

Mohit Agarwal

PhD Student
Electrical and Computer Engineering
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Research Interests Brain-Computer Interfaces, Signal Processing, Machine Learning, Ubiquitous Computing
Deep Learning, Reinforcement Learning and Wireless Communications

Education



Georgia Institute of Technology
MS/PhD in Electrical and Computer Engineering
Advisor: Prof. Raghupathy Sivakumar
GPA: 4.0/4.0 (Expected Graduation: Dec 2019)

Aug'14 - Present



Indian Institute of Technology Kanpur
B.Tech in Electrical Engineering
GPA: 8.7/10.0

July'10 - May'14

Publications **Mohit Agarwal** and Raghupathy Sivakumar, "Characters vs. Words - Observations on Command Design for Brain-Computer Interfaces", Poster, International Conference on Mobile Systems, Applications and Services (MobiSys), Niagara Falls, NY, USA, June 2017

Mohit Agarwal and Raghupathy Sivakumar, "THINK: Toward Practical General-Purpose Brain-Computer Communication", 2nd ACM Workshop on Hot Topics in Wireless (HotWireless), 2015

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

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

Mohit Agarwal and Raghupathy Sivakumar. "*Don't charge for a day: Low-Power Wakeup Command Detection for always-on BCI Wearables*" under review, ACM CHI 2019

Provisional Patents **Mohit Agarwal** and Raghupathy Sivakumar. *Cogito Ergo Sum: Using Brain Waves to Perform Personalization based on What Users Think*. US Provisional Patent Application 62/565349. 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
- Recipient of **MCM Scholarship** for continued excellent academic performance (2010-2014)

Technical Skills

C/C++, Java, Python, MATLAB/R, Android Development, Web (HTML/CSS/d3/js), \LaTeX
Network Simulation Tools: ns2, Netlogo, iperf and Wireshark
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)



Lawrence
Livermore
National
Laboratory

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 ML algorithms without burdening human-in-the-loop through EEG-based brain waves
- Demonstration of the impact of our approach (including multi-human and multi-agent) in improving state-of-the-art RL algorithms by evaluating on Atari 2600 benchmark
- Preliminary results: **26.19%** improvement in detection of error-potentials — Reduces average number of steps in a cursor-target game by **72.98%** as compared to baseline

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)	
	<ul style="list-style-type: none"> 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)	
	<ul style="list-style-type: none"> 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)	
	<ul style="list-style-type: none"> 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)	
	<ul style="list-style-type: none"> 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 	
	NDroidPad: Android Application Dec'12 - Jan'13	
	Smartphone Application Development (Electronics Club, IIT Kanpur)	
	<ul style="list-style-type: none"> Developed an Android application to use smartphone as wireless controller/joystick for Laptop Implemented motion-sensor and multi-touch features, providing Xbox Interface to application Won 1st Prize in Techfest12; The app crossed 1000+ downloads within a week on Google Play 	
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 CPS: Small: <i>Multi-Human Assisted Learning for Multi-Agent Systems using Intrinsically Generated Event-Related EEG Potentials</i> (\$500,000 PI: Prof. Sivakumar, Co-PI: Prof. Fekri, Jan'19 - Dec'21): Co-authored the winning proposal with significant technical contribution	
References	Available on request	
Other Interests	Graphic and UI designing, Financial Technology	