

# Samee Arif

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## RESEARCH INTEREST

My research focuses on Natural Language Processing (NLP), NLP4SG, and Human-AI Interaction. I am committed to leveraging these fields to create meaningful social impacts, particularly by enhancing the accessibility and usability of technology.

## EDUCATION

**Bachelor of Science in Computer Science**

Sep 2019 - May 2023

[Lahore University of Management Sciences \(LUMS\)](#)

- Relevant Coursework: Artificial Intelligence, Machine Learning, Deep Learning, Natural Language Processing, Speech Processing, Principles and Techniques of Data Science, Computer Vision, Mathematical Foundations for Machine Learning and Data Science, Probability, Calculus I & II, Linear Algebra

## RESEARCH EXPERIENCE

**Multi-Agent Workflows for Iterative Self-improvement**

July 2024 - Present

- Working on using LLMs in multi-agentic workflows for iterative self-improvement.
- Implemented an iterative process for preference optimization dataset generation using LLM Feedback Loop and LLM-as-a-Judge. This approach generates an initial DPO dataset, fine-tunes a model, and then iteratively uses the fine-tuned model to create subsequent datasets.

**The Fellowship of the LLMs: Multi-Agent Workflows for Synthetic Preference Optimization Dataset Generation**

June 2024 - August 2024

- Evaluated multi-agent workflows for LLM-as-evaluators and LLM-as-generators modules to generate synthetic preference optimisation datasets using Llama-3.1, Gemma-2, and GPT-4 families.
- Tested LLM-as-a-Judge, LLMs-as-a-Jury, and LLM Debate, to identify the most effective LLM-as-evaluator strategy.
- Demonstrated the effectiveness of the LLM Feedback Loop with Llama-3.1-8b as the generator and Gemma-2-9b as the reviewer, achieving a **71.8% and 73.8% win rate** against single-agent Llama-3.1-8b and Gemma-2-9b, respectively.
- Presented DPO and KTO datasets generated using the LLM Feedback Loop with GPT-4o-as-a-Judge, focused on single-agent improvement. Presented DPO and KTO datasets aimed at improving multi-agent LLM Feedback Loop configurations.
- The [research paper](#) is currently **in submission at AAAI 2025**.

**Generalists vs. Specialists: Evaluating Large Language Models for Urdu**

April 2024 - June 2024

- Fine-tuned Llama-3, mT5 and XLM-R for 13 Urdu generation and classification tasks.
- Evaluated the fine-tuned models and compared their performance against GPT-4-Turbo and Llama-3-8b as the baseline.
- Presented benchmarking datasets in Urdu designed to evaluate the performance of LLMs as evaluators.
- The [research paper](#) is currently **in submission at EMNLP 2024**.

**Student Counseling Chatbot**

Aug 2023 - Present

- Developed a graduate assistant tool leveraging LLMs to provide educational counselling.
- Implemented multimodality by integrating Automatic Speech Recognition (ASR) and Text-to-Speech (TTS) systems.

**UQA: Corpus for Urdu Question Answering**

Jan 2023 - Oct 2023

- Developed a question-answer corpus for the Urdu language to address the limited resources available in the domain.
- Manually evaluated Seamless M4T and Google Translator for Urdu.
- Introduced EATS - a technique to preserve the answer spans in the translated context paragraphs and employed it to translate the SQuAD2.0 dataset to Urdu.
- Successfully generated 124,745 question-answer pairs and fine-tuned mBERT, XLM-RoBERTa, mT5 and LLaMA-2 on our dataset to achieve an **85.99% F1 Score** and **74.56% Exact Match**.
- First authored and published a [research paper](#) at **LREC-Coling 2024**.

**Image-to-Speech Pipeline for Urdu Language | Python**

Sep 2021 - Sep 2022

- Evaluated Optical Character Recognition (OCR) models including Tesseract, EasyOCR, and Kraken on Nastaliq font.

- Established a pipeline to replicate scanned images using data augmentation to generate the dataset.
- Fine-tuned GANs to map the noisy images to clean images as a pre-processing module.
- Implemented a post-processing module based on BERT, Google search engine auto-correction and conditional random fields to enhance the model accuracy.
- Trained Tesseract to achieve a **1.53% Character Error Rate** and piped it with my Text-to-Speech (TTS) model.

## WORK EXPERIENCE

<b>Research Associate</b>   <a href="#">CSaLT (LUMS)</a>	<i>June 2023 - Present</i>
<ul style="list-style-type: none"> <li>• Advisor(s): <a href="#">Dr. Agha Ali Raza</a> (LUMS), <a href="#">Dr. Awais Athar</a> (EMBL-EBI).</li> <li>• Working on multi-agent frameworks for LLM, preference optimization and synthetic dataset generation.</li> </ul>	
<b>Research Associate</b>   <a href="#">ActualAlz (LUMS)</a>	<i>Aug 2023 - June 2024</i>
<ul style="list-style-type: none"> <li>• Advisor(s): <a href="#">Dr. Agha Ali Raza</a>, <a href="#">Dr. Ihsan Ayyub Qazi</a> and <a href="#">Dr. Zafar Ayyub Qazi</a> (LUMS).</li> <li>• Worked on developing a multimodal and multilingual graduate assistant tool leveraging large language models to provide educational counseling.</li> </ul>	
<b>Research Assistant</b>   <a href="#">CSaLT (LUMS)</a>	<i>Aug 2021 - May 2023</i>
<ul style="list-style-type: none"> <li>• Advisor(s): <a href="#">Dr. Raza</a> (LUMS), <a href="#">Dr. Awais Athar</a> (EMBL-EBI).</li> <li>• Worked on image-to-speech pipeline and Urdu question-answering system.</li> </ul>	
<b>Teaching Assistant</b>   <a href="#">Machine Learning (LUMS)</a>	<i>Fall 2022</i>
<ul style="list-style-type: none"> <li>• Oversaw and facilitated learning for a cohort of more than 140 students. Designed and administered course quizzes, assignments and a project to gauge student understanding and progress.</li> </ul>	
<b>Teaching Assistant</b>   <a href="#">Computational Problem Solving (LUMS)</a>	<i>Fall 2021</i>
<ul style="list-style-type: none"> <li>• Managed a 93-student cohort, designed quizzes, and labs and held weekly office hours.</li> </ul>	

## PROJECTS

<b>Speech Technologies</b>	<i>Aug 2023 - Dec 2023</i>
<ul style="list-style-type: none"> <li>• Fine-tuned Whisper and MMS ASR model, achieving a <b>13.01% WER</b>. Analyzed model quality and inference time, integrated quantization for faster inference, and utilized QLoRA for efficient fine-tuning.</li> <li>• Trained MMS-TTS and YourTTS, adapting a VITS TTS framework script for training.</li> <li>• Created a web-based audio annotation tool providing editable transcriptions and timestamps using ASR.</li> </ul>	
<b>ConvoLense</b>	<i>Aug 2023 - Sep 2023</i>
<ul style="list-style-type: none"> <li>• Evaluated speech-based (Wav2Vec2) and text-based (BERT, mT5, GPT, LLaMA) emotion classifiers.</li> <li>• Used Bark to generate a synthetic conversation dataset between customer and customer service representative.</li> <li>• Established a pipeline using my ASR model and LLM for emotion classification.</li> </ul>	
<b>Arabic Handwriting Recognition</b>	<i>Jan 2023 - May 2023</i>
<ul style="list-style-type: none"> <li>• Applied transfer learning techniques to adapt the Urdu OCR model for recognizing handwritten Arabic in Naskh font.</li> <li>• Utilized advanced pre-processing methods, such as skeletonization, to generate a synthetic handwritten dataset.</li> </ul>	
<b>Image Captioning</b>	<i>Jan 2023 - May 2023</i>
<ul style="list-style-type: none"> <li>• Conducted an experimental fine-tuning of Swin-Transformer on the Indiana University - Chest X-Rays dataset, exploring its application in medical image analysis.</li> </ul>	
<b>Fraudulent Job Prediction</b>	<i>Sep 2022 - Dec 2022</i>
<ul style="list-style-type: none"> <li>• Trained Logistic Regression, Support Vector Machine, and Random Forest classifiers to identify real versus fake job postings, achieving a <b>91% Accuracy</b>.</li> <li>• Conducted comprehensive data cleaning and exploratory data analysis on the dataset.</li> <li>• Authored and published an article on <a href="#">Medium</a> detailing the project's methodology and outcomes.</li> </ul>	
<b>Lane Analysis for Autonomous Vehicle</b>	<i>Sep 2022 - Dec 2022</i>
<ul style="list-style-type: none"> <li>• Created a lane-change warning system, integrating Lanenet for lane detection and YOLOv7 for vehicle detection.</li> </ul>	
<b>Learning Management System</b>	<i>Jan 2022 - May 2022</i>
<ul style="list-style-type: none"> <li>• Created a platform for schools to manage online education during the pandemic.</li> </ul>	
<b>Speech-based Language Classifier</b>	<i>Sep 2021 - Dec 2021</i>
<ul style="list-style-type: none"> <li>• Recorded voice samples in English, Urdu, and a mix of both languages at 1600MHz.</li> <li>• Developed and trained a neural network from scratch to classify speech using the recordings dataset.</li> </ul>	
<b>FoodSwings</b>	<i>Sep 2021 - Dec 2021</i>
<ul style="list-style-type: none"> <li>• Implemented food delivery web application.</li> </ul>	
<b>Neural Network from Scratch</b>	<i>Sep 2021 - Dec 2021</i>
<ul style="list-style-type: none"> <li>• Developed a feed-forward neural network from scratch using NumPy and optimized it with Numba JIT.</li> </ul>	

## AWARDS

Dean's Honour List | LUMS

Fall 2020

Dean's Honour List | LUMS

Spring 2019

## TECHNICAL SKILLS

**Languages** | Python, C/C++, SQL, JavaScript, HTML/CSS

**Frameworks** | React, Node.js, Next.js, FastAPI

**Developer Tools** | Git, Docker, Google Cloud Platform, VS Code, Visual Studio

**Libraries** | pandas, NumPy, Matplotlib, TensorFlow, PyTorch, Keras, transformers, Streamlit

## PUBLICATIONS

[1]. **Samee Arif**, Sualeha Farid, Abdul Hameed Azeemi, Awais Athar, and Agha Ali Raza, [The Fellowship of the LLMs: Multi-Agent Workflows for Synthetic Preference Optimization Dataset Generation](#). In Submission (**AAAI**)

[2]. **Samee Arif**, Abdul Hameed Azeemi, Awais Athar, and Agha Ali Raza, [Generalists vs Specialists: Evaluating Large Language Models for Urdu](#). In Submission (**EMNLP**)

[3]. **Samee Arif**, Sualeha Farid, Awais Athar, and Agha Ali Raza, [UQA: Corpus for Urdu Question Answering](#). In **LREC-COLING 2024** – Joint International Conference on Computational Linguistics, Language Resources and Evaluation. May 20–25, 2024, Torino (Italia). (**Coling Ranks 5th in Computational Linguistics** | **LREC Ranks 6th in Computational Linguistics**)

## Research Grants

**July 2024:** The project *The Fellowship of the LLMs: Multi-Agent Workflows for Synthetic Preference Optimization Dataset Generation* has received funding from the OpenAI Research Access Program.

**May 2024:** The project *Generalists vs Specialists: Evaluating Large Language Models for Urdu* has received funding from the OpenAI Research Access Program.