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- Fuzzy System Applications in Human-Machine Interface
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Detecting Hate Speech Against People with Disabilities in Social Media Comments Using Rag-enhanced Llms, Fine-tuning, and Prompt Engineering

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ABSTRACT

Social media is now deeply integrated into people's daily life, enabling rapid information exchange and global connectivity. Unfortunately, harmful content can be easily disseminated among all communities, including hate speech and biases against vulnerable groups such as people with disabilities. While social media platforms employ a mix of automated systems and skillful experts for content moderation, significant challenges remain in detecting nuanced hate speech, particularly when expressed through indirect or coded language. This paper proposes a novel approach to address these challenges through HEROL (Hate-speech Evaluation via RAG and Optimized LLM), a unified model that combines RAG-Enhanced Large Language Models with Prompt Engineering and Fine-Tuning. Experimental results, obtained through a structured evaluation methodology using annotated social media datasets, demonstrated that HEROL achieved an accuracy improvement by up to 10% compared to baseline models. This highlights its effectiveness in identifying subtle and indirect forms of hate speech and its potential to contribute to safer, more inclusive online environments.

Keywords

Social Media – Hate Speech Detection – Disability – Natural Language Processing – Large Language Models – Prompt Engineering – Fine-Tuning – Retrieval-Augmented Generation – Knowledge Graph

Enterprise Large Language Model Evaluation Benchmark

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ABSTRACT

Large Language Models (LLMs) enhance productivity through AI tools, yet existing benchmarks like Multitask Language Understanding (MMLU) inadequately assess enterprise-specific task complexities. We propose a 14-task framework grounded in Bloom's Taxonomy to holistically evaluate LLM capabilities in enterprise contexts. To address challenges of noisy data and costly annotation, we develop a scalable pipeline combining LLM-as-a-Labeler, LLM-as-a-Judge, and corrective retrieval-augmented generation (CRAG), curating a robust 9,700-sample benchmark. Evaluation of six leading models shows open-source contenders like DeepSeek R1 rival proprietary models in reasoning tasks but lag in judgment-based scenarios, likely due to overthinking. Our benchmark reveals critical enterprise performance gaps and offers actionable insights for model optimization. This work provides enterprises a blueprint for tailored evaluations and advances practical LLM deployment.

Keywords

Large Language Models (LLMs), Evaluation Benchmark, Bloom's Taxonomy, LLM-as-a-Labeler, LLM-as-a-Judge, corrective retrieval-augmented generation (CRAG).

Evaluation of Bagging Predictors with Kernel Density Estimation and Bagging Score

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ABSTRACT

For a larger set of predictions of several differently trained machine learning models, known as bagging predictors, the mean of all predictions is taken by default. Nevertheless, this proceeding can deviate from the actual ground truth in certain parameter regions. A method is presented to determine a representative value $\hat{y}_{BS}$ from such a set of predictions and to evaluate it by an associated quality criterion β_{BS} , called Bagging Score (BS), using nonlinear regression with Neural Networks (NN). The BS reflects the confidence of the obtained ensemble prediction and also allows the construction of a prediction estimation function $\delta(\beta)$ for specifying deviations that are more precise than using the variance of the bagged predictors themselves.

Keywords

Machine Learning, Neural Network, Bagging Predictors, Bagging Score, Nonlinear Regression, Deviation Estimation.

Meditrust: A Hybrid Medical Q&a Platform Combining AI Responses, Expert Review, and Traditional User Interaction to Deliver Fast, Reliable, and Trustworthy Medical Information

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ABSTRACT

Traditional Q&A platforms are slow in responding to users' questions, while AI responses are often unreliable and lack trustworthiness [1]. Meditrust aims to provide fast and reliable answers to users' questions by incorporating AI in conjunction with manual Q&A and review. Meditrust contains a Q&A platform where users can post their questions and get answers. It also has an AI Chat page where people can obtain real-time responses by expressing their medical concerns and questions to a large language model [2]. To increase the trustworthiness of the app and the AI response, if the user has questions or concerns about the AI response generated, they can request a review of the content generated by medical experts. In order to assess the effectiveness of the app, we created a survey consisting of 10 questions with answers ranging from 1 (strongly disagree) to 5 (strongly agree) and sent the survey to 20 college students to obtain responses. The results of the survey proved that our app is indeed effective as it provides quick and reliable answers to users' medical questions and receives positive feedback from users. The survey response also reveals that people do not generally trust the response of artificial intelligence and value human-to-human interaction for their medical questions and answers [4]. This finding further proves our app's effectiveness, as our app allows users to request a review from human experts if they have concerns with AI-generated content. Furthermore, our app also provides a traditional Q&A platform for manual interaction on users' questions and concerns. These features give Meditrust a unique edge compared to similar applications.

Keywords

AI medical answers, expert review, fast Q&A, trusted health info

An Adaptive Mobile Guitar Application to Assist Inlearning Guitar and Music Creation using Machine Learning and Membrane Button Matrix

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ABSTRACT

This paper addresses the challenge of creating an affordable and effective guitar learning system. Traditional guitar learning methods rely heavily on teacher-student interaction, which can be limited in terms of feedback and accessibility [10]. To solve this problem, we propose a system that uses membrane buttons on the guitar fretboard to detect user input, combined with machine learning to provide real-time feedback and corrections. The system converts raw guitar signals into a readable format and integrates with an application to enhance the learning experience. Key technologies include RP2040 for signal conversion and machine learning for input analysis. Challenges such as signal accuracy and real-time feedback were addressed by using membrane buttons, which are more accurate and costeffective compared to other methods like video detection or audio analysis. The system was tested in various scenarios, demonstrating its potential to provide an interactive, accessible, and personalized guitar learning experience that can improve how students learn the instrument.

Keywords

Adaptive, Assist, Guitar Learning, Music Creation, Machine Learning

Style Mate: An AI-driven Digital Closet App for Promoting Sustainable Fashion and Clothing Donation

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ABSTRACT

The increased use of fast-fashion lately and the detrimental environmental impacts it causes is a very prevalent issue in society. Not only does this impact on the environment, but it means that the homeless are receiving poor quality clothing and live in areas full of waste. My program idea is an app that promotes sustainable clothing and donating clothes. The key technologies are authentication, digital closet, and the StyleMate AI. The digital closet is a neat and organized way for people to store their clothes and also receive an in-detail analysis for the eco-friendliness of the clothing. A ChatGPT API call is also used to maximize the capability of the app [11]. The experiment was performed on the AI, where a series of questions were asked and the results were rated based on the similarity of the actual response to the expected response. The donations page is an extremely helpful map that has markers placed on donation centers near a person's location, and they can learn more just by clicking on the marker. My app is a fun way to organize clothes on a digital platform, but even more than that it promotes sustainable clothing and donating clothes to those in need.

Keywords

Sustainable fashion, Digital closet, AI-powered app, Clothing donation

Exploring the Influence of Relevant Knowledge for Natural Language Generation Interpretability

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ABSTRACT

This paper explores the influence of external knowledge integration in Natural Language Generation (NLG), focusing on a commonsense generation task. We examine how semantic relations from knowledge bases influence the generated text by creating a benchmark dataset that pairs input data with related retrieved knowledge and includes manually annotated outputs. Additionally, we conduct a detailed interpretability analysis to better understand these effects. By selectively removing relevant knowledge, we assess its impact on sentence quality and coherence. Our interpretability analysis shows that well-integrated external knowledge significantly enhances commonsense reasoning and concept coverage when generating a sentence. In contrast, filtering out key knowledge components leads to notable performance degradation, highlighting the critical role of relevant knowledge in guiding coherent generation. These findings underscore the value of interpretable, knowledge-enhanced NLG systems and call for evaluation frameworks that go beyond surface-level metrics to assess the underlying reasoning capabilities.

Keywords

natural language generation, interpretability, knowledge-enhanced, commonsense generation.

A Comparative Proof of Concept: Evaluating Migration Strategies From Monolithic SAP Commerce to Cloud-native Microservices Architecture

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ABSTRACT

This research presents a comprehensive proof of concept (PoC) study comparing migration strategies from monolithic SAP Commerce platforms to cloud-native microservices architectures. I propose an innovative six-phase transformation methodology that incorporates composable commerce patterns, AI-driven personalization, and event-first integration. Through simulation modelling, theoretical analysis, and a comparative evaluation against alternative approaches (modular monolith, lift-and-shift, and phased SOA), I project potential improvements of 60% in latency reduction, 4× deployment frequency, and 282% ROI over five years. The study employs mixed-methods research, combining quantitative modelling with qualitative analysis of organizational readiness factors. This framework includes detailed architectural blueprints, comprehensive risk mitigation strategies, implementation roadmaps, and decision matrices validated through industry benchmarks and theoretical modelling. This research aims to provide organizations with data-driven insights and actionable guidance for evaluating modernization strategies before committing to full-scale transformation, addressing the critical gap in empirical comparison of migration approaches for enterprise e-commerce platforms.

Keywords

Proof of concept, Migration strategy comparison, SAP Commerce modernization, Microservices architecture, ROI modelling, Risk assessment, Cloud transformation, Composable commerce, Event-driven architecture, Digital transformation

An Augmented Reality System for Event-driven Multimedia Unlocking on a Rubik-type Cube Using Vuforia and Firebase

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ABSTRACT

This paper presents an augmented reality (AR) system that overlays multimedia content on a Rubik-type cube using Vuforia Engine and Firebase services [1]. The system addresses the challenge of combining secure authentication, event-driven unlocking, and cloud-based content delivery. After user login through Firebase Authentication, cube interactions detected by Vuforia trigger the UnlockEventSystem, which updates Firestore to track progression [2]. Media files are retrieved from Firebase Storage and displayed in AR via Unity's VideoPlayer and ImagePlayer managers [3]. Experiments tested tracking reliability under varying lighting conditions and media load times across network environments. Results demonstrated strong accuracy in normal settings and low latency on modern networks, though performance declined in poor lighting and weak connectivity. Methodology comparisons showed that while prior research identified AR's educational potential, our work contributes a functional prototype that directly integrates progression, gamification, and cloud persistence. Ultimately, the project demonstrates a scalable, engaging, and secure AR framework for interactive learning and training.

Keywords

Augmented Reality (AR), Vuforia Engine, Rubik's Cube Tracking, Unity3D, Firebase Authentication.

Enhancing Public Speaking Confidence: An AI-powered Debate Practice App with Real-time Feedback

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ABSTRACT

This project introduces an AI-powered debate practice app designed to help users improve their public speaking and debate skills [9]. The app simulates real public forum debates by letting users input topics, choose roles, and engage with an AI opponent in various debate phases. It allows for flexible, on-demand practice and gives users instant feedback based on their choices [1]. To test the app's effectiveness, five users participated in a survey after using it. The results showed an average score of 8.0 in both preparedness and confidence, proving the app helped users feel more ready and self-assured. The app also stands out when compared to other public speaking methods, such as therapy, solo prep, or structured classes [2]. Unlike those, this app offers an interactive, real-time experience that helps users practice impromptu responses under pressure. Overall, this tool provides a practical and accessible way to build communication confidence and improve debate performance.

Keywords

AI debate app, Speaking skills, Instant feedback, Confidence building.

Design, Development, and Evaluation of a Unity-based educational Video Card Game for Teaching viruses, The immune System, and the Importance of Vaccination

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ABSTRACT

This research paper goes through the design, development, and testing of an educational video card game created to teach about viruses, the immune system, and the importance of vaccines [1]. The game was built in unity and designed with intuitive mouse controls. Core systems such as drag-and-drop, card mechanics and modular spawning waves were created to give an engaging and replayable gameplay experience [2]. There have been multiple previous studies on educational games for viruses, which found that educational games can improve engagement and teach as effectively as traditional teaching methods. This is also shown by my testing with surveys to players showing PUT DATA HERE. By teaching accurate representations of immune system cells and pathogen through descriptions, images and mechanics, this game shows the potential of video games as a medium for education [15].

Keywords

Educational Games, Immune System, Vaccines, Unity Development.

Developing an Electronic Platform for Social Workers and Their Integration Into E-employment (Independent From the SuperPuna Platform)

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ABSTRACT

This paper examines the critical need for creating a dedicated electronic platform for social workers in Kosovo and integrating it into the E-Employment system, developed independently from the existing SuperPuna platform. Currently, the absence of a comprehensive mechanism has generated significant gaps in managing social cases, negatively affecting service efficiency, institutional coordination, and process transparency. The study adopts a qualitative and comparative research approach grounded in international literature, institutional reports, and the experiences of countries with advanced digitalization of social services such as Estonia and Finland. In addition, a survey of 50 social workers and institutional representatives was conducted to support the empirical analysis. The survey results confirmed that 84% of participants identified the lack of a dedicated platform as the main challenge; 76% emphasized the importance of integration with E-Employment to increase efficiency, while 68% requested regular training on the use of digital technologies. These findings align with international literature (OECD, UN, World Bank), which underlines the pivotal role of digitalization in improving social services and reducing bureaucratic burdens. This paper presents a unique scientific contribution for Kosovo, as it is the first to propose an integrated model for social workers in relation to E-Employment. Furthermore, the study offers concrete recommendations to policymakers regarding the design of the legal framework, professional capacity building, and investment in technological infrastructure—all key elements for the successful implementation of the proposed platform.

Keywords

Ssocial workers, E-Employment, electronic platform, e-government, social services, Kosovo.

ECA-Driven Architectural Connectors Meet Rewrite Logic and Django for Smoothly Developing Adaptive Sound and Efficient AI-powered Knowledge-intensive Software Applications

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ABSTRACT

Whereas Artificial Intelligence (AI) with its Machine-Learning (ML) vertiginous advances are significantly reshaping our way of developing software either as (prompting) GenerativeAI- or purely ML-based ones, any significant influence of decades of investigations and findings around software-engineering (SE) concepts, principles and methods on such new AI-Era software is unfortunately almost desperately missing. The resulting is plethora of GenerativeAI- and MLbased software: Black-boxed rigid ill-conceptually and completely isolated from our "ordinary" yet mostly disciplined software landscape. The aim of this paper is to contribute in leveraging such unsatisfactory Promptingand ML-based software form to be well-conceptually, dynamically adaptable by intrinsically fitting it within our "ordinary" domain-oriented software landscape: We refer generically to as AI-Powered (knowledge-intensive) applications software; thereby reconciliating Domain- and AI-Experts instead of temporarily miserable 'confrontation'. We achieve such promising endeavour by exactly capitalizing on best advanced SE concepts and principles More precisely, we are putting forward an innovative stepwise integrated modeldriven approach that smoothly exhibits the following conceptual, founded and technological milestones. Firstly, any structural features are semi-formally modelled as UML components intrinsically thereafter mapped into (ordinary and MLbased) Web-Services. Behavioural crucial features are then captured as intuitive business rules mostly at the inter-service interactions. Secondly, for the precise conceptualization of such inter-service behavioural rules, we are proposing tailored graphically appealing stereotyped primitives as ECA-driven architectural (interservice) connector glues, we refer to as ECA-driven interaction laws. Thirdly, for the rigorous certification, while staying ECA-Compliant we are tailoring Meseguer's true-concurrent rewriting logic and its strategies-enabled Maude language for that purpose. Last but not least, for the efficient implementation we are proposing a four-level implementation still ECA-Compliant architecture, by relying on modern software technologies including python-empowered API with Django and its REST framework and Visual-Studio enterprise as advanced IDE. All approach milestones and steps are extensively illustrated using a quite realistic AI-powered software application dealing with Brain Tumor diagnostics while stressing all its benefits, with at-top reliability, dynamic-adaptability, self-learning and understandability.

Keywords

ECA-driven architectural interaction laws, UML and Service-orientation, Machine-Learning (ML), KNN, Brain-Tumor, Reliability and Adaptability, RewritingLogic, Domain- and AI-Experts, Django REST and Python API.

Enhancing Software Product Lines with Machine Learning Components

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ABSTRACT

Modern software systems increasingly integrate machine learning (ML) due to its advancements and ability to enhance data-driven decision-making. However, this integration introduces significant challenges for software engineering, especially in software product lines (SPLs), where managing variability and reuse becomes more complex with the inclusion of ML components. Although existing approaches have addressed variability management in SPLs and the integration of ML components in isolated systems, few have explored the intersection of both domains. Specifically, there is limited support for modeling and managing variability in SPLs that incorporate ML components. This article addresses this gap by proposing a structured framework that enhances SPL to support the inclusion of ML components. It facilitates the design of SPLs with ML capabilities by enabling systematic modeling of variability and reuse. The proposal has been partially implemented with the VariaMos tool.

Keywords

Machine Learning (ML), Software Product Lines (SPL), ML-based systems, variability modeling.

Training Reu Students Using Quantum Computing Tools

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ABSTRACT

This study describes the development of the Research Experience for Undergraduate students (REU) training program on Quantum Machine Learning (QML), hosted by the SenSIP Center at Arizona State University. In 2025, the REU hosted several projects that engaged quantum computing in signal processing, audio analysis, computer vision, medical diagnostics, anomaly detection, and generative machine learning. The objectives of the training program are to a) engage students in QML research by immersing them in government and industry projects, b) train students in quantum information processing and machine learning simulations, c) encourage students to pursue graduate research, d) increase awareness of career opportunities in QML, and e) provide professional development training. As part of professional development, students presented to stakeholders and received training in preparing publications, building awareness on social implications, ethics, and privacy. The program is evaluated by the Center for Evaluating the Research Pipeline (CERP) and an independent evaluator. This paper describes the importance of introducing QML research at the undergraduate level, recruitment, program structure, summaries of REU projects, and preliminary evaluations.

KEYWORDS

REU, Quantum Computing, Quantum Machine Learning, Qubits, Workforce Development

Enhancing Independent Navigation for the Visually Impaired: A Wearable Smart Vest with Haptic and Voice Feedback using Multi-sensor Integration

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ABSTRACT

Visual impairments affect millions worldwide, creating significant barriers to safe navigation and independence. Traditional tools such as white canes and guide dogs offer limited range and capabilities, underscoring the need for advanced assistive technologies. This project proposes a wearable smart vest that integrates four VL53L1X distance sensors, four DRV2605L haptic motors, and an ESP32-S3 Feather microcontroller with a PCA9548A multiplexer. The system delivers directional haptic cues and optional voice alerts through a mobile application. Experiments tested the vest under different lighting conditions and target angles, revealing high accuracy in most cases, though performance degraded in harsh sunlight and at steep angles. Compared with related methodologies, our design reduces reliance on auditory overload, external semantic data, or GPS connectivity, ensuring reliability in both indoor and outdoor settings [3]. Ultimately, the smart vest demonstrates a practical, user-centered solution that enhances safety, independence, and quality of life for visually impaired individuals.

KEYWORDS

Visually Impaired individual, Navigation, Bluetooth, Vest.

Deconstructing AI Power: From Political Capital to Algorithmic Control

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ABSTRACT

This paper introduces a symbolic governance model that maps how political authorities (P1–P2, L, I), capital (F, C), and layered technical infrastructures (T1–T4) translate directives into recursive algorithmic control. Rather than treating AI as an autonomous or neutral technology, the model reframes it as an encoded structure of power operating across data (D), social interfaces (S1–S2), and global arenas (G1–G3). By compressing complex system interactions into an accessible symbolic language, the framework helps non-technical stakeholders trace influence from policy and finance to code, platforms, and behavioral feedback (R). Brief case snapshots illustrate how algorithmic logics shape information, decisions, and public life. The contribution is a practical lens for diagnosing power in AI ecosystems and a policy-oriented roadmap for oversight, transparency in optimization targets, and public-interest safeguards against algorithmic domination.

Keywords

Artificial Intelligence; Algorithmic Governance; Political Power; Digital Politics; Algorithmic Control.

An Effective Tool to Help Teenagers Recognize Emotional Health at an Early Age Using Big Data Analysis and Observative Journals

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ABSTRACT

This paper discusses how childrens low emotional literacy showed as a major issue that traditional mental health services ignore and that schools fail to adequately address or educate young age groups to recognize. We suggest SelfGen, a multimedia mobile application that helps kids identify, categorize, and control their emotions by fusing hobbies from journaling, music, and art. Through gamified and imaginative activities, SelfGen promotes daily emotional check-ins through Firebase authentication, AI image generation, and real-time survey tracking [10]. Secured logins, moderated content, and adaptive feedback loops helped to address issues with community safety, privacy, and emotion recognition accuracy. SelfGens AI and survey system were tested in two experiments. The first demonstrated an accuracy of 70%+ in AI-generated emotional interpretations, and the second verified that user reflections and daily survey scores were strongly correlated. These findings suggest that SelfGen is capable of effectively recognizing emotional patterns and empowering users. SelfGen provides a dynamic, habit-forming substitute for strict school-based SEL programs by fusing security, creativity, and psychological insight—making emotional growth both interesting and approachable [11].

Keywords

Psychology, Social Media, Teens, Data Analysis.

An Intelligent Mobile Application for Student Wellness: Integrating Time Management, Health Tracking, and Aipowered Assistance

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ABSTRACT

This research explores the development of a mobile application that integrates authentication, academic scheduling, health tracking, and AI-powered assistance to promote student well-being. High school students face increasing mental health challenges due to heavy workloads, poor time management, and insufficient self-care practices. Our system addresses these issues by combining secure login services, a Firestore-based health and event management module, and an AI feedback component powered by OpenAI's GPT model [15]. Challenges addressed during development included securing sensitive data, balancing workload in study plans, and designing an intuitive user interface. An initial usability experiment using surveys demonstrated high ratings for navigation and overall satisfaction, though long-term impacts on stress management require further testing. Compared to existing systems, this project offers a more holistic solution by uniting academic and health dimensions in a single app. Ultimately, the application demonstrates the feasibility of integrating AI with wellness tracking to support balanced student lifestyles.

Keywords

Student Wellness, Time Management, Mental Health, AI-Powered Feedback, Mobile Health Applications.

Culture Craft: An AI-powered Mobile Platform for Personalized Cultural and Creative Learning

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ABSTRACT

This research addresses the challenge of engagement within learning about cultural and creative practices in digital learning [1]. Existing platforms rely on generic static content and lack adaptability, reducing student motivation and effectiveness. Culture Craft is a mobile learning application that integrates structured modules with video tutorials, and an AI powered assistant to foster an engaging, personalized experience centered around cultural learning and crafts [2]. The system architecture contains a favorites system for more personalization, a video system for multimedia learning, and an ai system utilizing Natural Language Processing to generate contextual support and explanations to the user's content. Backend services of our application are Firebase Firestore for data storage, YouTube API to implement videos into course lessons, and OpenAI's API to provide dynamic responses modeling a helpful tutor [3]. We conducted a survey with five participants, where average ratings across various aspects of the app exceeded 4.0 from a 5.0 scale. The findings aid Culture Craft's effectiveness as a hybrid model, blending education and creativity in one application.

Keywords

AI Learning, Personalization, Cultural Education, Mobile Application.

Pet's Mind: An Ai-powered Mobile Application for Pet Care, Health Tracking, and Community Support

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ABSTRACT

This research paper explores the development of Pet's Mind, a mobile application designed to improve pet care through real-time AI assistance, health tracking, and community interaction [1]. The problem addressed is the lack of affordable, comprehensive, and accessible tools for new pet owners, many of whom struggle to provide proper care due to limited knowledge or resources. Our methodology involved designing three core systems: the AI Nutrition Expert, the Health Tracking system, and the Community Forum. These systems were implemented using Flutter and Firebase, ensuring accessibility across platforms [2]. To evaluate effectiveness, we conducted a user survey that tested navigation, usefulness, and satisfaction. The results showed high averages across most categories, particularly in usability and AI responses, with some room for improvement in design aesthetics and trust in AI accuracy. Overall, Pet's Mind offers a free, ad-free, and supportive platform that enables pet owners to make informed decisions and build healthier lives for their pets.

Keywords

Pet Care, Mobile Application, AI Assistance, Health Tracking.

Leveraging Technology to Address Homelessness: A Mobile Application for Resource Accessibility, Volunteer Engagement, and AI-powered Support in San Diego

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ABSTRACT

The inspiration for creating this program stemmed from seeing the large number of homeless individuals in my community, leading me to design an app that could provide essential support, raise awareness, and facilitate help. Seeing the prominent number of homeless people in my community inspired me to create this program so that they can have better support, spread awareness, and make it easier for other people to help [1]. The app is aimed at assisting the

homeless population in San Diego by offering immediate access to resources such as food, medical, mental health services, and shelter [2]. It also serves as a platform for donations and volunteer opportunities for people looking to help combat homelessness. The app focuses on accessibility and simplicity, ensuring its easy for anyone to use by making it available on kiosks around San Diego and on the app store [3]. A key feature is the AI-powered chatbot, created using OpenAI, which helps address any specific questions or concerns that users may have beyond the standard resources. The app uses Firestore to manage a comprehensive database of locations and organizations, including contact details, hours of operation, and descriptions, which helps users select the most suitable support services [4]. The app also includes a map feature that guides users to nearby organizations, with locations sorted by proximity. To ensure the apps resources are up to date, it will be refreshed every two months to incorporate any changes. The app was designed with simplicity in mind, featuring straightforward buttons and clear instructions for ease of use, with the AI chatbot providing additional help for more complex questions. As part of the testing process, I created a usability survey with 10 questions focusing on interface, navigation, map functionality, and the chatbots effectiveness [5]. Results showed an average score of 4.04/5, with the highest rating given to the apps potential for volunteers and donors. However, the map feature received the lowest ratings, suggesting some users might struggle with it. Despite minor issues, the app is performing as intended, and feedback indicates it successfully meets its primary goal of encouraging people to download it, especially for those seeking to help or looking for support in homelessness [6].

Keywords

Homelessness Support, Mobile Application, AI Chatbot, Volunteer and Donation Platform.

A Smart AI-powered Mobile System to Prevent Diabetes in Homeless Communities using Computer Vision and Personalized Nutritional Recommendations

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ABSTRACT

Diabetes affects homeless populations at rates similar to the general population (8%), but homeless individuals receive significantly less medical attention and face higher complication rates due to food insecurity and lifestyle instability. VitalityShield addresses this challenge through a Flutter-based mobile application that provides AIpowered food analysis and personalized diabetes prevention recommendations. The system integrates three core components: an OpenAI GPT-4 Vision food scanner for nutritional analysis, an AI recommendation service using GPT-4o-mini for personalized dietary suggestions, and interactive health analytics for progress tracking [1]. Key challenges included achieving accurate food recognition across varying image qualities and generating practical recommendations for populations with limited food access. Experimental results demonstrated 83.25% accuracy in nutritional analysis and moderate practicality scores (3.4/5) for recommendations. While limitations exist in accessibility and accuracy, VitalityShield offers significant advantages over traditional outreach methods by providing scalable, 24/7 diabetes prevention support that adapts to individual dietary patterns, potentially reducing diabetes risk in vulnerable homeless communities.

Keywords

Diabetes Prevention, Homeless Populations, Artificial Intelligence, Computer Vision, Mobile Health Applications.

AI-powered Smart Farm Robot for Real-time Crop and Soil Monitoring with Adaptive Imaging and Terrain-aware Navigation

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ABSTRACT

Today around the world, agriculture faces many challenges like pest outbreaks, plant disease, inefficient resource use, and limited access to affordable monitoring tools for small to medium scale farmers. Agriculture faces persistent challenges such as pest outbreaks, plant diseases, inefficient resource use, and limited access to affordable monitoring tools for small- and medium-scale farmers. Without effective detection and intervention, these issues can result in decreased yields, financial losses, and long-term soil degradation. This project presents a smart farm robot that integrates robotics, advanced sensors, and artificial intelligence to provide real-time crop and soil monitoring. The system is built on a Hiwonder robot base with a Raspberry Pi, and leverages Gemini AI and OpenAI for plant image analysis, Firebase for backend storage, and a mobile application for farmer alerts. Several limitations emerged during development, including inconsistent image recognition under variable lighting and reduced navigation accuracy on damp or uneven terrain. Experimental testing confirmed that lighting conditions significantly impact AI performance, while soil type affects movement precision. Proposed solutions include adaptive preprocessing, LED-based lighting, and terrain-aware navigation controls. By addressing these challenges, the farm robot demonstrates potential as a scalable, low-cost precision agriculture tool. It offers a sustainable alternative to traditional monitoring methods, enabling farmers to make proactive, data-driven decisions that improve efficiency, reduce losses, and support long-term agricultural resilience.

Keywords

Precision agriculture, Smart farming, AI crop monitoring, Agricultural robotics.

Machine Learning Algorithms in Facilitating and Assisting Rocket Descent and Landing

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ABSTRACT

This paper presents a Unity-based reinforcement learning system for simulating rocket descent and landing. Leveraging the Unity ML-Agents framework, our approach applies Proximal Policy Optimization (PPO) combined with imitation learning to balance exploration with guided behavior [8]. Unlike prior works, our system introduces vertical dynamics, randomized initial conditions to reduce overfitting, and variable environmental factors such as gravity, drag, rocket mass, and thruster power. We further refine the reward structure by incorporating precision and time-based incentives, including a “bullseye bonus” for accuracy and a time bonus for efficiency. Experimental results show that our rocket agents achieve competitive success rates compared to existing implementations, even under more complex conditions. By extending Unity’s simulation environment with both technical rigor and user-oriented design, this work contributes to advancing reinforcement learning applications in aerospace while also promoting accessibility and engagement for broader audiences interested in space exploration technologies [9].

Keywords

Unity, Machine Learning, Rockets, Landing

An Intelligent, Community-driven System to Optimize Beach Cleanup and Resource Allocation using AI-driven Analytics and Citizen Science

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ABSTRACT

Marine pollution presents a multifaceted challenge, extending beyond visible debris to include microscopic and chemical threats that damage ecosystems and economies. This paper proposes Beach Guardian, an innovative platform that transforms coastal communities into proactive environmental stewards through citizen science. By using a digital framework with AI-driven image analysis, our solution standardizes and leverages crowdsourced data to inform and optimize cleanup efforts. The platform directly addresses the limitations of existing solutions, such as the manual data collection in local initiatives or the lack of real-time ground-level data in large-scale aerial surveys and numerical models. Our experiments highlighted a key technical challenge of model overfitting, which we addressed by proposing a plan for continuous data validation and model retraining to improve accuracy. The findings demonstrate that by empowering a vast network of users, Beach Guardian can provide a scalable, low-cost, and real-time solution that makes a tangible, positive impact on a global scale.

Keywords

Machine Learning, Citizen Science, Environment, Marine Pollution.