English, Hindi, Bengali, Assamese, French (Elementary)

PERSONAL INFORMATION
- Date of Birth: 16^{th} June, 1987
- Place of Birth: Dibrugarh, Assam
- Marital Status: Single
- Nationality: Indian
- Blood Group: AB^{+}