Tanushree Banerjee

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RESEARCH INTERESTS

Inverse Generation, Inverse Rendering, Computer Vision, Optimization, Inverse Graphics

EDUCATION

Princeton University, Princeton, NJ — August 2020 — May 2024
Bachelor of Science in Engineering (BSE), Computer Science, *magna cum laude*
Certificates in Statistics and Machine Learning, Optimization and Quantitative Decision Science
Thesis Title: Inverse Neural Rendering for Explainable 3D Perception — Advisor: Prof. Felix Heide

RESEARCH EXPERIENCE

Heide Computational Imaging Lab, Dept. of Computer Science, Princeton University — Princeton, NJ
Research Assistant under Prof. Felix Heide — June 2024 — Present
Heide Computational Imaging Lab, Dept. of Computer Science, Princeton University — Princeton, NJ
Summer Research Assistant under Prof. Felix Heide — June 2023 — August 2023
Princeton NLP Group, Dept. of Computer Science, Princeton University — Princeton, NJ
Summer Research Assistant under Prof. Karthik Narasimhan — May 2022 — June 2023
Visual AI Lab, Dept. of Computer Science, Princeton University — Princeton, NJ
Summer Lab Assistant under Prof. Olga Russakovsky — May 2021 — August 2021

SELECTED RESEARCH PROJECTS

Inverse Neural Rendering for Explainable 3D Object Tracking — ArXiv Preprint, 2024
Julian Ost, Tanushree Banerjee*, Mario Bijelic, Felix Heide*

- Recast visual inference tasks as inverse neural rendering (INR) problems. Evaluated our approach on multi-object tracking of vehicles in the wild using the Waymo and nuScenes datasets.
- To realize this approach efficiently, we first generatively pre-trained a neural representation model on cars in the ShapeNet v1 dataset and finetuned this model on images of vehicles from the Waymo and nuScenes datasets. We then performed INR by optimizing over the latent space of this pre-trained model to find a latent code that most closely represents the observed image of the detected car from the object detection stage in the canonical 3D object tracking pipeline. Finally, the latent code thus obtained served as an interpretable feature in the object association stage of the canonical 3D object tracking pipeline.
- Our method achieved performance comparable with other monocular MOT baselines. This work is under review at a conference.

Bootstrapping Reasoning for Lie Detection with Self-Generated Feedback
Tanushree Banerjee, Richard Zhu, Runzhe Yang, Denis Peskov, Brandon Stewart, Karthik Narasimhan

- Proposed a bootstrapping framework that leverages self-generated feedback to enhance LLM reasoning capabilities for nuanced natural language inference tasks. This framework consists of three stages: (i) the suggestion stage, where a cost-effective LLM generates an initial prediction; (ii) the feedback collection stage, where an LLM provides feedback on initial predictions; (iii) the modification stage, where an LLM refines the initial predictions based on the auto-generated feedback.
- Investigated our proposed framework for detecting deception in Diplomacy games by collecting a novel dataset of human feedback on initial predictions and comparing the modification stage performance when using human feedback rather than LLM-generated feedback. Our LLM-generated feedback-based approach achieved superior performance, with a 39% improvement over the zero-shot baseline in lying-F1 without any training required.

Reducing Object Hallucination in Visual Question Answering
Independent Work Project, Spring 2023, Princeton University — Advisor: Prof. Olga Russakovsky

- Studied the tendency of Visual Question Answering (VQA) models to predict non-existent objects when queried with an image and an unrelated question. Devised a procedure to quantify the extent to which VQA models can identify unrelated questions, based on the tradeoff between the risk of failing to identify an unrelated question with the number of related questions that are incorrectly identified as unrelated to the question.
- Proposed several approaches to identify questions unrelated to an image. The best approach involves quantifying the extent to which an off-the-shelf VQA model relies on the text input relative to the image input to determine whether the input image-question pair is unrelated. This approach achieves a 40% improvement over the random baseline.

AWARDS

Outstanding Computer Science Senior Thesis Prize Princeton University
One of 6 in 216 in the graduating class of the CS Dept. Received for my thesis work under Prof. Felix Heide. May 2024

Princeton Research Day: FitzRandolph Gate Award Princeton University
Received the award for my video presentation on my senior thesis work under Prof. Felix Heide. May 2024

Nominee, Computing Research Association Outstanding Undergraduate Research Award Princeton University
Nominated for the award by the CS Department for my work under Prof. Karthik Narasimhan. October 2023

ACADEMIC SERVICE

Undergraduate Course Assistant: Independent Work Seminar on AI for Engineering and Physics Spring 2024
I held office hours for students in the seminar, helping them debug their code and advising them on their semester-long independent work projects.

Princeton AI4ALL Research Instructor, Princeton University July 2022
Taught AI technology and policy to rising 11th-grade students from underrepresented groups. Led the NLP workshops and developed coding tutorials and lectures in preparation for an NLP-based capstone project. Organized guest lectures by Princeton faculty.

REFERENCES

Prof. Felix Heide, *Assistant Professor, Department of Computer Science, Princeton University, Princeton, NJ*
Prof. Karthik Narasimhan, *Associate Professor, Department of Computer Science, Princeton University, Princeton, NJ*
Prof. Olga Russakovsky, *Associate Professor, Department of Computer Science, Princeton University, Princeton, NJ*