

# ZAFARULLAH MAHMOOD

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## SKILLS

**Technical:** Python (Fluent), C/C++ (Familiar), JavaScript (Prior experience), Flask, Sanic, SQLAlchemy, Alembic, Angular

**Deep Learning & NLP:** PyTorch, NVIDIA NeMo, HuggingFace (transformers, PEFT), spaCy

**Generative AI:** LangChain, LangGraph, LlamaIndex, RAG Evaluation (RAGAs), Model Serving (vLLM)

**MLOps & Cloud:** Docker, Kubernetes, Elastic Container Services, Kubeflow, AWS (Bedrock, SageMaker), GCP (Vertex AI)

**Databases & Vector Stores:** BigQuery, PostgreSQL (pgvector), Firestore, Redis, ChromaDB, FAISS

## EDUCATION

- ♦ **Master of Applied Science in Computer Engineering at the University of Toronto** 2023 – 2025
  - Thesis: A Fully Generative Counsellor Chatbot for Smoking Cessation and LLM-Based Synthetic Smokers | GPA: 4.0/4.0
  - Deployed a multi-agent therapeutic chatbot [1] on **AWS ECS**, which helped smokers increase their confidence in quitting smoking by 1.7 (0-10 scale). Improved chatbot's therapeutic quality by 26% by implementing **ReAct** for counsellor behaviour selection. Reduced SLOC by ~60% by re-implementing the chatbot system using **LangChain LCEL**. Gained experience in **ChromaDB**.
  - Devised a validation framework for high-fidelity persona installation. Tested the framework's viability by installing human smoker attributes into LLM-based synthetic smoker "doppelgängers".
- ♦ **Bachelor of Technology in Computer Engineering at Jamia Millia Islamia, New Delhi** 2014 – 2018
  - Focus: Natural Language Processing | Internship: Indian Space Research Organisation | CGPA: 8.2/10

## WORK EXPERIENCE

- ♦ **Natural Language Processing (NLP) Engineer at Dialpad Canada Inc.** Apr 2019 – Aug 2023
  - Deployed a real-time Spanish-English bilingual sentiment classification model by fine-tuning an English-only model. Achieved target F1 on the Spanish testset without performance loss on original English testset. Used **transformers** and **spaCy**.
  - Reduced real-time inference latency by 4% by replacing a sequential punctuation and casing pipeline with a multi-classification-head **BERT** model. Identified and fixed performance bottlenecks in model's custom tokenizer using **py-spy** and **scalene**.
  - Learned **Angular** to develop an internal text-to-speech annotation platform. Adopted the iterative co-design paradigm and improved annotator efficiency by 12% by adding features like hotkeys, smart text completion, and dynamic keyword highlighting. Used **Sanic** and **PostgreSQL** for the backend, connected with cloud data sources and sinks, including **BigQuery** and **Cloud Storage** and deployed the application on **Google Kubernetes Engine Deployment**.
  - Built a tool to create synthetic speech data from a list of *keywords*: used **Beautiful Soup** for web scraping, **spaCy** for named entity recognition and sentence creation, and **Coqui TTS** to generate speech from sentences. The synthetic dataset was used to train a keyword boosting algorithm [2] and helped improve keyword recognition accuracy on a real test set by 26% relative.
  - Built a **Kubeflow** pipeline to automate the generation and verification of pronunciations of newly coined words (e.g., *COVID-19*). The pipeline added ~10,000 words in a year and helped the team beat a benchmark on pronunciation generation [3].
- ♦ **Data Scientist at Exzeo Software, India** Jun 2018 – Mar 2019
  - Built a text-based, omni-channel conversational agent using **Google DialogFlow** to help customers file insurance claims.

## PUBLICATIONS

- [1] A Fully Generative Counsellor Chatbot for Moving Smokers Towards the Decision to Quit. *ACL Findings*, 2025. [🔗](#)
- [2] N-gram Boosting: Improving Contextual Biasing with Normalized N-gram Targets. *ICASSP*, 2023. [🔗](#)
- [3] Avengers, Ensemble! Benefits of ensembling in grapheme-to-phoneme prediction. *SIGMORPHON*, 2021. [🔗](#)

## PROJECTS

- ♦ **AutoAnnoMI: Automating Annotations of MI Conversations using LLMs** [🔗](#) 2023
  - Built an LLM-based tool to label utterances in counselling conversations. Incorporated chain-of-thought reasoning and few-shot examples leading to a ~12% accuracy improvement over baseline.
- ♦ **Benchmarking Batch Renormalization** [🔗](#) 2017
  - Implemented BatchReNorm1d module in **PyTorch** and benchmarked its performance on image recognition datasets.

## AWARDS

- ♦ **Edward S. Rogers Sr. Graduate Scholarship, University of Toronto** 2024
  - Received CAD 20,000 in recognition of outstanding academic accomplishments during Master's studies.
- ♦ **Best Kernel Award, Kaggle** 2018
  - Won Best Kernel Award among 80 kernels in DonorsChoose.org Application Screening Challenge.

† Eligible to work in Canada without sponsorship.