Mohit Agarwal

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Research Interests	Brain-Computer Interfaces (BCIs), Machine Learning, Biosignal Sensor Data (EEG) Analysis Human Experiment Design, Signal Processing, Wearable Computing

Education

Georgia Institute of Technology   Aug'14 - Dec'20
MS and PhD in Computer Engineering, Minor in Computer Science, GPA: 4.0/4.0
Thesis: On The Interplay between Brain-Computer Interfaces and Machine Learning Algorithms
Advisor: Prof. Raghupathy Sivakumar

Indian Institute of Technology Kanpur   July'10 - May'14
Bachelors in Electrical Engineering, GPA: 8.7/10.0

Work Experience

Goldman Sachs - Quantitative Stratgeist   Feb'21-Present
Knowledge Graph, Data Science, Financial Research at Asset Management Division

- Building an Investment Research Platform, covering 1.8M+ companies, and 10M+ contacts from multiple data sources to surface investment opportunities and accelerate portfolio value creation
- Leading, designing and developing Knowledge Graph to derive insights from connections with applications in warm introductions, value acceleration, talent management and graph-based search
- Productionized various functionalities in the platform: entity resolution for contacts (70% recall, 98% precision), search functionalities (with ElasticSearch), API queries, Data ETL pipelines, etc.

Relevant Research Projects

On Using Brainwaves as Implicit Human Feedback in RL   Aug'18 - Dec'20
BCIs, Human-In-The-Loop Experiment Design, RL [NeuroComputing'21] [RL4G, AAAI'20] [ACM WearSys'20]
Prototyped and developed an end-to-end Human-in-the-loop system to accelerate RL algorithms via implicitly generated human feedback (EEG brainwaves)

- *Human Experiments and Systems Research:* Designed experimental protocols and system frameworks to perform IRB approved human experiments and collect high-fidelity EEG data.
  - Conducted in-lab experiments for 25+ users on 5 virtual/robotic spaces, 20k+ stimulations.
  - Benchmarked manual feedback against EEG-based implicit feedback on accuracy and latency.
- *Error-Potentials (ErrP) Research*: Experimentally validated and proposed algorithm to learn ErrPs in a zero-shot manner across environments, with 9.61% accuracy improvement.
- *Integration with RL Algorithms:* Integrated ErrP based feedback to accelerate RL training using action biasing, control sharing and reward shaping approaches (1.52x acceleration on DQN)

Low-Power WakeUp Command Detection for BCI Wearables   Aug'16 - Aug'18
BCIs, Human Experiment Design, Wearable Computing [ACM CHI'20] [IEEE Allerton'19]

- *Human Experiments and Systems Research:* Created experimental protocols to collect four eye-blink datasets: 2.5k+ eye-blinks, 80+ users, multiple EEG headsets, and user activities.
  - Characterized the battery life of BCI wearables (using OpenBCI) with experimental insights into the energy consumption of control knobs, to determine the low-power mode specifications.
- *EEG Signal Processing Research:* Proposed eye-blink detection algorithms, and implemented wake-up command detection on OpenBCI (Arduino, C++) to experimentally validate the system performance for accuracy, latency, power implications and end-user usability.
  - BLINK - a self-supervised eye-blink detection algorithm (98% accuracy, 0.934 precision)
  - Trance - a wake-up command detection strategy and algorithm (2.7x battery life).

Internship Experience	**Apple** - *Wireless Software Development*	Summer'18

- Developed a system-level discrete event simulator in C++ to characterize and optimized the parameters of a radio-access technology (undisclosed, and developed in-house)

Lawrence Livermore National Laboratory - *Machine Learning Research* Summer'17

- 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)

Cisco Systems, Inc - *Deep Learning Research* Summer'16

- Designed DNNs using LSTMs in Tensorflow, for action recognition in video clips using UCF-101
- The proposed stateful model perfomed with more than 25% accuracy over stateless model

Other Projects

Skin Lesion Analysis towards Melanoma Detection - *Deep Learning* Mar'16 - Apr'16

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

Selected Publications

Mohit Agarwal*, Duo Xu*, E. Gupta, F. Fekri and Raghupathy Sivakumar, "Accelerating Reinforcement Learning using EEG-based implicit human feedback", *NeuroComputing, 2021*

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", *IEEE 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, SK Venkateswaran and R. Sivakumar, "Human-in-the-loop RL with an EEG wearable headset: on effective use of brainwaves to accelerate learning", *ACM WearSys'20*

Mohit Agarwal and Raghupathy Sivakumar, "Cerebro: A Wearable Solution to Detect and Track User Preferences using Brainwaves", *ACM WearSys'19*

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

Y. Jian, C-L Tai, Shyam K. Venkateswaran, **Mohit Agarwal**, Y. Liu, Douglas M Blough, Raghupathy Sivakumar, "Algorithms for addressing line-of-sight issues in mmWave WiFi networks using access point mobility", *Journal of Parallel and Distributed Computing 2022*

Technical Skills

Python, Tensorflow, LaTeX. **Databases:** MongoDB, ElasticSearch, Neo4J (Graph DB)
Prior experience in C/C++, Java, Web, MATLAB/R, Android Development

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 awarded proposal with significant technical contribution

Professional Service

PC Member	ICWSM 2020	
Session Chair	Allerton 2019: Statistical and Signal Processing	
Reviewer	IMWUT'22,20,19, ACM CHI Play'22, ACM CHI'20, , CogSci'20, ACI'19, MobileHCI'19, ICWSM'20,'19, AutomotiveUI'19, IEEE Transactions on Mobile Computing'17,'18,'19	