Mohit Agarwal

PhD Student	www.agmohit.com
Electrical and Computer Engineering	Email: magarwal37@gatech.edu
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Research Interests

Brain-Computer Interfaces, Signal Processing, Machine Learning, Deep Learning, Reinforcement Learning and Wireless Communications

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: Dec 2019)

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, "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, 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)

- 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

- 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

Democratizing Brain-Computer Communication Aug'16 - Present
BCI Research Project, Deep Learning (Doctoral Thesis: Prof. Sivakumar and Prof. Fekri)

- Building an automatic learning framework that application developers can leverage to build BCI 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

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

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

NDroidPad: Android Application   Dec'12 - Jan'13

Smartphone Application Development (Electronics Club, IIT Kanpur)

- Developed an Android application to use smartphone as wireless controller/joypad 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: *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

References   Available on request

Other Interests   Graphic and UI designing, Financial Technology