

## Mohit Agarwal

PhD Student  
Electrical and Computer Engineering  
Georgia Institute of Technology

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**Research Interests** Brain-Computer Interfaces, Signal Processing, Machine Learning, Deep Learning, Artificial Intelligence 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: May 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), Niagra 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: Lightweight wakeup command detection for always-on BCI wearables" to be submitted, ACM MobileHCI, 2018

Jun Zou, **Mohit Agarwal**, Yashas Saidutta, Faramarz Fekri and Raghupathy Sivakumar, "EEG Sequence Recognition using Deep Learning and Hidden Markov Models for BCI" to be submitted

**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

- 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),  $\text{\LaTeX}$   
**Network Simulation Tools:** ns2, Netlogo, iperf and Wireshark  
**Deep Learning Frameworks:** Tensorflow, Caffe, Torch and Keras

## Internships



Lawrence  
Livermore  
National  
Laboratory

### High Dimensional Spectral Sampling Methods

Summer'17-Present

*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)
- Building a unified spectral synthesis framework to generate Point Sets for any distribution by interpolating in Pair-Correlation Space using GANs



### 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
- Performed experiments to leverage temporal coherence in sequence of video frames
- 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

### Brainwaves based Personalization in Recommendation Systems

Aug'17 - Present

*BCI Research Project under Prof. Sivakumar as a part of Doctoral Research Work*

- Conceptualize, research, and develop a fully functional BCI system to directly tap the thought-based feedback in a non-intrusive and passive manner over the recommended items
- Exploring the fundamental and quantitative benefit of understanding user by observing their thoughts in addition to the user's actions
- Demonstration of the impact of our approach in improving recommendation system, as a case study by implementing and evaluating on current state-of-the-art recommender systems

### Democratizing Brain-Computer Communication

Aug'16 - Present

*BCI Research Project under Prof. Sivakumar as a part of Doctoral Research Work*

- Research, design and develop an automatic learning framework that application developers can leverage to build applications effectively without any explicit knowledge in many related domains
- Framework learns the statistical pattern of brain waves and their correlation with mental thoughts using Deep-Neural Networks (e.g. CNNs, RNNs) and hybrid HMM models for sequence detection
- Exploring the practical challenges including usability, computational and communication aspects, from both user and developer standpoint

### 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

<b>Academic Projects</b>	<b>VisualAIDS: An Interactive visualization of HIV/AIDS data</b> Oct'17 - Nov'17	
	<i>Information Visualization Project</i> (Information Visualization: Prof. Alex Endert)	
	<ul style="list-style-type: none"> <li>An interactive visualization designed in d3.js to investigate and explore HIV/AIDS data for various countries over time. More information at <a href="http://www.agmohit.com/VisualAIDS/">www.agmohit.com/VisualAIDS/</a></li> </ul>	
	<b>Modelling the Rehearsal Effect of Humans</b> Oct'16 - Nov'16	
	<i>Neuroscience and Machine Learning Project</i> (Computation and Brain: Prof. Santosh Vempala)	
	<ul style="list-style-type: none"> <li>Demonstrated the notion of forgetting and rehearsal in humans in the realm of neural networks</li> <li>Successfully simulated Ebbinghaus forgetting curve and learning curve, and explored various rehearsal properties by building a Recurrent Neural Net in Tensorflow</li> </ul>	
	<b>Skin Lesion Analysis towards Melanoma Detection</b> Mar'16 - Apr'16	
	<i>Deep Learning Project</i> (Deep Learning: Prof. Zsolt Kira)	
	<ul style="list-style-type: none"> <li>Automated skin cancer detection by proposing Deep Learning architectures based on CNNs for skin lesion segmentation, feature extraction and classification</li> <li>Won 2nd prize for the classification (81.3%) and feature extraction in ISBI 2016 Challenge</li> </ul>	
	<b>OCR based Mathematical Equation Recovery</b> Mar'15 - Apr'15	
	<i>Machine Learning Project</i> (Statistical Signal Processing: Prof. Mark Davenport)	
	<ul style="list-style-type: none"> <li>Developed a mathematical equation recognition system, capable of converting scanned mathematical equations to machine readable format along with its L<sup>A</sup>T<sub>E</sub>X code and solution</li> <li>Achieved 98.92% accuracy in case of 60 symbols including operators and greek characters</li> </ul>	
	<b>General Game Playing Agent</b> Jan'13 - Apr'13	
	<i>Artificial Intelligence Project</i> (Artificial Intelligence: Prof. Amitabha Bhattacharaya)	
	<ul style="list-style-type: none"> <li>Developed an artificial gaming agent, capable of playing any game without human intervention</li> <li>Selected amongst top 5 projects, to compete on a global scale in GGP competition in AAAI</li> </ul>	
	<b>NDroidPad: Android Application</b> Dec'12 - Jan'13	
	<i>Smartphone Application Development</i> (Electronics Club, IIT Kanpur)	
	<ul style="list-style-type: none"> <li>Developed an Android application to use smartphone as wireless controller/joystick for Laptop</li> <li>Implemented motion-sensor and multi-touch features, providing Xbox Interface to application</li> <li>Won 1st Prize in Techfest12; The app crossed 1000+ downloads within a week on Google Play</li> </ul>	
<b>Academic Courses</b>	<b>Computer Science</b>	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
	<b>Mathematics</b>	Probability and Statistics, Linear Algebra, R Programming
	<b>Telecom/SP</b>	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
<b>References</b>	Available on request	
<b>Other Interests</b>	Graphic and UI designing	