Md Abdur Rahaman

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Education

Georgia Institute of Technology, GA, USA
PhD in Computational Science and Engineering | Expected August 2024

University of New Mexico, NM, USA
M.S. in Computer Science, July 2019

Experience

Graduate Research Associate – June 2019 to present.
Center for Translational Research in Neuroimaging and Data Science (TReNDS) at Georgia Tech

- Research Interests: Machine Learning, Deep Learning, Computer Vision, Pattern Minning, Computational Neuroscience
- Developing computational frameworks for learning discriminative and semantically meaningful patterns from big data
- Implement robust AI for multi-dimensional clustering, pattern recognition, and multi-modal fusion.
- Leveraging neurocomputational paradigms to enhance SOTA AI (Neuromorphic Computing).

Data Science Research Intern – September 2021 to December 2021
Nokia Bell Labs

- Worked with log analytics group to develop a log summarizer to compress the machine logs (billions of lines).
- Applied BERT models for learning log representation to detect a system failure.
- A multi-modal framework for combining system logs and user's error descriptions to route the failure alert.

Graduate Research Assistant – May 2017 to April 2019
Mind Research Network at the University of New Mexico

- Designed exhaustive biclustering and tri-clustering algorithms by relaxing the specification of the model order (k).

Projects

Bi-clusformer: a Transformer based end-to-end biclustering framework.

- Leveraged transformer's self-attention across feature and sample dimensions to generate coherent submatrices.
- A two-dimensional attention mechanism to approximate 2D homogeneity.

mBAM: deep multi-modal fusion with neuromorphic design

- A multi-modal latent space fusion using spatial and modality-wise attention inspired by the 'Bottleneck Attention Module'.
- Model's architecture and processing is powered by neuromorphic computing.
- Combines Neuroimages (fMRI, sMRI) and genomics to classify mental disorder.

SpaDE: Semantic locality preserving Auto-decoder for deep biclustering

- Auto encoder-based feature learning with a novel bi-clustering regularization – uncovering data point's true manifold.
- Formulated the regularization terms for semantic locality preservation (increases biological relevance) and sparsity.
- Designed a latent space-based meta-heuristic for two-dimensional cluster assignment of samples and features.

Statelet: a data summarization framework for time series data

- Discovers a set of 'k' representatives (shapes) from a collection of the brain's functional network connectivity time course.
- Novel implementation of Earth Mover Distance (EMD) for motifs comparison and Kernel Density Estimator (KDE) for smoothing motif's frequency space.
- Developed a module for selecting the summary shapes with maximum prevalence and diversity.

BrainGraph: a graph neural network (GNN) for modeling brain's functional connectivity

- BrainGraph: Nodes (brain networks), weighted edges (Statistical dependence a.k.a functional connections).
- Spatio-temporal attention to learn the coordination among the functional hubs of the brain.

IBRNN: Information-theoretic introspection method for Recurrent Neural Networks (RNNs)

- CBOW for word2vec embedding of the text corpus and bi-LSTM for the downstream task.
- Inspired by information Bottleneck theory, compute MI around labels, features, and layers and quantifies feature compression.

mriCAV: Concept Activation Vector (CAV) for model interpretability

- Introspect the fully trained deep models by finding active concepts - orthogonal vectors towards learned features.
- Allows testing model's inclination towards pre-defined concepts e.g., brain networks, activations.

N-BiC: greedy biclustering Algorithm with an unknown numer of clusters (k).

- Constraint depth-first search (DFS) - based algorithm to semi-exhaustively explore all possible combinations of instances.
- Doesn't require the specification of the number of clusters (k). Continously optimizes for a list of intrinsic biclusters.

Skills

Languages: C++, Python, C#, Java, JavaScript, Jquery, SQL **Tools:** Visual Studio, Free Surfer, FSL, SPM, Git, MATLAB, Anaconda
Cloud Technologies: AWS, Google, Docker, Spark **Libraries:** PyTorch, TensorFlow, OpenCV, Stanford CoreNLP, NLTK, Scikit Learn