# Redwanul Karim, M.Sc.

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| **RESEARCH INTERESTS** | **Secure & Trustworthy AI** (adversarial ML, differential privacy, watermarking, interpretability) • **Federated Learning** • **LLMs** (+reasoning) • **Efficient ML** (quantization, pruning, knowledge distillation) • **Reinforcement Learning** |

**RESEARCH EXPERIENCE**

**Pattern Recognition Lab, FAU Erlangen-Nürnberg**     *June 2025 – Present*
*Student Assistant*

- Developed large-scale **knowledge graphs** in Neo4j for modeling and querying complex power grid data.
- Implemented **physics-informed GNNs** for AC power flow, achieving up to **99.5% and 87.1% RMSE improvement** in voltage and angle prediction over baselines.
- Implemented **LoRA** in GNS, achieving near full fine-tune gain with a **85.46% reduction in trainable weightss**.
- Built an **LLM-based RAG pipeline** to translate natural language queries into Cypher for graph-based knowledge retrieval.
- **Supervisor:** Dr.-Ing. Siming Bayer | Changhun Kim, M.Sc.

**Self Learning Systems Lab, Fraunhofer IIS**     *Apr 2025 – Present*
*Student Assistant*

- Implemented **zero-knowledge-proof watermarking** in federated learning, achieving **virtually zero loss** for GNSS jammer detection/localization task.
- Implemented several black-box and white-box watermarking methods (e.g. `WAFFLE, Class-Hidden Client Side`) for GNSS models.
- **Supervisor:** Dr.-Ing. Tobias Feigl | Dr.-Ing. Felix Ott

**North South University**     *Sep 2019 – Dec 2019*
*Research Assistant*

- Published **research paper on Bangla NLP** in IEEE Access.
- Built *Master Moshai* — an **AI-powered educational tool** funded by the ICT Ministry of Bangladesh.
- **Supervisor:** Dr. Nabeel Mohammed

**INDUSTRY EXPERIENCE**

**Samsung Research Bangladesh**     *Dec 2019 – Aug 2023*
*Senior Software Engineer*

- Developed commercial software solutions for Galaxy Book.
- Contributed in designing backend architecture and led UI dev team.
- **Supervisor:** Md Salahuddin, Principal Engineer, Group Head, SRBD

**EDUCATION**

**Friedrich Alexander Universität Erlangen-Nürnberg**     *Oct 2023 – Present*
*M.Sc. in Artificial Intelligence*
**Current CGPA: 1.40** (max: 1.0 min: 4.0, German Scale)   **(on-going)**

**North South University, Bangladesh**     *Jan 2015 – Sep 2019*
*B.Sc. in Computer Science & Engineering*
**CS Courses CGPA: 3.77** (max: 4.0 min: 1.0, US Scale)   **Overall CGPA: 3.47**

**RELEVANT COURSEWORK**
- Deep Learning • Advanced Deep Learning • Reinforcement Learning
- ML Security • Advanced Data Engineering • Interpretable ML • AI

**PUBLICATIONS**
- "**ZKP-Authenticated Federated Few-Shot Learning for Secure Client Participation in Distributed Monitoring Devices**," — *(first author) Under review at IEEE TAES-2026.*
- "**Parameter-Efficient Domain Adaptation of Physics-Informed Self-Attention based GNNs for AC Power Flow Prediction**," — *(first author) Under review at EUSIPCO-2026.* DOI: 10.48550/arXiv.2602.18227.
- "**Physics-informed GNN for medium-high voltage AC power flow with edge-aware attention and line search correction operator**," — *(co-author) Accepted at ICASSP-2026.* DOI: 10.48550/arXiv.2509.22458.
- "**A Step towards Information Extraction: NER in Bangla using Deep Learning**," — *(first author) IOS Press.* DOI: 10.3233/JIFS-179349.
- "**Banner: A Cost-Sensitive Contextualized Model for Bangla Named Entity Recognition**," — *(co-author) IEEE Access.* DOI: 10.1109/ACCESS.2020.2982427.
- "**Crime Prediction Using Multiple-ANFIS Architecture and Spatiotemporal Data**," — *(co-author) IEEE Intelligent Systems IS'18.* DOI: 10.1109/IS.2018.8710564.

**PROJECTS**
- **A Comparative Study of Quantum-Accurate Force Prediction using Geometric Deep Learning,** [repository]    *Apr 2025*
  Trained SchNet, FieldSchNet, PaiNN, and SO(3)Net on MD17 and QM7-x datasets to predict molecular dynamics; **technologies:** PyTorch, ASE, RDKit.
- **Influence of Solar Activity on Earth's Climate,** [repository]    *Sept 2024*
  Built an ETL data pipeline using advanced data engineering methodologies to correlate solar activity with climate metrics; **technologies:** Sci-kit Learn, CI/CD.
- **Master Moshai — AI Educational Tool,** [repository]    *Dec 2019*
  Developed an AI-based tutoring assistant using knowledge retrieval from text data; **technologies:** NLP, PyTorch, Flask, Node.js, React.js, MongoDB.

**TECHNICAL SKILLS**
Python, C/C++, C#, TypeScript, SQL • PyTorch, LangChain, LangGraph, .NET, React.js • Pandas, Matplotlib, Seaborn, NumPy • Git, Docker, Kubernetes, CI/CD, MLFlow, gRPC, MCP

**AWARDS & HONORS**
- On Jul, 2023 received Global Korea Scholarship (GKS) – *MS in AI at UNIST*
- On Mar, 2022 achieved Professional Level – *Samsung Software Competency Test*
- On Oct, 2021 awarded Icon of the Month title at *Samsung Research Bangladesh*
- On 2019 awarded a grant for the project – *Master Moshai*

**CERTIFICATIONS**
- **Generative Adversarial Networks (GANs) Specialization (deeplearning.ai),** [certificate]    *Sept 2024*
- **Machine Learning Engineering for Production (MLOps) Specialization (deeplearning.ai),** [certificate]    *Aug 2024*
- **Deep Learning Specialization (deeplearning.ai),** [certificate]    *Dec 2019*

**LANGUAGES**
- **English:** IELTS 7.0 (overall) • **Bangla:** Native