논문 요약 보고서

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How Effectively Can BERT Models Interpret Context and Detect Bengali Communal Violent Text?

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초록:

The spread of cyber hatred has led to communal violence, fueling aggression and conflicts between various religious, ethnic, and social groups, posing a significant threat to social harmony. Despite its critical importance, the classification of communal violent text remains an underexplored area in existing research. This study aims to enhance the accuracy of detecting text that incites communal violence, focusing specifically on Bengali textual data sourced from social media platforms. We introduce a fine-tuned BanglaBERT model tailored for this task, achieving a macro F1 score of 0.60. To address the issue of data imbalance, our dataset was expanded by adding 1,794 instances, which facilitated the development and evaluation of a fine-tuned ensemble model. This ensemble model demonstrated an improved performance, achieving a macro F1 score of 0.63, thus highlighting its effectiveness in this domain. In addition to quantitative performance metrics, qualitative analysis revealed instances where the models struggled with context understanding, leading to occasional misclassifications, even when predictions were made with high confidence. Through analyzing the cosine similarity between words, we identified certain limitations in the pre-trained BanglaBERT models, particularly in their ability to distinguish between closely related communal and non-communal terms. To further interpret the model's decisions, we applied LIME, which helped to uncover specific areas where the model struggled in understanding context, contributing to errors in classification. These findings highlight the promise of NLP and interpretability tools in reducing online communal violence. Our work contributes to the growing body of research in communal violence detection and offers a foundation for future studies aiming to refine these techniques for better accuracy and societal impact.

Evaluating Compliance with Visualization Guidelines in Diagrams for Scientific Publications Using Large Vision Language Models

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초록:

Diagrams are widely used to visualize data in publications. The research field of data visualization deals with defining principles and guidelines for the creation and use of these diagrams, which are often not known or adhered to by researchers, leading to misinformation caused by providing inaccurate or incomplete information. In this work, large Vision Language Models (VLMs) are used to analyze diagrams in order to identify potential problems in regards to selected data visualization principles and guidelines. To determine the suitability of VLMs for these tasks, five open source VLMs and five prompting strategies are compared using a set of questions derived from selected data visualization guidelines. The results show that the employed VLMs work well to accurately analyze diagram types (F1-score 82.49 %), 3D effects (F1-score 98.55 %), axes labels (F1-score 76.74 %), lines (RMSE 1.16), colors (RMSE 1.60) and legends (F1-score 96.64 %, RMSE 0.70), while they cannot reliably provide feedback about the image quality (F1-score 0.74 %) and tick marks/labels (F1-score 46.13 %). Among the employed VLMs, Qwen2.5VL performs best, and the summarizing prompting strategy performs best for most of the experimental questions. It is shown that VLMs can be used to automatically identify a number of potential issues in diagrams, such as missing axes labels, missing legends, and unnecessary 3D effects. The approach laid out in this work can be extended for further aspects of data visualization.

Curating art exhibitions using machine learning

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초록:

Art curatorship has always been mostly the subjective work of human experts, who, with extensive knowledge of many and diverse artworks, select a few of those to present in communal spaces, spaces that evolved into what we now call art galleries. There are no hard and fast set of rules on how to select these artworks, given a theme which either is presented to the art curator or constructed by her/him. Here we present a series of artificial models -- a total of four related models -- based on machine learning techniques (a subset of artificial intelligence) that attempt to learn from existing exhibitions which have been curated by human experts, in order to be able to do similar curatorship work. We focus exclusively on the last 25 years of past exhibitions at the Metropolitan Museum of Art in New York, due to the quality of the data available and the physical and time limitations of our research. Our four artificial intelligence models achieve a reasonable ability at imitating these various curators responsible for all those exhibitions, with various degrees of precision and curatorial coherence. In particular, we can conclude two key insights: first, that there is sufficient information in these exhibitions to construct an artificial intelligence model that replicates past exhibitions with an accuracy well above random choices; second, that using feature engineering and carefully designing the architecture of modest size models can make them as good as those using the so-called large language models such as GPT in a brute force approach. We also believe, based on small attempts to use the models in out-of-sample experiments, that given more much more data, it should be possible for these kinds of artificial intelligence agents to be closer and closer to the aesthetic and curatorial judgment of human art curators.

LLM-Based Social Simulations Require a Boundary

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초록:

This position paper argues that large language model (LLM)-based social simulations should establish clear boundaries to meaningfully contribute to social science research. While LLMs offer promising capabilities for modeling human-like agents compared to traditional agent-based modeling, they face fundamental limitations that constrain their reliability for social pattern discovery. The core issue lies in LLMs' tendency towards an ``average persona'' that lacks sufficient behavioral heterogeneity, a critical requirement for simulating complex social dynamics. We examine three key boundary problems: alignment (simulated behaviors matching real-world patterns), consistency (maintaining coherent agent behavior over time), and robustness (reproducibility under varying conditions). We propose heuristic boundaries for determining when LLM-based simulations can reliably advance social science understanding. We believe that these simulations are more valuable when focusing on (1) collective patterns rather than individual trajectories, (2) agent behaviors aligning with real population averages despite limited variance, and (3) proper validation methods available for testing simulation robustness. We provide a practical checklist to guide researchers in determining the appropriate scope and claims for LLM-based social simulations.

KnowML: Improving Generalization of ML-NIDS with Attack Knowledge Graphs

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초록:

Despite extensive research on Machine Learning-based Network Intrusion Detection Systems (ML-NIDS), their capability to detect diverse attack variants remains uncertain. Prior studies have largely relied on homogeneous datasets, which artificially inflate performance scores and offer a false sense of security. Designing systems that can effectively detect a wide range of attack variants remains a significant challenge. The progress of ML-NIDS continues to depend heavily on human expertise, which can embed subjective judgments of system designers into the model, potentially hindering its ability to generalize across diverse attack types. To address this gap, we propose KnowML, a framework for knowledge-guided machine learning that integrates attack knowledge into ML-NIDS. KnowML systematically explores the threat landscape by leveraging Large Language Models (LLMs) to perform automated analysis of attack implementations. It constructs a unified Knowledge Graph (KG) of attack strategies, on which it applies symbolic reasoning to generate KG-Augmented Input, embedding domain knowledge directly into the design process of ML-NIDS. We evaluate KnowML on 28 realistic attack variants, of which 10 are newly collected for this study. Our findings reveal that baseline ML-NIDS models fail to detect several variants entirely, achieving F1 scores as low as 0 %. In contrast, our knowledge-guided approach achieves up to 99 % F1 score while maintaining a False Positive Rate below 0.1 %.

The Starlink Robot: A Platform and Dataset for Mobile Satellite Communication

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초록:

The integration of satellite communication into mobile devices represents a paradigm shift in connectivity, yet the performance characteristics under motion and environmental occlusion remain poorly understood. We present the Starlink Robot, the first mobile robotic platform equipped with Starlink satellite internet, comprehensive sensor suite including upward-facing camera, LiDAR, and IMU, designed to systematically study satellite communication performance during movement. Our multi-modal dataset captures synchronized communication metrics, motion dynamics, sky visibility, and 3D environmental context across diverse scenarios including steady-state motion, variable speeds, and different occlusion conditions. This platform and dataset enable researchers to develop motion-aware communication protocols, predict connectivity disruptions, and optimize satellite communication for emerging mobile applications from smartphones to autonomous vehicles. The project is available at https://github.com/StarlinkRobot.

Canary in the Mine: An LLM Augmented Survey of Disciplinary Complaints to the Ordre des ingénieurs du Québec (OIQ)

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초록:

This study uses pre-trained LLMs to conduct thematic analysis to investigate disciplinary incidents involving engineers in Quebec, shedding light on critical gaps in engineering education. Through a comprehensive review of the disciplinary register of the Ordre des ing₩'enieurs du Qu₩'ebec (OIQ)'s disciplinary register for 2010 to 2024, researchers from engineering education and human resources management in technological development laboratories conducted a thematic analysis of reported incidents to identify patterns, trends, and areas for improvement. The analysis aims to uncover the most common types of disciplinary incidents, underlying causes, and implications for the field in how engineering education addresses (or fails to address) these issues. Our findings identify recurring themes, analyze root causes, and offer recommendations for engineering educators and students to mitigate similar incidents. This research has implications for informing curriculum development, professional development, and performance evaluation, ultimately fostering a culture of professionalism and ethical responsibility in engineering. By providing empirical evidence of disciplinary incidents and their causes, this study contributes to evidence-based practices for engineering education and professional development, enhancing the engineering education community's understanding of professionalism and ethics.

A Survey of Multi-sensor Fusion Perception for Embodied AI: Background, Methods, Challenges and Prospects

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초록:

Multi-sensor fusion perception (MSFP) is a key technology for embodied AI, which can serve a variety of downstream tasks (e.g., 3D object detection and semantic segmentation) and application scenarios (e.g., autonomous driving and swarm robotics). Recently, impressive achievements on AI-based MSFP methods have been reviewed in relevant surveys. However, we observe that the existing surveys have some limitations after a rigorous and detailed investigation. For one thing, most surveys are oriented to a single task or research field, such as 3D object detection or autonomous driving. Therefore, researchers in other related tasks often find it difficult to benefit directly. For another, most surveys only introduce MSFP from a single perspective of multi-modal fusion, while lacking consideration of the diversity of MSFP methods, such as multi-view fusion and time-series fusion. To this end, in this paper, we hope to organize MSFP research from a task-agnostic perspective, where methods are reported from various technical views. Specifically, we first introduce the background of MSFP. Next, we review multi-modal and multi-agent fusion methods. A step further, time-series fusion methods are analyzed. In the era of LLM, we also investigate multimodal LLM fusion methods. Finally, we discuss open challenges and future directions for MSFP. We hope this survey can help researchers understand the important progress in MSFP and provide possible insights for future research.

Accurate, fast, cheap: Choose three. Replacing Multi-Head-Attention with Bidirectional Recurrent Attention for Long-Form ASR

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초록:

Long-form speech recognition is an application area of increasing research focus. ASR models based on multi-head attention (MHA) are ill-suited to long-form ASR because of their quadratic complexity in sequence length. We build on recent work that has investigated linear complexity recurrent attention (RA) layers for ASR. We find that bidirectional RA layers can match the accuracy of MHA for both short- and long-form applications. We present a strong limited-context attention (LCA) baseline, and show that RA layers are just as accurate while being more efficient. We develop a long-form training paradigm which further improves RA performance, leading to better accuracy than LCA with 44% higher throughput. We also present Direction Dropout, a novel regularization method that improves accuracy, provides fine-grained control of the accuracy/throughput trade-off of bidirectional RA, and enables a new alternating directions decoding mode with even higher throughput.

Exploring Developer Experience Factors in Software Ecosystems

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초록:

Context: Developer experience (DX) plays a key role in developers' performance and their continued involvement in a software ecosystem (SECO) platform. While researchers and practitioners have recognized several factors affecting DX in SECO platforms, a clear roadmap of the most influential factors is still missing. This is particularly important given the direct impact on developers' interest in SECO and their ongoing engagement with the common technological platform. Goal: This work aims to identify key DX factors and understand how they influence third-party developers' decisions to adopt and keep contributing to a SECO. Methods: We conducted a systematic mapping study (SMS), analyzing 29 studies to assess the state-of-the-art of DX in SECO. Additionally, we conducted a Delphi study to evaluate the influence of 27 DX factors (identified in our SMS) from the perspective of 21 third-party developers to adopt and keep contributing to a SECO. Results: The factors that most strongly influence developers' adoption and ongoing contributions to a SECO are: financial costs for using the platform, desired technical resources for development, low barriers to entry into the applications market, and more financial gains. Conclusion: DX is essential for the success and sustainability of SECO. Our set of DX factors provides valuable insights and recommendations for researchers and practitioners to address key DX concerns from the perspective of third-party developers.

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