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Accepted Papers

Integrating Event-based Neuromorphic Processing and Hyperdimensional Computing With Tropical Algebra for Cognitive Ontology Networks

Robert McMenemy, Independent Researcher, UK

ABSTRACT
This paper displays and explains an all encompassing framework for integrating event-based neuromorphic processing with hyperdimensional computing & using tropical algebra for cognitive ontology networks. Using the Iris dataset I have constructed a virtual ontology network in order to simulate cognitive computing processes. Event-based neuromorphic processing models with spike activities and stochastic synapses are set up to dynamically adapt the network's topology. Hyperdimensional vectors represent the entities and relations with tropical algebra operations encoding complex relationships between them. A Multi-Layer Perceptron (MLP) with adaptive dropout and learning rates is added & influenced by the neuromorphic spike activities, performing clustering and classification tasks. The framework demonstrates the improved clustering accuracy and adaptive learning capabilities of the method highlighting the potential of combining neuromorphic and hyperdimensional computing for advanced cognitive applications.

KEYWORDS
Neuromorphic Processing, Hyperdimensional Computing, Tropical Algebra, Ontology Networks, Cognitive Computing.

Adversllm: a Practical Guide to Governance, Maturity and Risk Assessment for LLM-based Applications

Othmane Belmoukadam, Jiri De Jonghe, Sofyan Ajridi, Amir Krifa, AI Lab, EY FSO Belgium

ABSTRACT
Large Language Models (LLMs) have become ubiquitous in various applications, revolutionizing and accelerating AI transformation cross industries. However, their widespread adoption has also exposed organizations to new and complex security threats such as prompt injections and data poisoning. In response to the escalating threat, there is an urgent need for organizations to enhance their readiness and resilience against the LLM risks. We introduce AdversLLM, a framework designed to support organizations in evaluating their governance and adoption maturity of LLM-based applications (e.g., Chatbots, Few-shot learning classifiers ...), as well as in identifying and addressing associated risks. At the heart of our framework is an assessment form that includes reviewing governance practices, gauging maturity levels, and auditing specific strategies for mitigation. To ground the latter in real life, we provide a set of real-world scenarios and situational cases, illustrating best practices strengthen AI governance. On the technical side, AdversLLM illustrates a prompt injection testing ground equipped with a benchmark dataset for stress-testing both commercial and open-source LLM implementations against various malicious prompts, thereby enhancing situational awareness and resilience. Furthermore, we discuss the ethical implications of security risks such as prompt injections and propose: (1) a zero-shot learning approach that serves as a first line of defense, filtering harmful content in real-time, and (2) RAG-based LLM safety tutor that fosters awareness of LLM security risks, shielding techniques, and red teaming practices. Overall, AdversLLM offers a focused, actionable solution that equips organizations with the tools and insights to promote responsible AI adoption.

KEYWORDS
Large Language Models, Natural Language Processing, Prompt Injections, Data poisoning, Responsible AI, Zero-shot learning, AI guardrails, Retrieval Augmented Generation.

Unveiling Swahili Verb Conjugations: A Comprehensive Dataset for Low-resource NLP

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ABSTRACT
This paper introduces a comprehensive dataset of Swahili verb conjugations, designed to address the linguistic challenges posed by Swahili's agglutinative morphology, a key feature that has made it dificult for Natural Language Processing (NLP) models to efectively process this low-resource language. The dataset includes over 56,812 verb forms across five tenses, three grammatical persons, and both singular and plural forms, of ering a rich resource for tasks such as tokenization, lemmatization, and morphological analysis. By systematically capturing the complex verb structures of Swahili, this dataset enables researchers and practitioners to improve model performance and build more accurate NLP tools for Swahili. This resource represents a significant step forward for the development of language models tailored to Swahili, with broader implications for processing other agglutinative languages in the Bantu family.

KEYWORDS
Linguistic resources, Verb morphology, Computational linguistics, Natural language processing.

Swaquad-24: Qa Benchmark Dataset in Swahili

Kondoro Alfred Malengo, Department of Data Science, Hanyang University, Seoul, South Korea

ABSTRACT
This paper proposes the creation of a Swahili Question Answering (QA) benchmark dataset, aimed at addressing the underrepresentation of Swahili in natural language processing (NLP). Drawing from established benchmarks like SQuAD, GLUE, KenSwQuAD, and KLUE, the dataset will focus on providing high-quality, annotated question-answer pairs that capture the linguistic diversity and complexity of Swahili. The dataset is designed to support a variety of applications, including machine translation, information retrieval, and social services like healthcare chatbots. Ethical considerations, such as data privacy, bias mitigation, and inclusivity, are central to the dataset's development. Additionally, the paper outlines future expansion plans to include domain-specific content, multimodal integration, and broader crowdsourcing efforts. The Swahili QA dataset aims to foster technological innovation in East Africa and provide an essential resource for NLP research and applications in low-resource languages

KEYWORDS
Linguistic resources, Question Answering (QA), Bias mitigation, Natural language processing.

Nepal License Plate Vision

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ABSTRACT
This paper presents the design and development of a vision-based license plate recognition system tailored specifically for Nepal's diverse license plate formats. The study aims to create an eficient solution for automatic vehicle identification by leveraging computer vision techniques, convolutional neural networks (CNN), and YOLO-based object detection. This LPR system is designed to capture and process real-time images from camera feeds, localize and extract license plate information, and convert it into machine-readable text for smart trafic management applications. Methodologically, a comprehensive dataset of Nepali license plates with varied fonts, colors, and backgrounds was collected to train the recognition model. Preprocessing techniques are applied to enhance image quality, followed by the CNN model's feature extraction for precise character recognition. Stored images, timestamped entries, and license plate data are organized in a database for tracking and analysis. The system holds substantial potential for applications in law enforcement, toll collection, and parking management, contributing to automated, eficienttrafic monitoring solutions in Nepal.

KEYWORDS
License plate recognition, computer vision, convolutional neural networks, YOLO, optical character recognition, smart trafic management.

Dynamic Multi-agent Orchestration and Retrieval for Multi-source Question-answer Systems using Large Language Models

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ABSTRACT
We propose a methodology that combines several advanced techniques in Large Language Model (LLM) retrieval to support the development of robust, multi-source questionanswer systems. This methodology is designed to integrate information from diverse data sources, including unstructured documents (PDFs) and structured databases, through a coordinated multi-agent orchestration and dynamic retrieval approach. Our methodology leverages specialized agents—such as SQL agents, Retrieval-Augmented Generation (RAG) agents, and router agents—that dynamically select the most appropriate retrieval strategy based on the nature of each query. To further improve accuracy and contextual relevance, we employ dynamic prompt engineering, which adapts in real time to query-specific contexts. The methodology's effectiveness is demonstrated within the domain of Contract Management, where complex queries often require seamless interaction between unstructured and structured data. Our results indicate that this approach enhances response accuracy and relevance, offering a versatile and scalable framework for developing question-answer systems that can operate across various domains and data sources.

KEYWORDS
Information Retrieval, Question Answer, Large Language Models, Documents, Databases, Prompt Engineering, Retrieval Augmented Generation, Text-to-SQL.

Is This Software Repository Professionally Maintained or is It for Exploration Purposes? A Classification Attempt on Readme.md Files

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ABSTRACT
We propose a novel method to classify GitHub repositories as professionally maintained or exploratory using their README.md files. We compare Large Language Models (LLMs) with classical NLP approaches like term frequency similarity and word embedding-based nearest neighbors, using RoBERTa as a baseline. We created and annotated a new dataset of over 200 repositories. Our evaluation shows LLMs outperform classical NLP models. GPT-4o achieved the best zero-shot classification without multi-step reasoning. Among smaller models, Google's Gemini 1.5 Flash performed well. Few-shot learning improved performance for some models; Llama 3 (70b) reached 89.5% accuracy with multi-step reasoning, but improvements were inconsistent across models. Filtering based on word probability thresholds had mixed results. We discuss trade-offs between accuracy, time, and cost. Smaller models and prompt-based queries without multi-step reasoning offer faster, cost-effective solutions, useful in time-sensitive scenarios.Approximately 70% of repositories could be accurately classified based on README.md content.

KEYWORDS
Classification, README.md, Zero-shot, Few-shot, LLM.

Web Application Security Testing Using Artificial Intelligence And Machine Learning

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ABSTRACT
Cyber threats have rapidly evolved, rendering traditional security testing methods insufficient for the effective detection of vulnerabilities in software. This work proposes the development of an automated testing agent based on Machine Learning, aimed at enhancing the detection of vulnerabilities such as Cross-Site Scripting (XSS) and SQL Injection (SQLi). The study encompasses the collection and preparation of vulnerability data, as well as the selection and training of Machine Learning models, utilizing algorithms such as Support Vector Machines and Random Forests. Preliminary results indicate that the proposed approach improves accuracy in identifying vulnerabilities compared to traditional methods. This work contributes to the automation of security testing, providing a more adaptive and efficient solution to address the challenges of contemporary cyber threats.

KEYWORDS
Vulnerability Detection, Artificial Intelligence, Machine Learning .

Proposal of a Data Model for a Dynamic Adaptation of Resources in Iots (ADR-IOT)

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ABSTRACT
In this work, the main objective is to provide a contribution of resources adaptation to consumption demand in IOT environments. To do this, we have proposed a data model including the entities " resource ", " load ", " event ", " policy " and " device " as well as the different relationships between IOT devices and others. 0 This data model, an adaptation process is proposed as well as a mathematical model based on the optimization of resource consumption on requests while, taking into account certain constraints including the Maximum Capacity of resources, the Satisfaction of user or IOT device requests and the Energy Constraints have been proposed. The simulation results regarding the optimization of resource consumption show that our model could be beneficial for smart city management, industry 4.0 and e-health.

KEYWORDS
Resource adaptation – data model – IOT resource.

Research on the Talent Trainingmodeofschool-enterprise Cooperation--take Design of the Innovative Experimental Platform as an Example

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ABSTRACT
Based on the exploration and practice of training applied talents in automation major, combined with the practical experience of teaching and scientific research in automation major, and the combination of production, study and research, an innovative experimental platform of linear motor based on NI Elvis is developed and realized. The platform makes full use of the advantages of NI Elvis and LabVIEW, and realizes the connection of software and hardware between NI Elvis and linear motor; The experimental design aims at the cultivation of innovation and practical ability to enhance students' ability to analyze and solve problems. By selecting diferent control strategies, the comprehensive experiment of the control system of linear motor tracking sinusoidal curve can be realized, so that students can deepen their understanding of the basic theory and basic concepts of control, and cultivate innovative thinking and innovative ability.

KEYWORDS
School-enterprise Cooperation; Experimental Platform; Linear Motor; Talent Training Mode.

Helping Physicians to Understand "Havana Syndrome" and a Novel Method Ofmanaging Ahis.

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ABSTRACT
This paper is aimed at helping medical practitioners to better understand a novel condition colloquially called “Havana Syndrome”. Never before have physicians encountered patients with, or were challenged with diagnosing this condition. In order to make sense of many symptoms and findings of the acute events of “Havana Syndrome”, known as AHIs (Anomalous Health Incidents), the author frames these attacks as brain entrainment problem, and conceptualizes the long-term neurological condition that results, as a nonkinetic injury to the brain. Currently, no therapeutic interventions have been offered to manage debilitating symptoms of AHI attacks. A novel promising method of managing AHIs of "Havana Syndrome" is described, and effectiveness demonstrated. The method is based on the understanding of AHIs as a brain entrainment event due to external pulses of EM energy. The method utilizes two percussive massagers set to different pulsating frequencies used simultaneously.

KEYWORDS
Neurology, Havana Syndrome, AHI, Brain Entrainment, Coupling, Non-Kinetic Injury.

Set Theory: Foundations, Developments, and Applications

Sanjib Khadka, Xavier’s College, Nepal

ABSTRACT
Set theory, as the mathematical study of collections of objects, forms a cornerstone of modern mathematical logic, computation, and systems theory. This paper explores set theory's foundational principles, including subsets, unions, intersections, power sets, and Cartesian products, highlighting its role in advanced mathematical concepts and computational frameworks. It also explores the multifaceted domain of set theory, laying a foundation by tracing its historical roots and exa mining its fundamental principles. We delve into the axiomatic framework underpinning set theory, including the ZermeloFraenkel axioms and the Axiom of Choice. The discussion extends to the intricate concepts of cardinality, ordinality, and the continuum hypothesis. Emphasizing pr actical relevance, we highlight the application of set theory , focusing on fuzzy sets, rough sets, and their roles in decision-making and control systems.

KEYWORDS

Set Theory, Zermelo-Fraenkel Axioms, Axiom of choice, Fuzzy sets, Rough sets, Cardinality, Ordinality, Continuum Hypothesis.

Socioeconomic Determinants Associated With the Occurrence of Births Outside the Maternity: Case of the Chongoene Health Center- Chongoene District in the 1st Quarter of 2023

Osvaldo Bernardo Muchanga, Department of Human Science's and Etic, University of St Tomás de Moçambique. Xai-Xai,Mozambique, 2024.

ABSTRACT
The study aimed to study the socio-economic determinants associated with the occurrence of Births outside the Maternity: Case of patients treated at the Chongoene Health Center in the 1st trimester of 2023. This was a quantitative study, with 8 mothers randomly selected and 4 health technicians allocated to the SSC selected intentionally. The 8 women participating in the study have a mean age of 25 years and each had an average of 2 years outside the health unit and with study was proven a positive and strong relationship between age and number of births outside the hospital, where older women tend to be the ones who had more deliveries outside the health unit. About the research it is concluded that among them are: extreme poverty, difficulty of access to health units; family history of home births; sociocultural beliefs/myths/taboos; delay in attendance at the health unit/maltreatment level and lack of prenatal consultations. Thus it is recommended the allocation of Community Ambulances, Community awareness, Humanization of Health Services.

KEYWORDS
Socio-economic determinants; Domicile; Maternity; Births.