Masum Hasan

PhD Candidate (4^{th} year), Computer Science
University of Rochester, NY

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Human-like virtual agents driven by large language models

Research Experience

Anthropomorphism in LLMs, Agentic Workflow, Virtual Avatars, Human-AI Interactions, Synthetic Data for Computer Vision, AI for Education, ML for Code, ML for Healthcare

Education

University of Rochester — Rochester, NY
Ph.D. Candidate (4^{th} year), Computer Science — Full Scholarship — *August 2021 - Present*

University of Rochester — Rochester, NY
M.Sc. Computer Science — *August 2021 - August 2023*

Bangladesh University of Engineering and Technology (BUET) — Dhaka, Bangladesh
B.Sc. Computer Science & Engineering — *February 2013 - October 2018*

Professional Experience

University of Rochester — Rochester, NY
Graduate Research Assistant, ROC-HCI lab, Supervised by Prof. Ehsan Hoque — *Aug 2021 - Present*

- **Virtual Humans Driven by LLM:** My research focuses on aligning virtual humans driven by LLMs for human-AI interactions – enabling fluent human-like multimodal conversations, while navigating the ethical challenges. In my work *SAPIEN* [1], we built an LLM-driven 3D virtual avatar platform for a variety of use cases, such as academic tutoring, job interviews, business training. We are applying virtual-human based interactions to train clinicians on difficult conversations [14] (project).
- **Synthetic Data:** For many applications such as healthcare or industry, collecting human-annotated data is tedious and expensive. We show that image data generated by modern 3D game engines can be on par with human-annotated data for complex Hand Pose Estimation tested on a ViT-Pose model.
- **Machine Learning for Healthcare:** We predicted the risk of ataxia from a video of a person walking using object detection, pose estimation, and classification [2]. The classifier automatically learned clinical knowledge, without being explicitly trained on them. I also built ParkBot [5], a helpful chatbot for explaining Parkinson's Disease.

Auburn University — Auburn, AL
TES Remote Research Assistant, Supervised by Prof. Shubhra Kanti Karmaker (Santu) — *Jun 2021 - Aug 2021*

- Semantic similarity in natural language, vector search, paraphrasing, Quora Question Pairs dataset.

Bangladesh University of Engineering and Technology (BUET) — Dhaka, Bangladesh
Research Assistant (RA), Applied Machine Learning Lab
Supervised by Prof. Rifat Shahriyar and Prof. Anindya Iqbal — *Nov 2018 - Jun 2021*

- **Machine Learning for Code**: Created one of the largest Code-Natural Langauge parallel datasets at the time [3]. Language models for source code Summarization/ Synthesis/ Search [3,6,7,10]. Functional Android apps from Natural Language text [10]. Automated program repair from code review comments using Neural Machine Translation [7].
- **Low-Resource NLP**: Developed Bengali-GPT-2 in 2020, state-of-the-art Bengali-English Machine Translation [9], low-resource machine translation for endangered Chakma language [12].

Publications

[1] **SAPIEN: Affective Virtual Agents Powered by Large Language Models** – **Masum Hasan**, Cengiz Ozel, Sammy Potter, Ehsan Hoque. (ACIIW 2023)

[2] **Auto-Gait: Automatic Ataxia Risk Assessment with Computer Vision on Gait Task Videos** – Wasifur Rahman, **Masum Hasan**, Md Saiful Islam, Titilayo Olubajo, Jeet Thaker, Abdelrahman Abdelkader, Phillip Yang, Tetsuo Ashizawa, Ehsan Hoque. (UbiComp 2023)

[3] **CoDesc: A Large Code–Description Parallel Dataset** – **Masum Hasan**, Tanveer Muttaqeen, Ishtiaq Niloy, Kazi Mehrab, Tahmid Hasan, Mahim Pantho, Wasi Ahmad, Rifat Shahriyar, Anindya Iqbal. (ACL Findings 2021)

[4] **LowResource at BLP-2023 Task 2: Leveraging BanglaBert for Low Resource Sentiment Analysis of Bangla Language** – Aunabil Chakma, **Masum Hasan**. (EMNLP 2023, BLP Workshop)

[5] **A User-Centered Framework to Empower People with Parkinson's Disease** – Wasifur Rahman, Abdelrahman Abdelkader, Sangwu Lee, Phillip Yang, Md Saiful Islam, Tariq Adnan, **Masum Hasan**, Ellen Wagner, Sooyong Park, E. Ray Dorsey, Catherine Schwartz, Karen Jaffe, Ehsan Hoque. (IMWUT, UbiComp 2024)

[6] **Using a Balanced Scorecard to Identify Opportunities to Improve Code Review Effectiveness: An Industrial Experience Report** – **Masum Hasan**, Anindya Iqbal, Amiangshu Bosu, Mohammad Rafid Ul Islam, A.J.M. Imtiajur Rahman. (EMSE Journal)

[7] **Review4Repair: Code Review Aided Automatic Program Repairing** – Faria Huq, **Masum Hasan**, Mahim Pantho, Sazan Mahbub, Anindya Iqbal, Toufique Ahmed. (IST Journal)

[8] **Hitting your MARQ: Multimodal ARgument Quality Assessment** – Md Kamrul Hasan, James Spann, **Masum Hasan**, Md. Saiful Islam, Kurtis Haut, Rada Mihalcea, Ehsan Hoque. (EMNLP 2021)

[9] **Not Low-Resource Anymore: Aligner Ensembling, Batch Filtering, and New Datasets for Bengali-English Machine Translation** – Tahmid Hasan, Abhik Bhattacharjee, Kazi Samin, **Masum Hasan**, Madhusudan Basak, M. Sohel Rahman, Rifat Shahriyar. (EMNLP 2020)

[10] **Text2App: A Framework for Creating Android Apps from Text Descriptions** – **Masum Hasan**, Kazi Sajeed Mehrab, Wasi Uddin Ahmad, Rifat Shahriyar. (NLP4Prog, ACL-IJCNLP 2021)

[11] **Recognition of Bengali Handwritten Digits Using Convolutional Neural Network Architectures** – **Md Mahmudul Hasan**, Md Rafid Ul Islam, Md Tareq Mahmood. (ICBSLP 2018, **Best Student paper award**)

[12] **ChakmaNMT: A Low-resource Machine Translation On Chakma Language** - Aunabil Chakma, Aditya Chakma, Soham Khisa, Chumui Tripura, **Masum Hasan**, Rifat Shahriyar. (EMNLP WAT2024 Workshop 2024)

[13] **Hi5: 2D Hand Pose Estimation with Zero Human Annotation** - **Masum Hasan**, Cengiz Ozel, Nina Long, Alexander Martin, Samuel Potter, Tariq Adnan, Sangwu Lee, Amir Zadeh, Ehsan Hoque (Archive)

[14] **Poker with Play Money: Exploring The Perceived Humanness of AI Virtual Patients for Psychotherapist Training Role-Play** - Cynthia Baseman, **Masum Hasan**, Nathaniel Swinger, Sheila Rauch, Ehsan Hoque, Rosa Arriaga (Under review)

Invited Talks

- Rethinking Capitalism in the Age of AGI at ROC Talks Annual Event April 2024. Video
- Future of Interactive Education with Generative AI at New York Academy of Sciences, February 2024
- Privacy, Security, Ethics of Generative AI, University of Rochester, February 2024
- Radio appearance on WXXI News, "Connections with Evan Dawson" talking about the future of human-AI interactions, December 2023.
- Speaker at FlowerCity.AI conference, December 2023.
- Speaker on 4-part workshop series on Generative AI, Fall 2023 at University of Rochester.
- Conducted "Introduction to ChatGPT" workshop, Spring 2023 at University of Rochester.

Technical Skills

Languages & Framworks: Python, Java, C/C++, SQL, JavaScript, PyTorch, HuggingFace, AWS, Azure

Technologies: LLM alignment, DPO, RLHF, VLLMs, Diffusion, ViT, RAG, Machine Translation

Relevant Courses

Artificial Intelligence: Frontier of Deep Learning, Knowledge Representation in AI, Introduction to Artificial Intelligence, Machine Learning, Deep Learning, Natural Language Processing Specialization, Computer Vision Specialization

Computer Science: Database Management Systems, Advanced Algorithms, Theory of Computation, Computational Modeling, Computer Organization. Object Oriented Programming, Structured Programming Languages, Operating Systems, Networking, Algorithms and Data Structures, Human Computer Interactions

Teaching Experience

University of Rochester Rochester, NY

Department of Computer Science : Graduate Teaching Assistant

- CSC 282/482 - **Advanced Algorithms** (Fall 2023)
- CSC 261/461 - **Database Systems** (Spring 2022)
- CSC 211/411 - **Human Computer Interaction**, (Spring 2022)

Machine Learning Online Course Dhaka, Bangladesh

Created an introductory course on Machine Learning focusing on Neural Networks in Bengali, 2021.