Utshab Kumar Ghosh

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RESEARCH INTERESTS

Machine Learning, Large Language Models, Information Retrieval, Retrieval-Augmented Generation, Biomedical.

EDUCATION

Ph.D. in Computer Science   **Missouri, USA**
Missouri University of Science & Technology   Aug 2025 - Present
Research Domain: Large Language Models and their real-world applications.
Supervisor: Dr. Shubham Chatterjee

B.Sc. in Computer Science & Engineering   **Rajshahi, Bangladesh**
Rajshahi University of Engineering & Technology   Jan 2017 - Oct 2022
Result (CGPA/4.0): 3.22 (3.48 in last 3 semesters)
Thesis: Most Dominant Metabolomic Biomarkers Identification for Lung Cancer. [Read here]
Supervisor: Abu Sayeed and Dr. Md. Al Mehedi Hasan

PUBLICATIONS

- Mukhopadhyay[1], Debayan and **Ghosh[1], Utshab Kumar** and Chatterjee, Shubham (2025). "Tip-of-the-Tongue Retrieval: A Multi-Stage Hybrid Retrieval Pipeline with a Single-Turn LLM-Based Query Reformulation". In: TREC 2025.

- Rifaat[1], Nahian and **Ghosh[1], Utshab Kumar** and Sayeed, Abu (2022). "Accurate gait recognition with inertial sensors using a new FCN-BiLSTM architecture". In: Computers and Electrical Engineering, 104, p. 10842. [**Q1 journal, first author**]

- **Ghosh, Utshab Kumar** et al. (2022). "Most dominant metabolomic biomarkers identification for lung cancer". In: Informatics in Medicine Unlocked 28, p. 100824. [**Q2 journal, First author**]

EXPERIENCE

Machine Learning Engineer   **Dhaka, Bangladesh**
Nascenia Ltd.   Dec 2022 - Jun 2025

Led the development of software solutions across multiple projects, specializing in AI-powered applications and full-stack web systems for government and enterprise use cases. My responsibilities include:

- **Conversational AI and RAG Systems for Government Services**
  - Developed and integrated multilingual conversational chatbots (Bengali & English) for government websites using **LangChain** and **Llama-3**, deployed on **AWS**. Performed R&D on several LLM models like Mistral, Bloom, GPT, etc.
  - Designed and implemented a Retrieval-Augmented Generation (RAG) pipeline with LangChain and **ChromaDB**, enabling document-driven question-answering and custom action execution.
  - Built AI-driven workflows using LangChain and **LlamaIndex**, ensuring context-aware responses by integrating external APIs and knowledge bases for real-time data access.
  - Optimized LLM performance through prompt engineering and model inference techniques.
  - Deployed applications on AWS, utilizing cloud infrastructure for scalability and reliability.
  - Enhanced system efficiency by GPU acceleration and quantization techniques like **LoRA**. The current Llama-3.1 8B model has been deployed with 5-bit quantization.
  - Collaborated with Project Manager, ML engineers, and software developers to integrate AI solutions into client products, conducting bi-weekly meetings to align requirements and prevent scope creep.
- **Full-Stack Web Application**
  - Built a full-stack web application with Laravel, implementing secure user authentication, data management, an admin panel, and interactive dashboards.
  - Ensured security, privacy, and compliance in AI systems by implementing secure user authentication and data encryption.
  - Continuously optimized backend and frontend code, resolving conflicts and ensuring scalability.
- **Industrial Sensor Monitoring App**
  - Developed and released an Android app for hardware sensors using the Modbus protocol, enabling real-time data collection and monitoring for industrial applications.

Co-Founder & ML Mentor
Code Studio Academy

Dhaka, Bangladesh
May 2019 - Jun 2025

- Co-founded Code Studio, a startup that has grown into a medium-sized company in Bangladesh. In my role there, I built the core team and managed client relationships, the marketing team, and budgets.
- Through our sister organization, Code Studio Academy, I have driven social change by addressing unemployment through education. My Machine Learning Bootcamp has helped numerous individuals secure jobs. Selected classes are also available on YouTube.

AI Research Assistant
MyMedicalHUB Int.

Florida, USA (Remote)
Oct 2020 - Sep 2022

- Developed an AI system for detecting Parkinson's disease with an accuracy of about 0.98, utilizing pattern recognition and ML models. Analyzed image and video data of gait and sports with angle-based posture patterns, OpenPose model, etc.

Smart Book Writer
10 Minute School

Dhaka, Bangladesh
Oct 2020 - Sep 2022

- Comprehensive demystifier to simplify O-level and A-level textbooks.

MACHINE LEARNING COMPETITIONS

- **Submitted**
  TREC Tip-of-the-Tongue: The phenomenon of failing to recall something from memory, combined with partial recall and the feeling that recall is imminent.
- **54th out of 2034 Participants (Top 2.6%)**
  HackerEarth ML Challenge: A Fine Windy Day.
- **86th out of 2796 Participants (Top 3%)**
  HackerEarth ML Challenge: Fast, Furious and Insured.
- **443th out of 3545 Participants (Top 12.5%)**
  Kaggle PetFinder.my - Pawpularity Contest.
- **1019th out of 2109 Participants (Top 48%)**
  Kaggle TensorFlow - Help Protect the Great Barrier Reef.
- **Running**
  DataHack Traffic Forecasting.

PROJECTS

NER & POS Tagging
2024

An NLP project for Bangla sentence processing, tagging Named Entity Recognition and Parts of Speech. This features a FastAPI-powered web application, utilizing deep learning models and comprehensive data preprocessing. Link.

Bone Marrow Cell Classification
Ongoing

Classified bone marrow cells using image processing and machine learning techniques. Last, by fine-tuning the EfficientNetB7, obtained a precision of 0.84-0.90 for some classes, such as Abnormal eosinophils, Artefacts, etc.

ML Bootcamp
2023

Mentored over 120 students on Python, data analysis, visualization, mathematics for ML, algorithms, SQL, CNN, etc. Added hands-on projects relevant to the topics so that the students can get some handy experience of the theories. Link.

IMDB Clone
2023

Created a web application replicating functionalities similar to IMDB using ReactJS. Link.

Time Series Analysis
2022

Prediction of stock price, air quality, ads currency forecasting, etc. with an accuracy of 0.8-0.9. Link.

E-commerce Site
2020

Developed an e-commerce website using the Django framework. This project involved building functionalities like product management, user accounts, shopping carts, etc. Link.

Accomplishments

- **The Swedish Institute Scholarship for Global Professionals, 2025** (awarded to 300 recipients worldwide).
- **Kaggle Expert** (x3).
- **300+ Problems solved** in *Codeforces, Codechef, Leetcode, and other Online Judges*.
- **Gold Medalist** in *National High School Programming Contest*.
- **Deep Learning Specialization** in *deeplearning.ai*.
- **Applied Data Science Specialization** in *IBM*.
- **Data Scientist Career Track** in *Datacamp*.
- **AI for Medical Diagnosis** in *deeplearning.ai*.

Skills

Programming	Python, C, OOP, Data Structures & Algorithms.
Data Science, ML and DL	Data Analysis & Visualization, ANN, CNN, RAG, LLM, Supervised & Unsupervised Learning Algorithms, Pipelines, Feature Engineering, Selection & Extraction, Fine-tuning, Training, Prompt engineering, GPU acceleration, Quantization.
Frameworks and Tools	TensorFlow, PyTorch, Keras, OpenCV, NumPy, Pandas, Scikit-Learn, LangChain, LlamaIndex, OpenAI API, Hugging Face.
Mathematics for ML	Algebra, Statistics, Possibility, Geometry, Matrix.
Web Development	ReactJS, SaaS, Tailwind, JavaScript, Django, Flask.
Database	MySQL, MariaDB, ChromaDB, Redis, Firebase, MongoDB.
Cloud	AWS, Azure, Apache Server, Nginx.
Miscellaneous	Git, Docker, Linux, Gradio, Latex, MS Office, Adobe Illustrator, Premiere Pro.

Peer Review & Talks

Peer Reviewer	2025-Present
LREC 2026	
Opportunities in programming career: Talk with the experts	May 2023
IEEE RUET RAS Student Branch Chapter	

Activity & Administrative Experience

- **Blog Writer:** Medium
- **Vice President (Admin):** *Onuronon, RUET Cultural Club*
- **Cultural Secretary:** *Bangladeshi Student Association - Missouri S&T*
- **Asst. Publication Secretary:** *RUET Career Forum*
- **Founder, Keyboardist, and Guitarist:** *Plectrum, a Bangladeshi Band*

References

Available upon request.