Abdalgader Abubaker

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Education

2019 – 2021 MSc, **Machine Intelligence**, African Institute for Mathematical Sciences (*Top 5*).
2018 – 2019 MSc, **Mathematics**, University of Khartoum (*Distinction*).
2012 – 2017 BSc (Hons), **Mathematics and Computer Sciences**, University of Khartoum (*First Class*).

Professional Experiences

Feb. 2024 – Present **Senior AI Engineer** at **Technology Innovation Institute**, Abu Dhabi, UAE.
Focus on building and training state-of-the-art generative models, e.g Falcon models, and enhance their capabilities in reasoning and alignment.

Aug. 2023 – Feb 2024 **Senior AI Engineer** at **Kera Health Platform**, Remote.
I was responsible of developing an AI-powered engines for healthcare running with LLMs e.g Question Answering RAG System.

Aug. 2021 – Feb. 2023 **AI Resident** at **Meta**, London, UK.
I was working as full-time employee in the Modern Recommendation System (MRS) team to build a graph-based recommendation system for better user experience at Meta platforms (Facebook, Instagram, etc). My research focus was on building scalable, high-performance graph-based novel algorithm.

Nov. 2020 – Jul. 2021 **AI Research Associate** at **LIVIA - École de Technologie Supérieure ÉTS**, Montreal, Canada.
I joined LIVIA research group as a AI research associate to collaborate on large research project at the intersection of graph machine learning and software engineering.

Jun. 2020 – Dec. 2020 **AI Research Intern** at **Mila-Quebec AI Institute**, Montreal, Canada.
It was paid internship. I was working in research area comprise Meta-Learning and Graph Representation Learning (GNNs) to tackle the drug discovery challenges. I supervised by Prof. Samira E. Kahou and Prof. Doina Precup.

May 2019 – Aug. 2019 **Software Developer** at **Financial and Banking System Co. Ltd**, Khartoum, Sudan.
I worked in the development and deployment core bank system "Meezan", as service for many banks in Sudan. It was 3 months training position.

Academic Positions

Jan. 2019 – present **Lecturer at Pure Mathematics Department, University of Khartoum**, Khartoum, Sudan.

Nov. 2017 – Dec. 2018 **Teaching Assistant at Pure Mathematics Department, University of Khartoum**, Khartoum, Sudan.

Researches & Projects

AI/ML

2024 **PORT: Preference Optimization on Reasoning Traces**
We introduce preference optimization methods for Chain-of-Thought steps in language models, enhancing reasoning performance by generating rejected answers through digit corruption and weak prompting. This approach achieves up to an 8.47% increase in accuracy on different reasoning benchmarks. https://arxiv.org/abs/2406.1606

2024 **Investigating Regularization of Self-Play Language Models**
examines regularization in language model alignment via self-play, addressing SPIN method instability. We propose Kullback-Leibler regularization and fictitious play to enhance stability. https://arxiv.org/abs/2404.04291

2022 – 2023 **Pretraining Hypergraphs Neural Networks**
At Meta, I worked on developing a novel pretraining framework that leveraging the hypergraph structure to generate informative node embeddings, and use these embeddings for different downstream tasks and usecases. https://arxiv.org/abs/2311.11368.

2020 – 2021 **From Legacy System to Microserveices**
At LIVIA, I was working on a research to develop machine learning based architecture to migrate the monolithic legacy system to microservices. The framework use several ML models such as GNNs. This work accepted at *Journal of Software: Evolution and Process*.https://onlinelibrary.wiley.com/doi/abs/10.1002/smr.2503

2020 **Meta-Learning for Graph Representation with Application to Drug Discovery**
At Mila, I was working to develop a machine learning model to foretell the link connections in sparse graphs using graph representation methods with meta-learning paradigm.

2020 **Automatic Speech Recognition for Arabic Language.**
It was a mini-project aim to generate an ASR model for the Arabic language, using our own recorded 2-hours labeled dataset and pre-train using CPC self-supervision and fine-tune using CTC.

2020 **DNA Sequence Classification**

Using kernel methods to predicting whether a DNA sequence region is binding site to a specific transcription factor. The project was a Kaggle's challenge.

2020 **Cassava Disease Classification**

In this project, we used deep learning algorithms besides building a data pipeline to classify Cassava plant images, categorized in four different diseases (CBB, CBSD, CGM, CMD) and one healthy class. This project was a Kaggle's challenge.

2019 **Audio-Classifier**

Reproduced the paper "VERY DEEP CONVOLUTIONAL NEURAL NETWORKS FOR RAW WAVEFORMS, Wei Dai et al." by building a deep Convolutional Neural Networks (CNN) for five different architectures M3, M5, M11, M18, and M34-res on UrbanSound dataset using Pytorch.

Cryptography

2018 – 2019 **Zero-Knowledge Proofs**

By made a research on Zero-Knowledge Proofs techniques I implemented the Prime Factorization scheme by using Java Security framework as a proof of concept.

2017 – 2018 **Secure Mailing System Using Signcryption**

As gradauation team-project, we built an email client that applies a Signcryption scheme to provide confidentiality and authentication. The scheme security is on a par with encryption and digital signature schemes of comparable parameters but at a lower cost using Java.

Journal Publications

2022 From Legacy to Microservices: a Type-based Approach for Microservices Identification using ML and Semantic Analysis, I. Trabelsi, M. Abdellatif, **A. Abubaker**, N. Moha, S. Mosser, S. Ebrahimi-Kahou, and Y. Guéhéneuc.

[Paper] *Accepted at Journal of Software: Evolution and Process.*

Engineering Skills

Programming Languages/Skills	Python, C++, Linux/Unix shell scripting, Algorithms analysis, design and optimization.
ML Frameworks	PyTorch, PyG, Transformer, Scikit-Learn, NumPy, Pandas, Matplotlib.
Databases	Graph Database (Cypher Neo4j), SQL, MySQL/PostgreSQL, NoSQL, Dockers.
Infrastructure	GCP, AWS (SageMaker), Parallel Computing and Distributed Training.
MLOps	Designing ML systems, Data engineering, Model deployment.
OS	Linux, Mac and Windows.
Others	CI/CD, Git, LaTeX, Java (security), Matlab, HTML/CSS.

Awards and Scholarships

2019 Google and Facebook Full Scholarship for AMMI Program (MSc).
2018 Sudan's Ministry of Higher Education (MSc) Scholarship.
2017 IEEE-Sudan Best Project Award (1st place) - title:"Secure Mailing System Using Signcryption".
2015 Exchange Program: Beifang University of Nationalities, Ninxia, China. (given to the top 5 students)

Conferences & Summer Schools

Dec. 2022 Learning on Graph (LoG) Meetup @ University of Cambridge, Cambridge, UK.
Sep. 2020 Montreal AI Symposium, Montreal, Canada - (Virtual).
Aug. 2020 Machine Learning Summer Schools-MLSS— Indonesia - (Virtual).
Jun. 2020 Machine Learning Summer Schools-MLSS — Tübingen, Germany - (Virtual).
May 2020 Computer Vision and Pattern Recognition (CVPR)- Volunteer (Virtual).
Mar. 2019 CIMPA: Hyperplane Arrangements, Recent Advances and Open Problems - Hanoi, Vietnam.

Memberships & Academic Services

- Reviewer for *Journal of Software: Evolution and Process*
- Member of Black in AI Community.
- Member of Sudanese Machine Learning Community (SMLC).

Languages

English, Arabic, and French (beginner).