Mohit Agarwal

PhD Student
Electrical and Computer Engineering
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Research Interests Brain-Computer Interfaces, Human-In-The-Loop Reinforcement Learning, Ubiquitous Computing Applications in Machine Learning, Deep Learning and Signal Processing

Education

Georgia Institute of Technology Aug'14 - Present
MS/PhD in Electrical and Computer Engineering
Advisor: Prof. Raghupathy Sivakumar
GPA: 4.0/4.0 (Expected Graduation: Summer 2020)

Indian Institute of Technology Kanpur July'10 - May'14
B.Tech in Electrical Engineering
GPA: 8.7/10.0

Publications

Mohit Agarwal and Raghupathy Sivakumar, "Charge for a whole day: Extending Battery Life for BCI Wearables using a Lightweight Wake-Up Command", ACM CHI 2020

Mohit Agarwal and Raghupathy Sivakumar, "BLINK: A Fully Automated Unsupervised Algorithm for Eye-Blink Detection in EEG Signals", Allerton 2019

Mohit Agarwal, Duo Xu, Faramarz Fekri and Raghupathy Sivakumar, "Playing Games with Implicit Human Feedback", Workshop on Reinforcement Learning for Games at AAAI, 2020

Mohit Agarwal and Raghupathy Sivakumar, "Cerebro: A Wearable Solution to Detect and Track User Preferences using Brainwaves", ACM WearSys Workshop at MobiSys 2019

Mohit Agarwal, Duo Xu, Faramarz Fekri and Raghupathy Sivakumar, "Accelerating Reinforcement Learning Agent with EEG-based Implicit Human Feedback", IJCAI 2020 (under review)

Mohit Agarwal and Raghupathy Sivakumar, "THINK: Toward Practical General-Purpose Brain-Computer Communication", HotWireless Workshop at MobiCom 2015

Mohit Agarwal and Raghupathy Sivakumar, "Characters vs. Words - Observations on Command Design for Brain-Computer Interfaces", Poster, MobiSys, 2017

Shruti Lall, **Mohit Agarwal** and Raghupathy Sivakumar, "A YouTube Dataset with User-level Usage Data: Baseline Characteristics and Key Insights", ICC 2020

Ekansh Gupta, **Mohit Agarwal** and Raghupathy Sivakumar, "Blink to Get In: Biometric Authentication for Mobile Devices using EEG Signals", ICC 2020

Atul Kumar Sinha, **Mohit Agarwal** and Ajit K. Chaturvedi,"Multi-Level SINR Thresholding for Reduced Complexity MIMO Detection" in NCC, 2013

Onur Ozdemir, Lakshmi N. Theagarajan, **Mohit Agarwal**, T. Wimalajeewa and Pramod K. Varshney, "An MCMC Approach to Multisensor Linear Modulation Classification", WCNC 2017

Awards and Achievements

- **Semi-Finalist** of Qualcomm Innovation Fellowship 2018, USA
- Ranked **2nd** in worldwide Melanoma Detection Challenge (2016) organized by ISBI
- Ranked in the **Top 0.1%** (amongst 475,000 students) in IIT-JEE 2010
- Selected in the **Top 1%** (amongst 40,000 students) in National Physics Olympiad 2010

Technical Skills **Python**, C/C++, Java, MATLAB/R, Android Development, Web (HTML/CSS/d3/js), LaTeX
Deep Learning Frameworks: **Tensorflow**, PyTorch, Caffe, Torch and Keras

Internships

Wireless Technologies and SW Engineering Summer'18
Wireless Software Development Project
Under Firouz Behnamfar and Velu Elangovan at Apple (USA)

- Worked on the development of a system-level discrete event simulator (in C++) to characterize and optimize a radio-access technology (undisclosed, and developed in-house)

High Dimensional Spectral Sampling Methods Summer'17
Machine Learning and Data Analysis Research Project
Under J. J. Thiagarajan at Lawrence Livermore National Labs (USA)

- Automated the Pair-Correlation Function (PCF) estimation for arbitrary point clouds (which traditionally either require manual tuning for estimation, or takes several days for MD simulation)

Video Action Classification using Deep Stateful Networks Summer'16
Deep Learning Research Project
Under the guidance of Rob Liston and Dan Tan at Cisco Systems, Inc. (USA)

- Designed deep neural nets using LSTMs in Tensorflow, for action recognition in video clips
- Quantified the comparison between stateful and stateless models in UCF-101 dataset

Automatic Modulation Classification in WSNs Summer'13
Wireless Communication Research Project
Under the guidance of Prof. Pramod Varshney at Syracuse University (USA)

- Developed algorithm for automatic identification of digital modulation in wireless communication in the presence of noisy environment having unknown channel parameters using Bayesian model
- Proposed *Collapsed Gibbs sampling* based approach for channel parameter estimation — Performs well even in higher-order QAMs and reduces the local minima effect in high SNR regime

Research Experience

Multi-Human Assisted Learning for Machine Agents using EEG Aug'18 - Present
BCI Research Project, Reinforcement Learning (Doctoral Thesis: Prof. Sivakumar and Prof. Fekri)

- Research, design and develop an interesting solution paradigm allowing humans to assist RL algorithms without burdening human-in-the-loop through EEG-based brain waves
- Demonstration of the impact of our approach in improving state-of-the-art RL algorithms (e.g., DQN) by developing multiple Atari-like discrete-grid based games in OpenAI Gym
- Experimentally showed that error-potentials can be learned in a zero-shot manner (with AUC ≥ 0.8), and achieves a training acceleration of **2.25x** while making 75.56% less queries

Low-Power Command Detection for BCI Wearables Aug'16 - Mar'18
BCI Research Project, Ubiquitous Computing, Deep Learning (Doctoral Thesis: Prof. Sivakumar)

- Proposed a wakeup command detection design and detection strategy enabling always-on BCI wearables to run on low-power mode achieving **2.7x** improvement in battery life
- Proposed BLINK, an algorithm to self-learn and detect eye-blinks in user brainwaves with 98% accuracy and low false-positive rate without requiring any user-training

THINK: Turning Thoughts into Action Jan'15 - July'15
BCI Research Project under Prof. Sivakumar as a part of Master's Thesis

- Developed THINK, a general purpose platform to communicate by mere imagination
- Explored signal processing and detection of *mu-waves*, specifically in non-invasive domain (EEG)
- Achieved counter-intuitive results for system accuracy (81.2%), think rate and form-factor

Academic Projects

VisualAIDS: An Interactive visualization of HIV/AIDS data Oct'17 - Nov'17
Information Visualization Project (Information Visualization: Prof. Alex Endert)

- An interactive visualization designed in d3/js to investigate and explore HIV/AIDS data for various countries over time. More information at www.agmohit.com/VisualAIDS/

Modelling the Rehearsal Effect of Humans Oct'16 - Nov'16
Neuroscience and Machine Learning Project (Computation and Brain: Prof. Santosh Vempala)

- Demonstrated the notion of forgetting and rehearsal in humans in the realm of neural networks
- Successfully simulated Ebbinghaus forgetting curve and learning curve, and explored various rehearsal properties by building a Recurrent Neural Net in Tensorflow

Skin Lesion Analysis towards Melanoma Detection Mar'16 - Apr'16
Deep Learning Project (Deep Learning: Prof. Zsolt Kira)

- Automated skin cancer detection by proposing Deep Learning architectures based on CNNs for skin lesion segmentation, feature extraction and classification
- Won 2nd prize for the classification (81.3%) and feature extraction in ISBI 2016 Challenge

General Game Playing Agent Jan'13 - Apr'13
Artificial Intelligence Project (Artificial Intelligence: Prof. Amitabha Bhattacharaya)

- Developed an artificial gaming agent, capable of playing any game without human intervention
- Selected amongst top 5 projects, to compete on a global scale in GGP competition in AAAI

Academic Courses

Computer Science	Machine learning, Deep Learning, Artificial Intelligence, Computation and Brain, Applied Cryptography, Mobile Computing, Advanced Programming Techniques, Android Application Development, Information Visualization, Data Structure and Algorithms
Mathematics	Probability and Statistics, Linear Algebra, R Programming
Telecom/SP	Information and Coding Theory, Random Processes, Digital Communication Networks, Communication Systems, Digital Signal Processing, Statistical Signal Processing, Advanced Digital Communications, Wireless Communications and Networks, Convex Optimization in SP/COM

Grants

NSF Award #1837369, *CPS: Small: Multi-Human Assisted Learning for Multi-Agent Systems using Intrinsically Generated Event-Related EEG Potentials* ($500,000 PI: Prof. Sivakumar, Co-PI: Prof. Fekri, Jan'19 - Dec'21): Co-authored the winning proposal with significant technical contribution

Academic Responsibilities

PC Member	ICWSM 2020
Session Chair	Allerton 2019: Statistical and Signal Processing
Reviewer	ACM CHI'20, CogSci'20, ACI'19, AutomotiveUI'19, IMWUT'19, MobileHCI '19, ICWSM'20,'19, IEEE Transactions on Mobile Computing'17,'18,'19

References

Available on request