Aditya Ahuja

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Research Interests

- Visual Reasoning and Scene Understanding
- Time Series Forecasting and Anomaly Detection
- Neuro-Symbolic Modeling
- Deep Learning on Signals

Education

- **Birla Institute of Technology and Science (BITS) - Pilani** — Goa, India
  Bachelors of Engineering (B.E.) in Computer Science. — Aug. 2017 - Jul. 2021

Experience

- **Computer Vision and Robotics Laboratory, UIUC** [Web] — Champaign, USA
  Visiting Researcher, Advisor - Prof. Narendra Ahuja — Nov. 2020 - Current
  - Working on developing interpretable Computer Vision architectures.

- **APP Center for AI Research (APPCAIR) & TCS Research** [Web] — BITS Pilani, Goa
  Undergraduate Researcher, Advisors - Prof. Ashwin Srinivasan and Dr. Shirish Karande — Jan. 2020 - Current
  - Currently working on three projects - [1] Compositional Visual Reasoning using Action Graphs, [2] Root Cause Analysis in Time Series datasets, & [3] Optimising RL algorithms using the Winnow Learning Rule.
  - [1] Focuses on methods to generate Action Graphs to model temporal reasoning on the CATER dataset. [Preliminary Demo]
  - [2] Focuses on developing algorithms that can identify important features in multi-variate Time Series data.
  - [3] Focuses on using the Winnow Learning Rule to speed up inference time on Standard Reinforcement Learning algorithms.
  - Previously worked on Neuro-Symbolic models for the Bongard Problems, by extending the DeepProbLog framework.
  - In the above, used Deep Models for pattern detection/localization & Problog for estimating hypothesis likelihoods.

- **European Centre for Medium-Range Weather Forecasts** [Web | Project | Talk | Slides | Demo] — Reading, UK
  Research Intern, Advisor - Dr. Peter Dueben — May. 2020 - Oct. 2020
  - ECMWF is Europe's largest meteorological research institute and serves $\sim$ 400 TB of weather data daily.
  - Built Machine Learning models for Streaming Time-Series Anomaly Detection to optimise ECMWF's data services.
  - Implemented Deep Time Series Forecasting methods like N-BEATS; reduced Server Downtimes by up to 4 hours.
  - Work was supported by a grant of £5,000 and was done as part of ECMWF's Summer of Code program - ESoWC.

- **Media.net, Directi** [Web] — Mumbai, India
  Software Development Intern — May. 2020 - Jul. 2020
  - Media.net is one of the largest Ad-Tech companies in the world, specifically focused on contextual advertisements.
  - Worked in the Ad-Experience team building models to predict and act on malicious bids for web advertisements.
  - Implemented algorithms for client-side detection and identification of malicious activities in foreign scripts.

- **Head Office, Bank Of Maharashtra** [Project] — Pune, India
  Software Development Intern — May. 2019 - Jul. 2019
  - Developed a framework for automatic signature verification that learnt signatures from few ($\leq$ 24) samples.
  - Used a Siamese Network to train signature representations, and encapsulated the code into a python package.

- **Pixxel** [Web] — Bangalore, India
  Research Intern — Feb. 2019 - Apr. 2019
  - Pixxel is a space-tech start-up. I worked on real world Machine Learning applications for their satellite data.
  - Built use-case prototypes from existing satellite data vendors for Geological applications [Feasibility Report]

Research Projects

- **Schizophrenia detection using Electroencephalography Signals.** — BITS Pilani, Goa
  Advisor: Prof. Amalin Prince — Sep. 2019 - Current
  - Areas: Deep Learning, Signal Processing.
  - Developing Deep Convolutional Neural models for automated diagnosis of Schizophrenia using EEG signals.
  - Exploring various Signal Processing techniques for building better representations from raw signals.
  - Exploring techniques such as Short Term Fourier Transform (STFT) and Empirical Mode Decomposition (EMD).

- **Implementing STDP on a Basal Ganglia model of a Layered Spiking Neural Network.** — BITS Pilani, Goa
  Advisor: Prof. Basabdatta Sen Bhattacharya — Jul. 2019 - Dec. 2019
  - Areas: Spiking Neural Networks, Neuroscience.
  - Implemented reinforcement learning in a spiking neural network using Spiking-Timing-Dependent Plasticity (STDP).
  - Developed a Basal Ganglia model that makes use of the Three-Factor Learning rule [Report]
  - In collaboration with the Human Brain Project, and the SpiNNaker neuromorphic computing framework.

Selected Personal Projects

- **Emotion Recognition from Audio Signals** [Github | Code]
  - Developed a Deep Learning pipeline for Emotion recognition using speech data, on the MELD Dataset.
  - Classified emotions across various emotions : [Disgust, Fear, Neutral, ...] across a highly unbalanced data sample.
  - Used Mel-frequency cepstral coefficients (MFCCs) to form speech representations and CNNs for classification.
- **Memotion Sentiment Analysis** [Github | Code]
  - Integrated deep text and image processing models to build a Multimodal Sentiment Analysis system.
  - Fine-tuned pretrained BERT and ResNext model and combined their representations using Late Fusion.
  - Classified sentiments on Internet Memes across different categories using the fused model.

Mentorship & Leadership Experience

- **President - Society for Artificial Intelligence and Deep Learning** [Webpage] Jun. 2020 - Current
  - President of the University's Artificial Intelligence and Deep Learning Research Society - SAiDL
  - Helped organise the Summer Symposium on AI Research - hosting top researchers from industry and academia.
  - Leading a group ($\sim$ 30) of talented undergraduates, holding Paper Reading sessions and working on Open-Source projects.
- **Teaching Assistant - BITS F464 [Machine Learning] (Twice)** [Webpage] Aug. 2019 - Current
  - Conducted Labs & Tutorials on topics like - Linear Regression, Bayes Nets, SVMs, Neural Nets, Decision Trees & Clustering.
  - Also responsible for developing the course projects/competitions and evaluating them.
- **Teaching Assistant - Data Science, iXperience** [Webpage] Jul. 2019 - Aug. 2019
  - Professionally taught Data Science & Machine Learning as a TA for iXperience's Data Science program.
  - Taught and mentored a diverse group of college students from various universities (Yale, Harvard, Cambridge, Princeton, UCLA, UCSD, etc) around the world, covering topics like Data Modeling, Time Series Analyis & Web Scraping.
  - Mentored a team of 8 interns for BUDS Lab, NUS, exploring data driven solutions to urban planning problems.
- **Technical Mentorship Programme, BITS Pilani** Aug. 2019 - May 2020
  - Mentored a group of 15 first-year Undergrads, under the Department Mentorship Programme.
  - Introduced them to various fields of Computer Science and helped them get started with programming.
- **Mentor, Machine Learning - Quark Summer Technical Projects** [Website] May. 2019 - Jul. 2019
  - Taught and mentored a group of over 200 undergrads, helping them get started with Machine Learning.
  - Duties included designing & evaluating assignments to grade their performance and helping them with their doubts.

Awards & Grants

- **AI Summer School - Google Research India** [Website] Jul. 2020
  - **Among 150 students selected across India** to attend a sponsored Summer School on Machine Learning.
  - Offered a seat in the **Computer Vision track** (containing 50 students) in line with previous research experiences.
- **ECMWF Summer of Weather Code** [Website] May. 2020
  - **Received a grant of £5,000** to develop Time-Series Anomaly Detection methods for ECMWF's massive data services.
- **CBSE Group Mathematics Olympiad [National Level]** [Ranklist] Dec. 2014
  - Secured **All India Rank 12** in CBSE Group Mathematics Olympiad (preliminary qualifier for IMO) in class 10.
  - Among the **33 students from CBSE grades 9-11** to qualify for **Indian National Mathematical Olympiad (INMO)**.

Technical Skills

- **Frameworks:** PyTorch, Tensorflow, Keras.
- **Languages:** Python, C++, C, MATLAB, Prolog, MySQL, LaTeX.
- **Libraries:** Numpy, Pandas, Matplotlib, Scikit-learn, OpenCV, MNE, Pytorch-Lightning.
- **Experience:** Computer Vision, Image Processing, Logic Programming, Data Structures and Algorithms.

Coursework

- **On Campus:** **Machine Learning** (was TA too, twice), **Neural Networks and Fuzzy Logic** (ranked 3/85), **Artificial Intelligence**, **Foundations of Data Science**, Compiler Construction, Computer Networks, Object Oriented Programming, Logic in Computer Science, Design and Analysis of Algorithms, Data Structures and Algorithms, Database Systems, Operating Systems, Linear Algebra.
- **Online:** Stanford CS231n - Convolutional Neural Networks for Visual Recognition, UC Berkeley CS 285 - Deep Reinforcement Learning, fast.ai - Deep Learning and Machine Learning courses.

Miscellaneous

- Hobbies - Bash Scripting, Watching Art-house Films, Swimming and Squash.
- Other Interests: Technology, Futurism, History & Geopolitics.