Ashutosh Kumar

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EDUCATION

Rochester Institute of Technology   Rochester, NY
Master of Science in Artificial Intelligence   *August 2023 – Expected May 2025*

Indian Institute of Technology Roorkee   Uttarakhand, India
Bachelor of Technology in Engineering Physics   *August 2019 – May 2023*

EXPERIENCE

Graduate Research Assistant   May 2024 – Present
Bill and Melinda Gates Foundation & Health Systems Engineering Laboratory, RIT   *Rochester, NY*
- Designed and implemented a data fusion pipeline that integrates heterogeneous static and dynamic data sources (epidemiology, demographics, socioeconomic factors) to enhance vaccine prioritization modeling.
- Developed a robust multi-objective time-series forecasting model leveraging Temporal Fusion Transformers to combine static and dynamic data, improving accuracy in decision-making for healthcare interventions.
- Built a data simulation and estimation algorithm leveraging the expectation-maximization algorithm to fill data gaps in global epidemiological studies, and to improve data reliability over the healthcare experts' parameters.

PROJECTS

Perceptual Piercing | *Code*   January 2024 – August 2024
- Developed an innovative machine-learning framework, inspired by the atmospheric scattering model and human visual cortex mechanisms, to significantly enhance object detection in low-visibility conditions.
- Validated the framework across multiple hazy datasets, including RESIDE-β, RESIDE-OTS, and Foggy Cityscapes, achieving a **26.8%** improvement in mean average precision over state-of-art-methods.
- Implemented a novel multi-tiered approach utilizing human-like visual cues, featuring an initial rapid detection phase, followed by targeted dehazing, and concluding with a comprehensive detection phase.

HPT: A Universal Evaluation Framework for LLMs | *Paper*, *Code*   January 2024 – June 2024
- Designed and implemented the Hierarchical Prompting Taxonomy (HPT) and Hierarchical Prompt Frameworks (HPFs), providing a robust and efficient method for evaluating LLMs based on task complexity.
- Developed Adaptive HPF, enabling dynamic selection of the most effective prompting strategies, significantly enhancing LLM performance across various datasets and tasks by leveraging a robust LLM.
- Introduced the HP-Score, a novel metric for evaluating agent performance on diverse datasets, offering detailed insights into LLM problem-solving capabilities like question-answering, summarization, and translation.

MoonMetaSync | *Poster*, *Code*   September 2023 – December 2024
- Built a custom image registration module, IntFeat, from scratch that combines key points and descriptors of SIFT, ORB for high- contrast lunar images in a single feature space using linear algebra and PCA.
- Built a Python package, *SyncVision* for image processing and supports SIFT, ORB, and IntFeat.
- Performed theoretical failure analysis of multiple interpolation techniques on high- vs low-contrast satellite images.

TECHNICAL SKILLS

Languages: Python, MATLAB, AMPL
Frameworks: PyTorch, Tensorflow, Keras, Scikit-learn, Caffe
Developer Tools: Git, Docker, Anaconda, Google Cloud Platform, VS Code, Streamlit, Hugging Face
Databases/Query Languages: SQL (PostgreSQL, MySQL)

PUBLICATIONS

Budagam, D., KJ, S., Kumar, A., Jain, V., & Chadha, A. (2024). **Hierarchical Prompting Taxonomy: A Universal Evaluation Framework for Large Language Models**. ArXiv. /abs/2406.12644

Kumar, A., Murthy, S. V., Singh, S., & Ragupathy, S. (2024). **The Ethics of Interaction: Mitigating Security Threats in LLMs**. ArXiv. /abs/2401.12273