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Nitin Kumar

MS Research, Computer Science

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Timeline: MS CS, University of Colorado Boulder '23 | Ex-Amazon SDE-II '17-21 | B.Tech. CS, Indian Institute of Technology, Ropar '17
Highlights: Ability to learn fast, Excited to solve new problems, Dive deep skills

Summary: Strong expertise in Deep Learning, Software Design and Development. Experience in Deep Learning architectures, NLP and Neuroscience through academic research at University of Colorado, Boulder. 4+ years experience in full-stack end to end design and development of large-scale software products at Amazon.

Education

MS in Computer Science, University of Colorado, Boulder **Aug 2021 – Dec 2023**
Advisor: Leanne Hirshfield
Research Areas: Deep Learning Architectures, Neuroscience, Neuro-inspired AI, Human-Agent Teaming, NLP

B.Tech in Computer Science, *Indian Institute of Technology, Ropar* **July 2013 – May 2017**

Research Experience

Graduate Research Assistant - University of Colorado, Boulder **July 2022 — Present**
Advisor: Leanne Hirshfield

- Designing and implementing **Transformer** based **4D fMRI** architecture for task-based fMRI modelling. (ongoing)
- Implemented the the measurement of **correlation** between deep brain **fMRI** and **fNIRS** signals using **Pearson's correlation**, **Dynamic Time warping** and **MdRQA** with its extension to model FMRI signals using FNIRS by encoder decoder architecture. (paper in progress)
- Contributed to the proposal of **Neuro-Inspired** deep reinforcement Learning based **Human-Agent Teaming architecture** with reward shaping using Neural signals.
- Developed **transcription** system with **diarization** using **Whisper AI** and **pyannote** for experiment/study recordings (iSAT) outperforming Google Speech.

Graduate Research Assistant - University of Colorado, Boulder **Jan 2022 — June 2022**
Advisor: Lei Yuan

- Modeled child's learning using **Image Captioning encoder-decoder model** (using **CNN** and **LSTM**) for English and Chinese language to showcase the **learning of generative principles** by the model and its comparison with child learning.
- **Documented** the complete code development and also presented on "Software Engineering Practices" useful for managing the code development during research.

Work Experience

Software Development Engineer II - Amazon, Hyderabad, India **Oct 2020 — Aug 2021**

- **Designed and implemented** workflow (orchestrator) service for **Policy Simulation** based on change set with staged invocations, notifications and change approval using **authorization** to determine the impact of complex policy changes across WorkEvents system. **Led multiple teams (3)** for **requirement gathering, product feature finalization, design and implementation**. [**Python, Cloudformation, Lambda, Step Function, API Gateway, DDB**]
- **Designed High Level Design** for Policy Simulation Service (stated above) covering key design choices of simulation environment, parallel workflow invocations, **locking features** for maintaining **consistency** and identifier injection for **tracing invocation** of all the downstream services. Also, **Designed Low Level Design** for the service covering **orchestration** using Step Function with API Gateway, **Wait for Task Token Async** design, **Auto DB Sync, DynamoDB Table design and API Design**. Presented complete design and got it approved for further implementation.
- Implemented the packages for Policy Simulation Service with base code, required abstractions and modularity. Developed **infrastructure** for components using Cloudformation (**code as infra**) to enhance **extensibility and reuse** along with automated service monitoring, alarms and CI/CD deployment. Created **generic exception handling** package using **decorators** which was used across projects.
- **Mentored 3 SDEs** about organizational services, tools and software design and development practices at Amazon.
- Supported as **TA** for Machine Learning Bootcamp and Deep Learning Bootcamp at Amazon.

Software Development Engineer I - Amazon, Hyderabad, India **Aug 2017 — Oct 2020**

- **Designed and implemented** VNHO **payment** automation portal (along with complete test suite) and launched across multiple countries. Implemented **authentication and authorization** for the API services and UI. [**Java, Ruby, React, Redux, Enzyme, AWS DynamoDB**]
- **Designed and implemented the APIs** (with required **unit and integration tests**) for WEReporting Service using **restful** conventions. Developed the **portal** for report management and download. Identified and implemented **service monitoring alarms** for the WEReporting Service and created wiki dashboard (codified) for them. Service was part of WorkEvents product and was launched successfully across multiple countries. [**Java, Python, React, Redux, Ruby, Wiki, Monitoring Services**]

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- Integrated Population Service APIs for fetching employee details in Pay Portal. Implemented **Step Function Activity worker** to run the service in **MAWS** through **NAWS Step Function**. [**Java, AWS Step function**]
- Identified the solutions for **data streaming** of WorkEvents data and analyzed their capabilities (including Amazon Kinesis as well as change tracking of the SQL DB). [**Python, Amazon Kinesis, Amazon RDS**]
- **Created quick starter code** to **deploy** dynamic websites using **NodeJS, React, Redux** served through **Cloudfront** which was used across the organization to build further products faster with the reuse of the base services. **Conducted Tutorial sessions** on **"React and Redux Design Principles and Use"** to help build websites faster across the org.
- **Mentored 2 SDE interns** on common AWS Services as well as organization owned services in various tech stacks to help them to build new services.

Relevant Courses

Advanced Machine Learning, NLP, Deep Learning, Issues and Methods in Cognitive Science, Seminar on Statistics, Opt. and Machine Learning, Deep Reinforcement Learning, Data Centre Scale and Computing, Probabilistic modeling of Humans and Machine Learning, Linear Algebra, Algorithm, Data Structures, Artificial Intelligence, Machine Learning, Neurolinguistics

Skills

Languages/Libraries	Python, Java, C++, React, Javascript, R, Spark, NumPy, Pandas, Matplotlib
Tools/Platforms	Pytorch, Tensorflow, Sagemaker, Android Studio, MATLAB, AWS, GCP, Colab

Publications

- Using Speech Patterns to Model the Dimensions of Teamness in Human-Agent Teams. E. Doherty, C. Spencer, L. Eloy, **N. Kumar**, R. Dickler, L. Hirshfield (2023). In Proceedings of the 25th International Conference on Multimodal Interaction (pp. 640–648). Association for Computing Machinery. (Acceptance Rate: 39.3%) **Oct 2023**

Projects

- **Image Defogging using DDPM** : Proposed and implemented a generative model for **Image Defogging using Conditional Denoising Diffusion Probabilistic Model (DDPM)** architecture, leveraging U-Net and a linear noise scheduler to learn the transformation for Foggy CityScapes dataset. **May 2023**
- **CoAt-DQN** : Proposed and implemented **Convolution and Attention Deep Q-Network** architecture combining CNN and Transformers with Deep Q-Learning, leading to better generalization and improved Q-value approximation. Improvements were tested using **Atari Breakout Game** surpassing **DQN** and **Dueling DQN model by 164 % and 12.38 % respectively**. **Dec 2022**
- **ResearchDex** : Developed a slack **plugin** (with a **serverless** backend architecture using Google Cloud Platform) to help researchers stay informed about the latest research. **Dec 2022**
- **Creativity, Learning and AI** : Wrote a **paper review** on Creativity, Learning and AI, highlighting the current AI architectures with its capabilities and drawbacks in **modelling creativity**, with possible future directions of improvement in its modelling. **May 2022**
- **Neural Multi-channel reverse dictionary** : Proposed and implemented neural reverse dictionary model **grounded in linguistic predictors**, inspired from how humans infer word from descriptions, by using **FastText Embeddings** as well as fine-tuning **RoBERTa** LLM architecture. **May 2022**
- **Named Entity Recognition** : Implemented Named entity recognition for a medical dataset using **DeepCRF**, **BERT** fine tuning and **BioBert** fine tuning with an f1 score of **0.91** by the model fine-tuned BioBert. **Dec 2021**
- **Single Neuron Reconstruction** : Developed completely automatic method for tracing neuron morphology in 3D using Deep learning (CNN architecture). (**Advisor**: Dr. Deepti Bathula) **Jul 2016 - May 2017**

Achievements

'Most Creative Award' in TAA Hyderabad **Ideathon**, Amazon, Hyderabad **Nov 2020**

'Best Employee Award' in TAA Hyderabad, Amazon, Hyderabad **Mar 2020**

Recieved Merit-cum-Means **(MCM) Scholarship** at IIT Ropar. **Jul 2013 - May 2016**

Qualified **IIT JEE Mains and Advanced** examination **May 2013**