Paras Sharma

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Research Interests

My research interests lie in the intersection of Human-Computer Interaction, Natural Language Processing, and Multimodal Machine Learning particularly focusing on building educational technologies to help learners navigate through open-ended learning environments. I am interested in modeling learner behaviors during their multimodal interactions with educational systems and then utilizing these models to support varied learner dialogue interactions within the systems.

Professional Experience

Teaching Fellow, School of Computing & Information Aug. 2024 – Present
University of Pittsburgh *Pittsburgh, PA*

- Working as instructor for CS0011 Introduction to Computing for Scientists.

Graduate Student Researcher, Learning Research & Development Center Aug. 2022 – Present
University of Pittsburgh *Pittsburgh, PA*

- Building on developing techniques to incorporate lexical alignment in the dialogue system for a multi-party teachable robotic agent.
- Implementing structure and surface gestures in a teachable robotic agent to study the impact of gestures in math learning.
- Working on building a Simulated Student System to emulate learner interactions in open-ended learning environments.
- Used HMMs and Sequence Mapping to model learner activity data and extract SRL and cognitive states that learners transition through in open-design settings.
- Designed a multimodal sensing system to detect learners' sensors, programming, and dialogue activities while building a robot.

Software Development Engineer, EC2 June. 2021 – July 2022
Amazon Web Services *Seattle, WA*

- Developed an SDK to ease the onboarding of various workloads in Launch Wizard Service
- Integrated Launch Wizard with Alpine service to better monitor the impact of service and API failures on customers
- Improved tagging of Launch Wizard deployed workloads to enhance the revenue generation calculations

Research Intern, Institute for Creative Technologies March 2021 – Aug. 2021
University of Southern California *Los Angeles, CA*

- Worked on online virtual mentors project.
- Developed and Tested different question-answering classification techniques on the Covid-Answers dataset for building a virtual mentor.
- Used Transformers to model the similarity between input questions and answers for the mentor.
- Built and analyzed different classification techniques to improve accuracy for mentor answer generation.
- Tested different evaluation metrics on question-answering classification models.

Graduate Research Assistant, Social Media Analytics Lab Feb. 2021 – May 2021
Keck School of Medicine, USC *Los Angeles, CA*

- Developed methods to fetch and analyze video advertisement data of tobacco products on YouTube and TikTok.
- Created and analyzed various metrics for the impact of tobacco product advertisements by various companies using collected video data.

Graduate Research Assistant, Viterbi iPodia Feb. 2020 – Dec. 2020
University of Southern California *Los Angeles, CA*

- Developed diverse grouping algorithm to increase cultural and intellectual diversity among cohorts.
- Designed and implemented the backend of the framework returning groups of students.
- Collected video and transcript data for student interactions grouped using the above algorithm.

Software Development Engineer Intern, EC2 May 2020 – Aug. 2020
Amazon Web Services *Seattle, WA*

- Designed, developed, and deployed a dedicated host tenancy feature for SQL HA in the AWS Launch Wizard Service.
- Enabled Host Resource Group Integration for the AWS Launch Wizard Service.

Senior Software Engineer, Intelligence & IoT Division June 2017 – July 2019
Samsung R&D Institute *Bangalore, India*

- Implemented reinforcement learning in personalized Social Robot using user-interaction feedback.
- Created the Context Engine Module and reinforcement learning module of Social Robot.
- Developed and deployed Device Identity and Locksmith Microservice on AWS EC2 with data stored in DynamoDB enabling IoT devices' access to the IoT cloud utilized by partners Vodafone, and Sercomm.
- Designed and implemented Android as a Thing SDK to easily onboard any Android device onto the IoT cloud and expose its functionalities as controllable OCF resources.

Software Engineer Intern, Intelligence & IoT Division May 2016 – July 2016
Samsung R&D Institute *Bangalore, India*

- Developed anomaly Sensing and recommendation Engine for Smart IoT using Iotivity
- Built and trained a neural network model for anomaly detection using the Samsung IoT device data

Education

University of Pittsburgh Aug. 2022 – Present
Ph.D. in Computer Science *GPA:**3.92/4***
Advisor: Dr. Erin Walker

University of Southern California Aug. 2019 – May 2021
Masters of Science in Computer Science *GPA:**3.857/4***

Indian Institute of Technology (ISM), Dhanbad July 2013 – May 2017
Bachelor of Technology (with Honours) in Computer Science & Engineering *GPA:**9.55/10***

Honors and Awards

Travel Scholarship. 17th Educational Data Mining Conference (EDM2024), Atlanta, Georgia. $2600. 2024
Travel Scholarship. 25th International Conference on Artificial Intelligence in Education (AIED 2024), Recife, Brazil. $1200. 2024
3rd Position, Alexa Prize TaskBot Challenge 2. Amazon. $50,000. 2023
Pre-Doctoral Fellowship. School of Computing and Information, University of Pittsburgh. 2022-2023.
Viterbi Graduate Student Scholarship. Viterbi School of Engineering, University of Southern California. $7,500. 2019.
Director's Award for Academic Excellence. Indian Institute of Technology (Indian School of Mines), Dhanbad. 2015.

Publications

[1] **Sharma, P.**, Bella, V., E. B. Stewart, A., Walker, E. (2024). Multimodal Sensing of Goals and Activities During Interactions with a Co-created Robot. In: Ferreira Mello, R., Rummel, N., Jivet, I., Pishtari, G., Ruipérez Valiente, J.A. (eds) Technology Enhanced Learning for Inclusive and Equitable Quality Education. EC-TEL 2024. Lecture Notes in Computer Science, vol 15160. Springer, Cham. https://doi.org/10.1007/978-3-031-72312-4_22

[2] **Paras Sharma**, Angela E.B. Stewart, Qichang Li, Krit Ravichander, & Erin Walker. (2024). Building Learner Activity Models From Log Data Using Sequence Mapping and Hidden Markov Models. Proceedings of the 17th International Conference on Educational Data Mining, 584–593. https://doi.org/10.5281/zenodo.12729890

[3] **Paras Sharma**, & Qichang Li. (2024). Designing Simulated Students to Emulate Learner Activity Data in an Open-Ended Learning Environment. Proceedings of the 17th International Conference on Educational Data Mining, 986–989. https://doi.org/10.5281/zenodo.12730023

[4] Anthony Sicilia, Yuya Asano, Katherine Atwell, Qi Cheng, Dipunj Gupta, Sabit Hassan, Mert Inan, Jennifer Nwogu, **Paras Sharma**, Malihe Alikhani. "ISABEL: An Inclusive and Collaborative Task-Oriented Dialogue System". In Alexa Prize TaskBot Challenge 2 Proceedings, 2023. https://www.amazon.science/alexa-prize/proceedings/isabel-an-inclusive-and-collaborative-task-oriented-dialogue-system

Academic Projects

Emotion-Aware Graph Transformer for Social Interaction in VQA

- Built an early fusion multimodal model with a global fusion transformer for a video question-answering task, using the SocialIQ dataset.

Evaluation of Commonsense Reasoning Capacity in LLMs using Image Models

- Conducted experiments with GPT 3.5-turbo to evaluate if image generation models can independently and effectively communicate commonsense knowledge through visual means.
- Evaluated the effect of integrating image generation with LLMs on the commonsense reasoning capabilities of LLMs.

Empathetic Chatbot

- Ran a focus group to understand the effect of an individual's baseline empathy on their preference of empathy in a chatbot.
- Ran a Wizard-Of-Oz experiment to evaluate the likeliness of an empathetic chatbot under different conditions of empathy.

Persona Generation from Dialogue Utterances

- Built a dataset with templated personas based on the PERSONA-CHAT dataset.
- Compared different transformer models to generate the user's persona actively during the dialogue.

Personalizing Dialogue Agents

- Built a sequence-to-sequence model with attention to generate the bot's next utterance conditioned on various personas.
- Compared key-value memory networks and transformers model with sequence to sequence model for this task

Affective Horror Game

- Created Affective Horror game "Slender Man" using Unity 3D
- Conducted initial set of experiments with heart rate variability and skin conductance measurements using biopac.

- Used mouse movements and keystroke data from gameplay as features to derive relationships between arousal, fear, and enjoyment
- Used pre and post-game participant survey data to examine correlations between different game variables and enjoyment.

Sentiment Analysis

- Coded and analyzed Naive Bayes technique for classification of IMDB movie review dataset
- Devised a fuzzy-logic-based algorithm using Naive Bayes technique on this dataset

Technical Skills

Languages: Python, Java, C/C++
Libraries: PyTorch, TensorFlow, NumPy, pandas, Matplotlib, NLTK
Frameworks/Tools: Git, Android Development, AWS EC2, Elastic Search, IBM Watson, AWS S3