Alex MATHAI
Computer Science Researcher

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❤️ RESEARCH INTERESTS

I am passionate about solving challenging research problems. My areas of interest include **LLM Agents**, **LLM training**, **ML for structured data like programming languages and graphs**, **knowledge graphs** and **graph neural networks**.

I am currently a PhD student at Columbia University and am grateful to be advised by Prof. Baishkahi Ray, Prof. Junfeng Yang, and Prof. Suman Jana.

🎓 EDUCATION

Years	Degree	GPA	Rank
2023-27 (expected)	PhD in Computer Science, Columbia University	4.25 / 4	–
2016-20	B.E. in Computer Science, Birla Institute of Technology and Science Pilani	9.63 / 10	6th/123

🏆 AWARDS AND SCHOLARSHIPS

Year(s)	Award
2024-25	**Amazon AI** trusted challenge to help train code LLMs that generate secure code.
2023-25	**Google Cyber NYC** awards to pursue research (with **Google Deepmind**) at the intersection of AI and Security
2022	**IBM Research Distinguished Paper Award** Given to the top 2 papers from IBM Research India and Singapore
2016-20	**Institute Merit Scholarship** Awarded to top 3% students for Exceptional Academic Performance

📕 RESEARCH PAPERS

CRASHFIXER : A CRASH RESOLUTION AGENT FOR THE LINUX KERNEL ⬀ UNDER SUBMISSION
Alex Mathai, Chenxi Huang, Jihwan Kim, Suwei Ma et al.

KGYM : A PLATFORM AND DATASET TO BENCHMARK LLMS ON LINUX KERNEL CRASH RESOLUTION ⬀ NEURIPS 2024
Alex Mathai, Chenxi Huang, Petros Maniatis, Aleksandr Nogikh et al.

COMEX : A TOOL FOR GENERATING CUSTOMIZED SOURCE CODE REPRESENTATIONS ⬀ ASE 2023
Debeshee Das, Noble Saji Mathews, **Alex Mathai**, Srikanth Tamilselvam et al.

MONOLITH TO MICROSERVICES : REPRESENTING APPLICATION SOFTWARE THROUGH HETEROGENEOUS GNNS ⬀ IJCAI 2022
Alex Mathai, Sambaran Bandyopadhyay, Utkarsh Desai, and Srikanth Tamilselvam.

INCREMENTAL ANALYSIS OF LEGACY APPLICATIONS USING KNOWLEDGE GRAPHS FOR APP MODERNIZATION ⬀ CODS-COMAD 2022
Saravanan Krishnan, **Alex Mathai**, Amith Singhee, Atul Kumar, et al.

RECLIVE : REAL-TIME CLASSIFICATION AND QOE INFERENCE OF LIVE VIDEO STREAMING SERVICES ⬀ IEEE IWQOS 2021
Sharat Chandra Madanapalli, **Alex Mathai**, Hassan Habibi Gharakheili, and Vijay Sivaraman.

ADVERSARIAL BLACK-BOX ATTACKS ON TEXT CLASSIFIERS USING GENETIC OPTIMIZATION GUIDED BY DNNS ⬀ ARXIV, 2020
Alex Mathai, Shreya Khare, Srikanth Tamilselvam, Senthil Mani

💼 US PATENTS

AUTOMATICALLY IDENTIFYING APPLICATION PROGRAMMING INTERFACES BASED ON APPLICATION ARTIFACTS, 2023   ⬏ PATENT

A patent to automatically extract API signatures from old monolithic code.

SYSTEM AND METHOD TO EXPLAIN CANDIDATE MICROSERVICES FROM MONOLITH, 2022   ⬏ PATENT

A patent that uses explainable AI models like **GNN explainer** to justify the microservice recommendations we make when decomposing monoliths.

HETEROGENEOUS GRAPH GENERATION FOR APPLICATION MICROSERVICES, 2021   ⬏ PATENT

A patent for the creation of a heterogeneous graph from an application codebase. Clustering is then performed on this graph to create multiple smaller clusters representing microservices.

💼 INDUSTRIAL AND ACADEMIC RESEARCH EXPERIENCE

Aug 2025
May 2025

Applied Scientist Intern, Amazon Code Whisperer | Codebase Bug Localization, CA, USA
> I developed techniques for effective bug localization from a large codebase given a natural language issue. I collaborated with ⬏ Joe Hsu at Amazon AI.
> I showed upto **6%** performance improvements on the perfect recall of code snippets that are relevant to bug localization. I achieved this by training custom embedding models on the development history (i.e. commit history) of the codebase.

LLMs | Agentic Frameworks

Current
Sept 2023

PhD Student, Columbia University | LLM Agents for million line+ codebase debugging, NYC, USA
> I am currently designing effective LLM Agents that resolve bugs in massive million line+ system software codebases like the Linux kernel. This is in collaboration with **Deepmind :** ⬏ Petros Maniatis and **Google :** ⬏ Franjo Ivančić and ⬏ Aleksandr Nogikh
> We aim to show that LLMs can be effectively used even in challenging situations, i.e., in low-resource languages, in complex codebases, and for tough-to-debug crashes.

LLMs | Agentic Frameworks

Aug 2023
Aug 2020

Research Engineer, IBM Research | Modernizing Monoliths to Microservices , BANGALORE, India
> Worked with ⬏ Amith Singhee on the knowledge graph (KG) modeling of large monolith applications, and with ⬏ Srikanth Tamilselvam on KG partitioning to generate candidate microservices.
> Played a pivotal role in (i) **KG construction** using static analysis, (ii) **KG Inference** using graph traversal algorithms and (iii) **KG Partitioning** using graph neural network based representation learning coupled with unsupervised clustering to generate groups (microservice recommendations).

Java | Python | Neo4j | SQL | Pytorch

Dec 2019
Aug 2019

University of New South Wales (UNSW) | Time Series Analysis Research, SYDNEY, Australia
> Worked with ⬏ Vijay Sivaraman and ⬏ Hassan Habibi on creating deep learning models that can **classify** and isolate **live streaming** network traffic in **real-time** for 5000 Australian homes.
> Played a lead role in crafting and **extracting time-series features** at gigabyte scales. These features were resilient to challenging settings like network congestion and varying bandwidth capacities.

Pytorch | Python | Numpy | Matplotlib

Aug 2019
May 2019

IBM Research Labs | Natural Language Research Engineer, BANGALORE, India
> Generated **adversarial text** using black-box techniques to break NLP models trained for classification.
> Integrated deep learning models with a genetic algorithm for a hybrid AI system.
> Implemented LSTM classifiers, sequence to sequence translation models and language models.

Pytorch | Python | NLTK | Numpy | Matplotlib | FairSeq | TorchText | InferSent | GloVe

Aug 2018
May 2018

Indian Space Research Organization | Computer Vision Research Engineer, DEHRADUN, India
> Developed an **Image Segmentation API** for high-resolution satellite images.
> Implemented **U-Nets** for the segmentation of tarred roads and deep water bodies.
> Preprocessed 500 GB of multi-spectral geospatial data for its use in the computer vision model.

Tensorflow | Python | Matplotlib | Shapely | Gdal | Osr | Pandas | Descartes

</> Technical Expertise

Programming	Python, Java
Frameworks	Pytorch, Tensorflow, Flask-restx
Databases	Microsoft SQL Server, Neo4j Graph DB
Operating Systems	Mac OS X, Windows 7/8/10, Linux Redhat, Linux Ubuntu

Leadership Roles

2018-19   **Machine Learning Special Interest Group Coordinator, ACM** BITS Pilani Chapter (India's best ACM chapter 4 years in a row)