



# Weldesemayat Teklay Gebre

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## ABOUT ME

First-Class Honor BSc graduate in Computer Science and Engineering (CGPA: 3.92/4.00), with research experience in Artificial Intelligence, Machine Learning, Natural Language Processing, speech technologies, and low-resource language AI. Contributed to research on automatic speech recognition, retrieval-augmented generation, and AI-driven climate resilience systems, including work presented at an international conference. Aspires to develop reliable, interpretable, and socially impactful AI systems for real-world challenges.

## RESEARCH INTERESTS

### Research Interests

- Natural Language Processing
- Speech and Language Technologies
- Low-Resource Language AI
- Large Language Models
- Retrieval-Augmented Generation
- Explainable AI
- Knowledge Graphs
- AI for Social Good

## EDUCATION AND TRAINING

### Bachelor of Science (BSc.)

**Mekelle Institute of Technology - Mekelle University** [ 20/09/2019 – 26/06/2026 ]

**City:** Mekelle | **Country:** Ethiopia | **Website:** <https://www.mu.edu.et> | **Field(s) of study:** Computer Science and Engineering | **Final grade:** 3.92 out of 4.0 | **Type of credits:** ECTS | **Number of credits:** 285 | **Thesis:** Graph-Grounded Temporal RAG for Contradiction-Resilient Question Answering Over Evolving Documents

**Relevant Courses:** Machine Learning, Artificial Intelligence, Natural Language Processing, Data Structures, Design and Analysis of Algorithms, Distributed Systems, Operating Systems, Applied Mathematics I-III, Research Methods and Presentation, Discrete Mathematics, Probability and Statistics.

## PROJECTS

[ 09/02/2026 – 07/05/2026 ]

### Graph-Grounded Temporal RAG for Contradiction-Resilient Question Answering Over Evolving Documents

- Built a RAG system integrating a Neo4j temporal knowledge graph to resolve document version conflicts, ensuring answers are drawn from the legally active version at query time.
- Implemented hybrid retrieval combining dense vector search (ChromaDB), BM25, and keyword matching fused via Reciprocal Rank Fusion, followed by cross-encoder reranking.
- Deployed Llama 3.2:3B locally via Ollama for fully offline, privacy-preserving answer generation across a corpus of 3,408 document chunks spanning multiple evolving document versions.
- Achieved a 98% diagnostic validation rate across retrieval, temporal reasoning, and contradiction-detection tasks, demonstrating robust performance on evolving document collections.

**Technologies:** Python, Retrieval-Augmented Generation (RAG), Neo4j, ChromaDB, Sentence Transformers, Cross-Encoder Reranking, BM25, Ollama (Llama 3.2), FastAPI, Streamlit, PyMuPDF, Pandas, NumPy, Plotly, Git.

**Link:** <https://github.com/WeleTeklay/Graph-Grounded-Temporal-RAG>

[ 14/02/2026 – Current ]

### **Tigray Climate Resilience – Early Warning System (EWS)**

- Developed an end-to-end AI-based early warning system for flood and drought prediction across all 36 districts of the Tigray region, integrating data ingestion, forecasting, uncertainty quantification, and real-time alert delivery.
- Built and evaluated TFT, LightGBM, XGBoost, and LSTM-based forecasting models integrating satellite imagery, weather reanalysis, hydrological, and ground-observation data, achieving NSE = 0.980 for flood forecasting and  $R^2 = 0.878$  for drought prediction.
- Deploying the system through a FastAPI backend and React-based dashboard to provide real-time forecasts and multi-level humanitarian alerts for disaster preparedness and response.

Technologies: Python, PyTorch, FastAPI, React, Temporal Fusion Transformer (TFT), LightGBM, XGBoost, LSTM, Pandas, NumPy, REST APIs, Git.

(Under deployment)

[ 25/02/2025 – 05/06/2025 ]

### **Geez Speech-to-Text Transcription Using NLP**

- Fine-tuned and evaluated a Whisper-Small model for low-resource Geez speech recognition on a custom-curated dataset.
- Conducted systematic evaluation using Word Error Rate (WER) and Character Error Rate (CER) metrics, with the methodology documented for reproducibility.
- Analyzed transcription errors to identify key failure patterns and improve model robustness in low-resource language settings.

Technologies: Python, PyTorch, HuggingFace Transformers, OpenAI Whisper, Librosa, Torchaudio, Pandas, NumPy, Git.

Link: <https://github.com/WeleTeklay/Geez-Speech-to-Text-Transcription-Using-NLP>

## **PUBLICATIONS / RESEARCH OUTPUT**

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### **Systematic Evaluation of Automatic Speech Recognition Systems for Tigrinya**

- I Presented at *International Conference on Artificial Intelligence for Sustainable Development (AI4SD 2026)*, held at Mekelle University, Ethiopia, April 27-28, 2026.
- Camera-ready manuscript under preparation for publication.

Conference participant listing available on the official conference website.

Link: <https://www.mu.edu.et/index.php/component/content/article/artificial-intelligence-for-sustainable-development-conference-participants?catid=69&Itemid=101>

## **WORK EXPERIENCE**

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 **Lesan.AI** – Berlin, Germany

Website: <https://lesan.ai/>

### **Machine Learning Research Intern (Remote)**

[ 02/10/2025 – 31/01/2026 ]

- Conducted experimental evaluation of Automatic Speech Recognition (ASR) systems for the low-resource Tigrinya language.
- Curated and processed a 10,000+ utterance Tigrinya speech corpus spanning media, legal, and conversational domains.
- Performed detailed linguistic and acoustic error analysis to identify key failure patterns in ASR systems.
- Contributed to establishing baseline performance benchmarks for Tigrinya ASR systems, with results presented at AI4SD 2026 and under preparation for publication.

 **Mekelle Institute of Technology** – Mekelle, Ethiopia

### **Artificial Intelligence Laboratory Instructor (Volunteer)**

[ 12/02/2026 – 29/05/2026 ]

- Mentored and guided third-year Computer Science and Engineering students (the batch behind us) during their laboratory sessions.
- Delivered hands-on instruction on core AI concepts and practical implementations.
- Assisted them in applying theoretical knowledge through lab exercises.

## Machine Learning Trainer (Volunteer)

[ 16/07/2025 – 28/09/2025 ]

- Designed and delivered ML training on supervised/unsupervised/reinforcement learning, neural networks, and model evaluation.
- Led hands-on Python ML exercises to strengthen practical problem-solving skills.

## CERTIFICATIONS

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### Machine Learning & Data Science Training

- Machine Learning, NLP and Deep Learning Specializations – DeepLearning.AI (Coursera)
- Retrieval Augmented Generation (RAG) – DeepLearning.AI (Coursera)
- Artificial Intelligence & Data Analysis Nanodegree – Udacity
- Google Data Analytics Professional Certificate — Coursera

Portfolio and certificates can be found in the following link.

Link: <https://weleteklay.vercel.app/>

## SKILLS AND ABILITIES

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### Technical and Research Skills

Programming: Python, C/C++, SQL, JavaScript

AI/ML: PyTorch, TensorFlow, Scikit-learn, HuggingFace Transformers

Data Science: Pandas, NumPy, Matplotlib

Databases: MySQL, Neo4j, ChromaDB

Web & Deployment: FastAPI, React, Git, Docker

## MEMBERSHIP AND VOLUNTARY SERVICES

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### Leadership and Community Engagement

Department Coordinator – Mekelle Institute of Technology ICT Club (2025–2026)

Member – Blood Drive Club (2025-2026)

Member – Araya Charity Club (2024–2026)

Coordinator – Mekelle Institute of Technology Peace Forum Club (2024–2025)

## REFERENCE

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### Yaecob Girmay Gezahegn

Assistant Professor, Mekelle Institute of Technology, Mekelle University

Researcher | Meta Fellow (2019)

Taught me Machine Learning and Natural Language Processing and also supervised my internship research at Lesan AI

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