FALL 2024 UNDERGRADUATE RESEARCH SYMPOSIUM AWARDEES

Most Popular Project

MAE-BERT VQA: A Hybrid Model for Visual Question Answering

Presenters: Syed Ali Haider & Junyi Li

Project Subject: CS/DS/Engineering

Faculty Mentor: Li Guo

This project focuses on advancing VQA by integrating cutting-edge techniques and models. We start by fine-tuning the BLIP-VQA model, incorporating LoRA layers specifically at the decoder level to enhance model adaptability while maintaining computational efficiency. In parallel, a custom VQA model is developed, using the MAE ViT for image representation and a pre-trained BERT model for text processing. The model architecture is further augmented with a cross-attention mechanism that is first trained for image captioning tasks and subsequently fine-tuned for VQA, ensuring a deep semantic understanding of both visual and textual inputs.

SOCIAL SCIENCE

Best Research Project

Risk Factors Associated with Postpartum Mental Wellness and Childbirth Outcomes among Pregnant People in Da Nang, Vietnam

Presenter: Addie Dung Manh Nguyen

Project Subject: Social Science

Faculty Mentor: Etienne Jaime Hinojosa

This cohort study examines postpartum depression and its association with sociodemographic factors, social support, self-perception, and childbirth outcomes among postpartum women in Da Nang, Vietnam. 155 participants were interviewed using the PHQ-9 scale to assess depression, the CTS-2 scale for intimate partner violence (IPV), and items on sociodemographic factors and self-evaluated perception. Descriptive statistics analysis suggests a significant prevalence of PPD symptoms and IPV experiences. Chi-square association tests and regression models confirm associations between PPD symptoms' severity with factors including negative perceptions of oneself and their familial-social relationships, recent IPV experiences, lower birth weight, and preterm birth.

SOCIAL SCIENCE

Best Presentation

Impact of Heatwaves on Urban Population Mobility: Focus on Chinese Megacities

Presenter: Ziyun Xu

Project Subject: Social Science

Faculty Mentor: Kangning Huang

This study examines the impact of heatwaves on urban mobility across four Chinese megacities—Beijing, Shanghai, Guangzhou, and Chongqing—using phone signaling data to analyze socio-economic and demographic variations. Findings reveal significant decreases in travel activities during heatwaves, particularly among the elderly in Beijing (8.1%) and Chongqing (15.63%), while Shanghai and Guangzhou saw relative increases. These insights emphasize the need for urban resilience strategies to enhance quality of life amid increasing climate challenges.

BUSINESS & ECONOMICS

Best Research Project

China's Labor Market: Lying Flat

Presenters: Hafsa Shahama Hilmi Samsudeen & Dan Huynh

Project Subject: Economics

Faculty Mentor: Joseph Foudy

China’s rapid and undisrupted growth during the past three decades has been the greatest engine of wealth creation and poverty alleviation the world has ever seen. This growth was enabled by China’s massive and well-educated labor pool and informed allocation of capital. Yet, come 2020 and now, long after the pandemic, we are witnessing an earlier-than-expected slowdown in GDP figures as well as increasing unemployment, especially among new graduates. On paper, neither China’s Labor pool nor its total amount of Capital is nearly tapped. Our paper seeks to capture that discrepancy, or how government policies and a decade of unbalanced economic growth have disproportionately and negatively impacted its labor force.

BUSINESS & ECONOMICS

Best Presentation

Strategic Timing of Implementation Interventions: Maximizing Impact with Varied School Event Incentives

Presenters: Haozhan Jiang & Tongyu Wang

Project Subject: Economics

Faculty Mentor: Weiwei Weng

This experimental design is expected to look into the timing strategy of implementation intervention, in terms of school events with different incentive levels. This experiment will be carried out digitally through email, by sending out invitations as usual for campus activities with RSVP links but with different timing ahead of the events, and each experiment should be repeated among events with varied attractions to students. Experimenters should summarize the participation rate of each event and finally study the correlation between different incentive levels and the timing strategy. The report is expected to conclude with a general suggestion on timing strategy for different incentive levels of events.

STEM

Best Research Project

ToMA: Token Merging with Attention for Diffusion Models

Presenters: Shaoyi Zheng & Wenbo Lu

Project Subject: CS/DS/Engineering

Faculty Mentor: Shengjie Wang

Diffusion models have excelled in image generation but face high computational costs due to transformers' complexity. Existing token-merging methods fall short by neglecting efficient attention mechanisms and ignoring token relationships, ultimately compromising efficiency and image quality. In this paper, we propose Token Merging with Attention (ToMA) with three key innovations: (1) submodular-based token selection for diverse merge destinations, (2) attention merge, utilizing efficient attention with negligible overhead, and (3) abstraction of token (un-)merging as (inverse-)linear transformations, shareable across layers and iterations. Additionally, we propose potential further acceleration by performing attention on tokens in local tiles based on image locality.

STEM

Best Presentation

Information Gain Guides Attention Allocation in Multiple Object Tracking

Presenter: Shucheng Li

Project Subject: Neural Science

Faculty Mentor: Zhong-Lin Lu

The human brain constantly processes dynamic visual input but has limited computational resources. Attention plays a critical role in selectively tracking relevant stimuli while ignoring distractions. A key question is how the brain efficiently allocates attention to track multiple objects in dynamic environments. This research develops a process model using Bayesian adaptive estimation and information gain to explain attention allocation in multiple object tracking (MOT). The findings may advance cognitive science and inspire AI systems that predict attention or aid in training individuals with attention disorders like ADHD.