ABHISHEK TIWARI

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EDUCATION

INRS-EMT, University of Quebec, Montreal, Canada *May. '17 – Present*
PhD in Biomedical Signal Processing
Advisor: Prof. Tiago H. Falk, INRS-EMT, University of Quebec
GPA - 4.13/5.0

Indian Institute of Technology (IIT) Kharagpur, India *Jul. '11 – Apr. '16*
B. Tech. in Engineering Product Design and Manufacturing
M. Tech. in Design and Quality Engineering
Department of Industrial Engineering and Electrical Engineering – **Industrial Electronics Vertical**
GPA - 8.75/10.0

RESEARCH PROJECTS

Tracking Individual Performance with Sensors (TILES) study [PhD]

- Tracking physiological and activity information for more than 300 hospital nurses with a large number of sensors
- Deriving noise robust Heart Rate Variability and Breathing features for prediction of Stress and Anxiety levels in an "in-the-wild" setting.
- Integrating context (signal quality, activity level etc.) into machine learning models to improve prediction of psychological constructs.

Assessing mental workload and stress for Ambulatory Users using physiological signals [PhD]

- Experiment designed to assess mental workload and stress of subject while also doing physical activity
- Performed data collection including subject recruitment, experimentation etc.
- Focus on deriving noise robust features for various modalities (EEG, ECG etc.)
- Making use of multiple modalities for fusion and improvement of mental workload model performance

Analysis of mental fatigue and loss of alertness using Electroencephalography (EEG) signals [Masters]

- Implemented Synchronization Likelihood method with network parameters to study the mental fatigue and establish baseline.
- Modified the Motif Synchronization method to make it generalized over any motif degree and studied performance with different degrees of motifs
- Created a new complexity measure for time series analysis and verified it on Mental fatigue data

WORK EXPERIENCE

Senior Software Engineer at Robert Bosch Engineering and Business Solutions, Bangalore, India *Jul. '16 – Mar. '17*

- Worked on software development in the "Torque Structure Team"
- Developing embedded system software for Engine Brake Torque Coordination function for the Ford Motor Company

INTERNSHIPS

Graduate Internship at Thales Research Technology, Quebec City, Canada *Sep. '20 – Present*

- Undertook a project on **"Electrocardiogram (ECG) filtering algorithms for real-time ambulatory applications in harsh environments"** f
- Implemented and tested performance of various QRS detection methods for different noise types and levels on synthetic ECG data
- Implemented various ECG denoising algorithms and compared their performance based on filtering capability and algorithm complexity

Undergraduate Internship at Tata Motors, Pune *Jan. '14 – Jun. '14*

- Work on **"Design and Implementation of Sensor-less control strategy for a BLDC motor "**
- Simulated the third harmonic voltage sensing method for motor on Simulink
- Implemented control strategy on PIC18F4431 in Embedded C
- Boundary diagram analysis for motor with engine components for implementation in engine unit
- Implemented several of the CCP commands on Compact RIO FPGA for sending system sensor data to a monitoring tool

Undergraduate Internship at TVS Motors, Hosur *May. '13 – Jun. '13*

- Undertook a project on **"Improvement of Gage R&R for Chassis Dynamometer"** for improvement of quality assurance of scooter and bike variants
- Compared a optic engine fuel temperature sensor to a dipstick sensor
- Established the correlation between warm-up time of the engine fuel and vehicle speed
- Coordinated the measurements on the dynamometer performed in the Quality Assurance Department (QAD) lab to the working in the assembly plants
- Optimized the fuel consumption testing procedure on the chassis dynamometer to within 10% R&R value

RELEVANT COURSEWORK

Learning Representations	Machine Learning†	Probabilistic Graphical Models
Probability and Statistics	Multimodal Signal Processing	Digital Signal Processing
Signals and Networks	Introduction to Speech Processing	Design of Experiments

†(certified online course offered by Stanford University)

SOFTWARE SKILLS

- *Programming Languages*: C/C++, Python, Pytorch
- *Software Packages*: MATLAB, LaTeX, Simulink, LabView

ACADEMIC ACHIEVEMENTS

- Awarded 1st place (IEEE Brain Prize) at the B4IN.IO Toronto 2020 Hackathon at BMI Workshop, IEEE Systems Man and Cybernetics conference 2020 for project **"Optimizing Stroke Patient Motor Imagery Prediction with Amplitude Modulation Features"**

- Awarded 3rd place for the Best Paper Award competition at 42nd Conference of the Canadian Medical and Biological Engineering Society for the paper **"A Comparison of Two ECG Inter-beat Interval Measurement Methods for HRV-Based Mental Workload Prediction of Ambulant Users."**
- Awarded MITACS Accelerate scholarship for research internship at Thales Research Technology for a 4 month period for the project **"Electrocardiogram (ECG) filtering algorithms for real-time ambulatory applications in harsh environments"**.
- Among **top 0.5%** out of **0.5 million** students appearing for the **Joint Entrance Examination**, 2011

PUBLICATIONS

Journal Papers:

- Albuquerque, Isabela, **Abhishek Tiwari**, Mark Parent, Jean-François Gagnon, Daniel Lafond, Sebastien Tremblay, and Tiago Henrique Falk. **"WAUC: A Multi-Modal Database for Mental Workload Assessment under Physical Activity."** *Frontiers in Neuroscience 14 (2020): 1037.*
- **Abhishek Tiwari**, Isabela Albuquerque, Mark Parent, Jean-François Gagnon, Daniel Lafond, Sébastien Tremblay, and Tiago H Falk. **"Multi-Scale Heart Beat Entropy Measures for Mental Workload Assessment of Ambulant Users."**, *Entropy 21, no. 8 (2019): 783.*
- **Abhishek Tiwari** and Tiago H Falk. **"Fusion of motif-and spectrum-related features for improved eeg-based emotion recognition."**, *Computational intelligence and neuroscience 2019 (2019).*
- **Abhishek Tiwari** and Tiago H Falk. **"Lossless electrocardiogram signal compression: A review of existing methods."**, *Biomedical Signal Processing and Control 51 (2019): 338-346.*
- Andrea Clerico, **Abhishek Tiwari**, Rishabh Gupta, Srinivasan Jayaraman, and Tiago H. Falk. **"Electroencephalography amplitude modulation analysis for automated affective tagging of music video clips."**, *Frontiers in Computational Neuroscience 11 (2018): 115.*

Conference Papers:

- **Abhishek Tiwari**, Raymundo Cassani, Jean-Francois Gagnon, Daniel Lafond, Sebastien Tremblay, and Tiago H. Falk. **"Prediction of Stress and Mental Workload during Police Academy Training Using Ultra-Short-Term Heart Rate Variability and Breathing Analysis,"** *42nd Annual International Conference of the IEEE Engineering in Medicine Biology Society (EMBC), pp. 4530-4533. IEEE, 2020.*
- Raymundo Cassani, **Abhishek Tiwari**, and Tiago H. Falk. **"Optimal filter characterization for photoplethysmography-based pulse rate and pulse power spectrum estimation."** *42nd Annual International Conference of the IEEE Engineering in Medicine Biology Society (EMBC). IEEE, 2020.*
- **Abhishek Tiwari**, Isabela Albuquerque, Jean-François Gagnon, Daniel Lafond, Mark Parent, Sébastien Tremblay and Tiago H. Falk, **"Mental Workload Assessment During Physical Activity Using Non-linear Movement Artefact Robust Electroencephalography Features",** *2019 IEEE International Conference on Systems, Man, and Cybernatics (SMC)*
- Mark Parent, **Abhishek Tiwari**, Isabela Albuquerque, Jean-François Gagnon, Daniel Lafond, Sébastien Tremblay, and Tiago H. Falk. **"A Multimodal Approach to Improve the Robustness of Physiological Stress Prediction During Physical Activity."** *In 2019 IEEE International Conference on Systems, Man and Cybernetics (SMC), pp. 4131-4136. IEEE, 2019.*
- Isabela Albuquerque, João Monteiro, Olivier Rosanne, **Abhishek Tiwari**, Jean-François Gagnon, and Tiago H. Falk. **"Cross-Subject Statistical Shift Estimation for Generalized Electroencephalography-based Mental Workload Assessment".** *In 2019 IEEE International Conference on Systems, Man and Cybernetics (SMC), pp. 3647-3653. IEEE, 2019.*
- **Abhishek Tiwari**, Jennifer L. Villatte, Shrikanth Narayanan, and Tiago H. Falk. **"Prediction of Psychological Flexibility with multi-scale Heart Rate Variability and Breathing Features in an "in-the-wild" Setting."** *In 2019 8th International Conference on Affective Computing and Intelligent Interaction Workshops and Demos (ACIIW), pp. 297-303. IEEE, 2019.*
- **Abhishek Tiwari**, Shrikanth Narayanan and Tiago H. Falk, **" Breathing Rate Complexity Features for "In-the-Wild" Stress and Anxiety Measurement"**, *27th European Signal Processing Conference, EUSIPCO 2019*
- Anderson Avila R., Shruti R. Kshirsagar, **Abhishek Tiwari**, Daniel Lafond, Douglas O'Shaughnessy, and Tiago H. Falk. **"Speech-based Stress Classification Based on Modulation Spectral Features and Convolutional Neural Networks."** *In 2019 27th European Signal Processing Conference (EUSIPCO), pp. 1-5. IEEE, 2019.*

- **Abhishek Tiwari**, Shrikanth Narayanan and Tiago H. Falk, **"Stress and Anxiety Measurement "In-the-Wild" Using Quality-aware Multi-scale HRV Features"**, *41st International Engineering in Medicine and Biology Conference, EMBC 2019*
- **Abhishek Tiwari**, Raymundo Cassani, Shrikanth Narayanan and Tiago H. Falk, **"A Comparative Study of Stress and Anxiety Estimation in Ecological Settings Using a Smart-shirt and a Smart-bracelet"**, *41st International Engineering in Medicine and Biology Conference, EMBC 2019*
- **Abhishek Tiwari**, Isabela Albuquerque, Mark Parent, Jean-François Gagnon, Daniel Lafond, Sébastien Tremblay, and Tiago H Falk. **"A Comparison of Two ECG Inter-beat Interval Measurement Methods for HRV-Based Mental Workload Prediction of Ambulant Users."**, *CMBES Proceedings 42 (2019).*
- Isabela Albuquerque, **Abhishek Tiwari**, Jean-Franois Gagnon, Daniel Lafond, Mark Parent, Sbastien Tremblay, Tiago Falk. **" On the analysis of eeg features for mental workload assessment during physical activity"**, *2018 IEEE International Conference on Systems, Man, and Cybernatics (SMC)*
- Anwesha Sengupta, **Abhishek Tiwari** and Aurabinda Routray, **"Analysis of Cognitive Fatigue using EEG Parameters"**, *39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society 2017*
- Anwesha Sengupta, **Abhishek Tiwari**, Aritra Chaudhuri and Aurobinda Routray, **"Analysis of loss of alertness due to cognitive fatigue using Motif Synchronization of EEG records"**, *38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society 2016 , pp. 1652-1655*

HOBBIES

- Long distance running, participated in 6 half marathons finishing within 2 hours 30 minutes in all of them
- Playing acoustic and electric guitars for the past two years, interested in blues music genre
- Hiking enthusiast, completed several high altitude treks in the Himalayan ranges along with various shorter treks in Quebec