

Abstract: Science and Engineering Fair of Houston

1433

EyeOnSugar: How Sweet Is Your Receipt?

Dhruv Shah

Conroe ISD /Knox Junior High

Category

Systems Software

In the EyeOnSugar project, the question tested is: How Can Software Programming Be Used To Raise Awareness About Sugar Consumption? Obesity is a significant issue, affecting 76.1% of people in the country. This software aims to help reduce this number by allowing individuals to monitor and prevent sugar over-consumption by giving visibility to their shopping habits. A web application was developed to measure sugar content from uploaded receipts and provide users with the total amount. The hypothesis is that the software effectively identifies sugar content and raises awareness, as 65% of people process visual information better. Tools include a computer, Python and Flask programming systems, and Jupyter IDE to create the application. OCR API was utilized to analyze receipts, and tests were conducted three times, with data entered into tables and graphs. Control groups included: an existing AI software and the nutrition labels on products in receipts, which are 100% accurate and serve as a benchmark. A final comparison of the three results determined the accuracy of the new software. Results showed the software to be highly accurate, as its database provided sugar amounts aligning closely with the Nutrition Label control group. EyeOnSugar proved more accurate than the alternative AI software for this task, raising awareness about sugar consumption

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Abstract: Science and Engineering Fair of Houston

1434

Roadside Ready?

Henry Lecoq

Clear Creek ISD /Seabrook Intermediate School

Category

Systems Software

Autonomous cars are growing in popularity today. However, in 2024, there have been 83 fatalities from autonomous cars. The Roadside Ready project was to evaluate how accurately AI can recognize road signs in different backgrounds. The hypothesis was if the AI is exposed to images with different settings and backgrounds, then the photos that are a clear view of the sign and the backgrounds that are like the training data will be the photos that the algorithm will recognize the most accurately. To test the hypothesis, photos were taken of speed limit, school zone, work zone, yield and stop signs. Photos were taken in different settings, angles and light. One set of photos was put into an AI algorithm to train the algorithm. A second set of photos of the signs was put into the algorithm to see what percentage the algorithm recognized each sign. Fifty photos were tested. Data recorded what percentage the software recognized each sign and what percentage it recognized the signs in different settings. The data showed that the AI software recognized the yield and the school zone signs more accurately with yield being recognized 88% and the school zone signs being recognized 85%. The project showed that the hypothesis was correct; the AI program could aid in driving but is not accurate enough to be used for self-driving. If the project was to be done again, then it would be recommended more photos be collected for both the training data and signs tested.

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Abstract: Science and Engineering Fair of Houston

1435

AI Diagnosis Tool

Jesutomi Oginni

SST - Champions College Prep - HS

Category

Systems Software

The purpose of my project was to show how AI can be used to help people figure out their undiagnosed symptoms. I built an app that helped people query a ChatGPT AI model with any symptoms they were feeling and get a response that explained why they may be feeling the symptoms. Each user also completed a survey to give feedback on how they felt about the responses given by the app. The survey also asked how similar the app's results was to the doctors, if they were seen by one. 26 people used the app with the following results: 96% of users responded saying that the app did help them figure out their undiagnosed symptoms, 77% said the app response was similar to what their doctor said about their symptoms, and 72% of users highly rated (8/10 or more) the app results similarity to the doctors'. In conclusion, I believe that my app was very successful and had a positive impact in helping people figure out their undiagnosed symptoms. I would love to do more studies on a larger population, to see if this conclusion still holds true.

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Abstract: Science and Engineering Fair of Houston

1436

How Do Games effect Blood Pressure

Mirlentz Derat

Houston ISD /BCM Academy at James D Ryan - MS

Category

Systems Software

The purpose of this project was to examine the effect of different types of games on an individual's blood pressure. Initially, my test subject and I measured our baseline blood pressure before engaging in any gaming activities and recorded these values for comparison. Over the course of the study, we played various games, dedicating one hour to each type, and checked our blood pressure following each session. This procedure allowed us to gather a series of readings that were essential for comprehensive data analysis. The primary focus was to determine whether Player versus Player (PvP) games would cause the most significant increase in blood pressure compared to other genres. After analyzing the collected data, the results supported my hypothesis, showing that PvP games indeed resulted in the highest blood pressure readings for both my test subject and I. In addition to the physiological changes, we observed that both of us maintained a heightened level of focus throughout the day, suggesting that the competitive nature of the games may enhance cognitive engagement. These findings highlight the potential link between competitive gaming and increased physiological stress responses, as evidenced by elevated blood pressure levels. This research contributes to a better understanding of how different gaming modalities can affect not only cardiovascular health but also mental focus, warranting further investigation into the long-term implications of gaming on both physical and psychological well-being

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Abstract: Science and Engineering Fair of Houston

1437

Create a sustainable future: AI powered app for predicting future greenhouse gas emissions.

Srikar Karri

Karri - Homeschool

Category

Systems Software

Greenhouse gas emissions are a leading cause of climate change, causing rising temperatures, stronger hurricanes, and poor air quality. To address this issue, my project explores using machine learning to predict future emissions trends and provide actionable insights over next 5 years in USA by state and source of pollution and help us fight climate change! My project is based on data from EPA.gov, which has over 2 million records of data from 1990 to 2023. Upon data preprocessing, I trained multiple machine learning models using this data and LSTM (Long Short-Term Memory) which analyzes patterns in time-series data performed the best. I Improved the model performance further by hyper parameter tuning. I built a completely autonomous system that automates data preprocessing, normalization, analysis, visualization, model training, evaluation and hyper parameter tuning with a click of a button. The model achieved an accuracy of over 99%, with a prediction error of less than 1% of the total emissions range. It also identified key contributors to emissions, highlighting wildfires in California as a growing challenge and transportation as a consistent source in Texas. I built a user-friendly app powered by the model to predict future emissions under 5 seconds. These predictions are not just numbers—they offer policymakers a tool to prioritize their actions, targeting the biggest sources and making informed decisions to fight climate change. With this research, I believe we can move from reacting to climate change to preventing it, building a cleaner, healthier future for all.

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Abstract: Science and Engineering Fair of Houston

1438

Programming Notes

Kirill Ponomarev

Clear Creek ISD /League City Intermediate School

Category

Systems Software

In today's world, there are many advanced technologies and programming languages that support them. New languages continue to emerge and improve, raising the question: why are there so many programming languages, and how do we decide which one to learn? For businesses, speed is one of the most important factors, especially as more and more industries move into the digital space. This shift increases competition in the development of web applications. Have you ever noticed that some apps run faster than others? In this project, I selected five popular programming languages Go, Python, Java, JavaScript, and C# to test which one is the fastest for basic programming tasks like sorting, creating arrays, and performing math operations. The goal was to provide practical insights into the strengths and weaknesses of each language for specific use cases. The results showed that Java is excellent for math computations due to the optimization of the Java Virtual Machine (JVM). Go and C# performed well in tasks that require speed and efficient resource management, with C# also excelling in game development. Python and JavaScript stood out for their simplicity and flexibility, making them ideal for quick prototyping and web applications. The conclusion is that the choice of programming language depends on the project's specific requirements: use Java for heavy computations, C# for game development, and Python or JavaScript for easier and more general-purpose tasks. Ultimately, the "best" language depends on the developer's goals, whether it's speed, scalability, or ease of use.

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Abstract: Science and Engineering Fair of Houston

1439

AI Rubric Grader

Lucas Jiang

Isaac Behar

EMERY WEINER JEWISH SCHOOL

Category

Systems Software

Artificial intelligence, particularly ChatGPT has been an increasingly prevalent part of our daily lives. We decided to test how we can create an AI model to do a specific task in our case make the grading process for teachers as simple, quick, and easy as possible. Our AI model is able to create rubrics, grade papers, check for plagiarism as well as provide feedback on students work and your current rubrics. We created this AI model using Open AI's "create your own GPT" software. In our experiment we were able to learn that our AI model was able to grade assignments in about 15-20 seconds compared to around 15 minutes per assignment for a human. We were also able to learn that AI can actually give grades that are as consistent or even more consistent then teachers. Teachers spend an average of 5 hours grading every single week. This can be significantly reduced using the power of AI without the need to sacrifice efficiency or accuracy.

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Abstract: Science and Engineering Fair of Houston

1440

Creating an AI model to Identify Existing Autoimmune Disease

Mohit Premkumar

Conroe ISD /McCullough Junior High

Category

Systems Software

This experiment aims to show how important early diagnosis and late intervention is. Using a survey I created and mock data I also created, I created an AI called MoAI to predict if a patient has type 1 diabetes. I made a survey including symptoms of T1D, age, and ethnicity. I also created a table and divided it by ethnicity. This includes Hispanic, Asian, and White. I also divided them into age. I created mock data to feed MoAI. I divided each ethnicity in each age group into 30 people. Using the results from my survey, I coded MoAI using Java and I trained it for about a week. I used the formula for accuracy and put in the responses from my survey into MoAI to get a 70-75% accuracy. My Original goal was a 35% accuracy, but the model achieved an even higher accuracy. MoAI is important for basically everyone including elderly people, workers, and overall anyone who believes they might have T1D. MoAI shows how important early diagnosis is by predicting autoimmune type 1 diabetes at an early age.

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Abstract: Science and Engineering Fair of Houston

3421

A Neural Network-Based Approach to Detect Cancerous Lung Tissue in Histopathological Images

Neel Singal

Fort Bend ISD /Dulles High School

Category

Systems Software

Lung cancer is the leading cause of cancer deaths worldwide. It is often falsely diagnosed by clinicians in many parts of the world due to insufficient technology or human error in analyzing computed tomography scans. Patients struggle to understand the causes of their lung cancer and whether or not their diagnosis of the type and status of their lung cancer is dependable. This experiment tested the hypothesis that using histopathological images of lung tissue, a predictive model can identify key features to distinguish between the main two types of lung cancer – adenocarcinoma and lung squamous cell carcinoma – and benign lung tissue with statistical significance. A dataset of 750 histopathological images from HIPAA compliant sources was used to generate 25,000 training images using an augmentation package. Various predictive models, such as random forest classifiers and convolutional neural networks, with differing model parameters were fit and tested on this dataset. The models were built using the tensorflow and sci-kit-learn python packages, as well as existing benchmarked models such as ResNet50. Ultimately, a convolutional neural network built using ResNet50, with additional filtering and pooling layers, achieved 97.8 percent accuracy and less than 8 percent false negative rates. While neural networks are still relatively unexplainable, this study affirmatively answers the question of whether there exist features predictive of lung cancer and its type. Further experiments with more advanced explainability techniques on larger and more diverse datasets can help confirm these results and pinpoint specific features of interest.

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Abstract: Science and Engineering Fair of Houston

3422

ChatGuard: Enhancing Gaming Platforms' Chat Moderation with Natural Language Processing

Arda Varol

Conroe ISD /AST: Academy of Science and Technology

Category

Systems Software

Adolescents extensively use social media and gaming platforms, which are prone to exposure to inappropriate content. Despite existing chat moderation systems, such as Roblox's hashtag-based filters, users bypass them using altered expletive variations. This project proposes an enhanced Natural Language Processing (NLP) solution to improve content moderation by detecting expletive words, and their near-identical variations. Utilizing datasets from Carnegie Mellon University, GitHub, and a comprehensive English dictionary, synthetic variations of expletives are generated using Levenshtein Edit-Distance. Additionally, Jaro similarity measures are employed to identify subtle linguistic modifications. The solution's accuracy is tested against Roblox's current filtering system, evaluating improvements in detecting inappropriate content. While Roblox's chat moderation system had a success rate of 44.6% when detecting expletive content, my solution achieved 82.5% accuracy. The findings aim to enhance online safety and mitigate risks to adolescent users while balancing the need for effective moderation with freedom of expression.

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Abstract: Science and Engineering Fair of Houston

3423

An invisible layer of security: an innovative technique for copyright protection in AI and web 3.0

Melody Han
ST. JOHN'S SCHOOL

Category

Systems Software

This project aims to investigate an innovative approach within AI and Web 3.0 by utilizing steganography. Steganography technologies conceal information within ordinary carriers such as images, audio, or text, rendering hidden data imperceptible. Unlike complicated cryptography, which focuses on making data unreadable, steganography conceals the very existence of the message with low complexity. Key components include the carrier medium (e.g., the image or audio file), the secret message (the concealed information), and the embedding technique (the method used for hiding the data). This process is typically undetectable to human senses, leaving the carrier medium ostensibly unchanged. Applications examples are digital watermarking, where creator information is embedded to assert ownership and protect against unauthorized use, and authentication, ensuring file integrity and authenticity. Specifically for this project, image steganography is used to embed messages within photos, utilizing Python to handle the image as the carrier and the message as the hidden content. Results are evaluated and quantified using peak signal-to-noise ratio (PSNR) metrics, discussing the trade-offs between image quality and embedded content. This study underscores the potential of steganography as an invisible layer of security, thus offering a simple technique in the evolving landscapes of AI and Web 3.0.

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Abstract: Science and Engineering Fair of Houston

3424

Developing an Interpretable AI Model for the Diagnosis and Monitoring of Sleep Apnea

Ashrith Velagandula

Agastya Varanasi

Houston ISD /DEBAKEY HIGH SCHOOL FOR HEALTH PROFESSIONS - HS

Category

Systems Software

Sleep apnea is a medical condition characterized by irregular breathing while a person is asleep and is a widespread condition, affecting 6% of the U.S. population or 18 million people, and it's heavily associated with many other conditions such as diabetes, strokes, heart attacks, and shortened lifespan. In our project, we aim to build a model that can predict and diagnose sleep apnea in individuals based on various symptoms and characteristics such as heart rate during sleep, snoring, insomnia, irritability, weight changes, and many more. To do so, we combined data from various publicly-available data sets to train the initial model. Then, we further developed the model using a combination of neural networks and machine learning techniques, which enabled us to be able to predict and diagnose sleep apnea based on sleep-related data and symptoms associated with the condition. After testing the model for accuracy, we determined that the model is accurate to a high extent as it showed consistency and reliability in a wide range of real-world cases, showcasing its potential for use in real patients and medical settings. With this project, we would be able to predict and diagnose sleep apnea in a wide range of these cases, allowing doctors and researchers to better understand the condition and develop treatments, and overall, provide a higher quality of life for people affected by this condition.

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Abstract: Science and Engineering Fair of Houston

3425

Rebuilding Our Future- Alphabet Adventures

Dhyan Dileepkumar Remya

Enoch Adebiyi

Nykolos Greene

Fort Bend ISD /Willowridge High School

Category

Systems Software

"In Texas, ~57,000 eligible 4-year-olds and ~225,000 eligible 3-year-olds are not enrolled in public prekindergarten. (TEA)" These students are at a disadvantage in their education compared to students who have attended prekindergarten. With our project we aim to even this gap by providing students, regardless of their financial status, access to a prekindergarten education. We built this project by using PyGame's console, which allowed us to use our knowledge of Python to program an application that allows users to learn their ABCs and learn about some basic words. We haven't finished building the app, so in Phase 2 we plan to finish it and test with humans.

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Abstract: Science and Engineering Fair of Houston

3426

AI Enhanced Drone Navigation for Efficient Rescue Pathfinding

Raeef Dean

Clear Creek ISD /Clear Springs High School

Category

Systems Software

This project presents an AI-driven software solution for optimizing route planning in rescue operations by deploying a drone to autonomously identify and navigate around obstacles. Utilizing the graph traversal pathfinding algorithm, the AI analyzes simulated rescue scenarios to determine the safest and most efficient routes for first responders. By recording and mapping obstacles, the software enables rapid adaptation to complex, unstructured environments typical of disaster and emergency sites. All testing is conducted within a virtual simulation environment, ensuring consistent evaluation under diverse conditions while minimizing physical risks. Data on path efficiency, obstacle avoidance, and algorithmic performance are collected through virtual sensors, with metrics analyzed through statistical and graphical methods to assess effectiveness across iterative refinements of the AI. The expected outcomes include significant improvements in route safety and response times, contributing to a safer operational model for real-world applications in search-and-rescue missions. This project advances the application of AI in autonomous navigation and real-time obstacle detection, showcasing the potential for AI-enhanced tools to augment the safety and efficiency of rescue teams. By reducing risks and optimizing rescue pathways, this research aims to support the development of life-saving technologies, potentially transforming future emergency response protocols.

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Abstract: Science and Engineering Fair of Houston

3427

RESCUE: Real-world Emergency Solutions for Crisis and Urgent Evacuations - Optimizing Disaster Response Vehicle Routing

Aanya Singh

Fort Bend ISD /Dulles High School

Category

Systems Software

After a disaster, there are often many injured individuals and limited availability of emergency response resources. Efficient routing is crucial to minimize fatalities, yet existing algorithms fail to account for key real-life factors such as road damage, vehicle capacities, and unknown victim conditions. This research optimizes emergency vehicle routing by integrating these factors to improve disaster response. Four algorithms—Greedy, Simulated Annealing, Cluster, and Ant Colony Optimization—were tested in a city simulation using OpenStreetMap data to model 15 disaster-affected areas (5 urban, 5 suburban, 5 rural). The simulation incorporated varying levels of road damage and hospital accessibility while factoring in victim injury severities and vehicle types with different speeds and capacities. To assess each algorithm's efficiency and adaptability, response times to all victims, response times for critical victims, and average road damage scores along routes were recorded across different disaster conditions. Simulated Annealing achieved the fastest response time, averaging 87.4 minutes to reach all victims. Ant Colony Optimization had slightly higher response times but competitive risk scores. The cluster algorithm balanced speed and risk, averaging 91.8 minutes with moderate risk scores. In contrast, the Greedy algorithm had the slowest response time (102.2 minutes) and the highest risk scores, highlighting its inefficiency in complex disaster scenarios. This research highlights the importance of incorporating real-world variables into disaster response algorithms for emergency routing. These results suggest that Simulated Annealing and Ant Colony Optimization could offer improved response times in disaster scenarios, potentially enhancing vehicle deployment and reducing fatalities.

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Abstract: Science and Engineering Fair of Houston

3428

Where is your Data going

adam Daley

Pasadena Memorial High School

Category

Systems Software

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Abstract: Science and Engineering Fair of Houston

3429

Unobstructing voice for the deaf: A real-time centered sign language recognition system

May Espinola
Tompkins - HS

Category

Systems Software

Sign language serves as the main means of communication for the Deaf and Hard-of-Hearing community, yet barriers persist for non-signers who either lack the practical exposure to master it or a cultural complacency towards learning, due to little applicability in their lives. This creates a challenge for the deaf community, forcing them to rely on tools and make sacrifices to accommodate the general population. With remote working on the rise and artificial intelligence becoming more integrated into education and various fields, we can use advancements, specifically in computer vision, to remove communication barriers for the deaf. For practical adoption, the system must function in real-time without significant delays. This project aims to build a real-time, scalable system for American Sign Language (ASL) recognition, capable of large-vocabulary recognition and translation capabilities at over 30 FPS for both word- and sentence-level signing. By integrating MediaPipe for hand keypoint tracking and a hybrid static-dynamic fusion approach with a lightweight transformer architecture like MobileViT, the system calculates static spatial features alongside temporal dynamics with the use of multi-scale attention mechanisms to ensure high accuracy and low latency. Key functionalities of the system include sign-to-text/speech conversion, multimodal fusion of manual (hand gestures) and non-manual (facial expressions, body posture) markers, and real-time feedback via text display or speech synthesis. These features bridge the gap between signers and non-signers, not only enhancing accessibility and inclusion for the Deaf and Hard-of-Hearing community but also setting a foundation for the future integration of assistive technologies in everyday communication.

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Abstract: Science and Engineering Fair of Houston

3430

Predicting the Migratory Patterns of Invasive *Lycorma delicatula* Utilizing Ecological Niche Modeling and Exploring Drone Applications Across the U.S

Lekisha Nagpal

Conroe ISD /AST: Academy of Science and Technology

Category

Systems Software

Lycorma delicatula, commonly known as the Spotted Lantern Fly, is an invasive timber pest native to Southeastern Asia that migrated to parts of Pennsylvania, United States in 2018. This species has caused extensive damage to ecosystems and forest lumber industries within the U.S. due to its ability to feed on vascular plant tissue causing wilting and dieback. Ecological niche modeling (BRT, GAM, Maxent models) recognizes relationships between species distribution points and a location's environmental factors to determine the migratory patterns of this species. Validation techniques, including an area under the curve of 0.88 and a threshold table are generated to assess the model's performance ability on unseen data and overall reliability. Predictions for 2040, 2060, and 2080 are made for *Lycorma delicatula* distribution. By 2024, the models indicate the early stages of moderate species expansion into western territories. By 2060, the pest shows increased spread, furthering its ability to firmly establish itself. Lastly, by 2080, the model illustrates intense westward expansion as the species successfully thrives in previously unsuitable habitats (Colorado, North Dakota, Wyoming). This westward expansion can be seen due to rising temperatures and changing precipitation patterns caused by the gradual progression of climate change. Additionally, a prototype drone system is developed through hardware and software tools to ensure consistent surveillance of high-risk areas. Ultimately this information and development can assist pest management organizations in creating solutions to eradicate *Lycorma delicatula* from the U.S, safeguarding ecosystems and industries.

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Abstract: Science and Engineering Fair of Houston

3431

FlashGuard: Detecting and Sanitizing Triggering Media and Content for Photosensitive Individuals for Epileptic Seizure Prevention in Real Time

Ishan Pendyala

Friendswood ISD /Friendswood High School

Category

Systems Software

Photosensitive epilepsy presents significant challenges for individuals exposed to rapidly flashing, high-contrast visual stimuli on electronic devices. These stimuli can trigger seizures, rendering both virtual devices and real-world environments unpredictable and hazardous for affected individuals. Building on the detection algorithm developed in the previous year, this iteration of FlashGuard acts as an active mitigation tool, expanding its applicability to real-world integrations such as in AR glasses. In this novel method, the rate of change in the CIELAB color space is reduced by targeting both axes of perceived color shifting - luminance (L^*) and color (A^* and B^*). The mitigation model combines a scaled darkening approach to reduce rapid contrasting of luminance intensity to a viewable, non-triggering level. Alongside a novel color-blurring technique which temporally averages colors in a triggering area, the filters are overlaid onto the original media, allowing users to view the underlying content as normal without the original, dangerous flashing. Unlike current frameworks, FlashGuard is compatible with all computer applications, surpassing current models that rely on pre-recorded data in accuracy and computational efficiency. During testing, FlashGuard's filtering and prevention algorithm demonstrated a significant flash-reduction metric, sanitizing 92% of seizure-inducing video content, demonstrating its ability to create accessible viewing measures for photosensitive individuals in virtual and physical environments by removing dangerous stimuli. With its physical-world portability, FlashGuard acts as a safety barrier where photosensitive users can engage with content while minimizing exposure to potentially harmful visual stimuli.

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Abstract: Science and Engineering Fair of Houston

3432

Detecting False Statements through Visual Body Movements and Behavior Without the Use of Specialized Hardware

Ryan Nirmal

Owen Ye

Conroe ISD /AST: Academy of Science and Technology

Category

Systems Software

Traditional standards of lie detection have been tied with specialized hardware such as polygraphs. There are three key issues with these: it requires a specialist to interpret the data in real-time to understand, requires the target to be hooked up to the monitor, and is regarded as unreliable. The solution to this issue is tracking and identifying micromovements using only a device with a camera and the aid of dedicated software. Micromovements can be defined as irresistible movements that would be captured during lying, akin to facial movements such as eye twitching. The project is split into two major sections: detection and data collection and then analysis. Data collection begins with tracking 63 key landmarks in the face, allowing the understanding of face structure and movement over time. The pupils are also tracked in order to aid in the second section of the project being analyzed. The analysis starts with the neural network, which is a custom setup built with a transformer architecture in mind. Transformer architectures excel in understanding sequential data, which in this project would be a few mere seconds of constant face landmark positions. The transformer then can understand what areas of the sequential data are more important than others through a self-attention mechanism. Finally, the model would output a binary classification of either a 0, corresponding to a truth, or a 1, corresponding to a lie. With these focusing on various micromovements, all lead to vastly higher accuracy than predicted by current standard lie detection.

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Abstract: Science and Engineering Fair of Houston

3433

Making an Artificial Intelligence Chatbot for Aid in Science Comprehension

Ngoc Nguyen

Conroe ISD /AST: Academy of Science and Technology

Category

Systems Software

Generative Artificial Intelligence is a field of research that is increasing in popularity and has immense potential to affect many areas of life, ranging from medicine to recreational activities. Generative AI is currently revolutionizing daily life, with many organizations implementing AI in products. However, one area that Generative AI hasn't had much effect on is in the field of education. The present project aimed to develop an AI chatbot specialized in science, more specifically, anatomy & physiology, biology, chemistry, and physics in answer to the research question, "How can AI-powered chatbots enhance students' learning capabilities in the field of science?". This project utilized an LLM Model, an LLM embedding model, a retrieval-augmented technique, and a Llamaindex framework to develop a chatbot that could generate in-depth responses to any questions regarding anatomy & physiology, biology, chemistry, and physics. The chatbot was tested using 200 complex queries and its generated responses were compared to common web search engines' responses to the same 200 queries. This research has produced a product that can provide in-depth, contextually rich, applicable results (with a 95.5% accuracy) and can be applied in the real world as a tool for educators and students.

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Abstract: Science and Engineering Fair of Houston

3434

Testing the Effectiveness of Simple Machine Learning Models on ADHD Datasets

Molly Chen

Conroe ISD /AST: Academy of Science and Technology

Category

Systems Software

ADHD is a mental disorder characterized by inattentiveness, hyperactivity, and impulsivity. It affects millions of Americans, but according to Psychiatrist.com, only 10-25% receive adequate diagnosis and treatment, leading to greatly decreased quality of life. This experiment explores a way to combat that by testing three simple machine learning models for efficacy on an ADHD dataset of phenotypic variables. While successful studies have been done using deep learning and MRIs or EEGs, these imaging techniques cost just as much as an actual diagnosis, making it an unfavorable option for people who cannot afford a diagnosis. In this project, models are applied to phenotypic data, which is much easier to obtain. Logistic regression, Random Forest, and XGBoost were tested, achieving accuracies of 90%, 96%, and 97%, respectively. This outperforms many of the more sophisticated methods that have been used before and shows promise for use in the future for helping to identify ADHD in a less expensive and more convenient way.

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Abstract: Science and Engineering Fair of Houston

3435

Manipulating Non-Linear Storage System Performance Using Different Programming Approaches

Damir Diedukhov

Conroe ISD /AST: Academy of Science and Technology

Category

Systems Software

My study adventures through the performance characteristics of HDDs (Hard Disk Drives) and SSDs (Solid State Drives) under different conditions. While SSDs outperform HDDs due to their lack of moving parts, this experiment reveals that factors such as file size, number of files, and programming methods significantly change the efficiency. In the first experiment, SSDs and HDDs exhibited similar performance when copying a large number of small files, with SSDs' speed advantages offset by the overhead of managing numerous files. In the second test, the change from one million files to 65 larger file sizes highlighted a more noticeable performance gap, with SSDs outperforming HDDs, particularly in Disk B, which completed file transfers in under a minute. In the third experiment, switching from Bash to Python caused a significant performance shift, notably increasing the copy time for Disk B. These findings show the complexity of data storage performance and also tell the need for enhancing hardware and software for specific use cases.

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Abstract: Science and Engineering Fair of Houston

3436

Identifying Mood Level Using Facial Recognition to Improve Public Safety

Daniel Blessan

Friendswood ISD /Friendswood High School

Category

Systems Software

This project focuses on developing a facial recognition program using Python to identify individuals' emotional states based on their facial expressions. The purpose of this project is to create a tool that could proactively identify potential threats by analyzing people's moods through facial recognition. To achieve this, a Python-based program was designed and trained using publicly available facial expression datasets to enhance its accuracy. The software is intended to be integrated with surveillance cameras for real-time emotion analysis in public spaces. The results demonstrate an accuracy of 82% showing there may be some errors in the program also, indicating the program's potential for real-world applications, such as detecting suspicious behavior or assisting in crime prevention. This system could alert authorities to individuals exhibiting concerning emotional states, contributing to public safety. In conclusion, this program represents a promising approach to leveraging facial recognition technology for addressing real-world challenges, with potential applications in security and public monitoring systems.

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Abstract: Science and Engineering Fair of Houston

3437

Cycles: Autoregressive Algorithms and Analyzing Monotonicity in Body Pattern Data Through Mobile Applications

William Choi-Kim

Juhi Bhatt

Cv-Fair High School

Category

Systems Software

Cycles is an app that helps with identifying and understanding associations of bodily phenomena, such as symptoms, conditions, or health metrics to improve diagnosis, monitoring, and prediction. Created for those facing complex, periodic conditions, Cycles uses collected data to give insight into the health associations of common factors. Employing the evolving nature of machine learning alongside more traditional analysis, the app compiles information on how each recorded factor is connected to provided values, frequency, index, and time of the biological manifestations the user provides data on. This app aims to increase awareness of how specific factors are associated with medical consequences so that the user is better able to determine confounding factors of the health problem they are trying to address. By identifying patterns, Cycles helps users, medical professionals, and researchers understand how different factors can possibly contribute to changes in their biological state, providing more accurate and informed data that helps with interventions and treatment.

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Abstract: Science and Engineering Fair of Houston

3438

Thrive: An App for Regressive Autism Support, Redefining the Future of Neurodevelopmental Care with AI-Assisted Technology

Isha Sahnian

Conroe ISD /ACES: Academy for Careers in Engineering and Scien

Category

Systems Software

According to The United States Center of Disease Control (CDC), 1 out of 36 children in the US are diagnosed with Autism Spectrum Disorder (ASD). Fifty one percent of ASD children have Regressive Autism, consisting of typical development followed by a loss of previously gained skills. Despite this high prevalence of Regressive Autism, parents and children struggle to find tailored resources designed to support growth. To address this challenge, Thrive was created: an AI assisted resource designed to provide customized support for parents and children in one central platform. Thrive includes a set of games developed to provide independent intervention for children. These games target learning essential skills to help children communicate and interact within society. Additionally, the application includes an AI virtual assistant that provides parents with personalized strategies and advice that are scientifically proven to help their child's development. The applications' various components were individually built and tested. After testing, the components were integrated into one, seamless interface. Specifically, the virtual assistant was built and trained through specific prompting strategies. Subsequently, the assistant responses were also evaluated and on average the AI virtual assistant had 93.85% efficiency. Furthermore, the UI/UX elements and design features incorporated within the application were made on a development platform and further tested for functionality. This easily accessible application allows children and families to gain a resource specifically for Regressive Autism. Ultimately, Thrive fosters growth and equips families of Regressive Autism with essential tools designed to support them through every phase.

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Abstract: Science and Engineering Fair of Houston

3439

I Hear Deaf People: The Program That Translates Sign Language

William Smith

David Ochoa-Aguilar

Kameron Mentemeier

Conroe ISD /ASHP: Academy for Science and Health Prof

Category

Systems Software

American Sign Language (ASL) is a form of communication used by millions of people in the deaf community. For those who do not understand ASL, it can create barriers that lead to misunderstandings, frustration, and social isolation. To address this challenge, the project is to develop a program that translates ASL into English in real time. With this technology, bridging the communication gap and eliminating the frustration caused by miscommunication is the main goal. The program uses AI powered video analyzing to detect the positions of key points on a coordinate plane in a virtual environment so the program can represent each letter and word in ASL separately from a main computing system. It also uses a database to store all of the valid hand coordinates and the corresponding English translations. During the testing phase, a total of 25 tests were conducted, each corresponding to one of the 25 distinct signs being evaluated. The outcomes of these tests did not meet the expected standards of accuracy and performance, but achieved an 80% accuracy. All in all, because the results didn't meet the 90% accuracy goal for this project, the null hypothesis- "AI-powered systems cannot accurately translate live sign language into grammatically correct English 90% of the time because the necessary technology does not yet exist or is insufficiently advanced." -can be accepted based on the testing results. However, the null hypothesis is accepted due to the low accuracy, not because the necessary technology is insufficiently advanced.

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Abstract: Science and Engineering Fair of Houston

3440

Cyberattacks and how to avoid them

Crispin-Joseph Eliseo Saures

Ismael Fragoso

SST - Champions College Prep - HS

Category

Systems Software

Focused towards the cyberattacks of 2000 and onward. Cyberattacks have the potential to ruin someone's life and threatens other's safety. This topic is crucial towards our field of study: cyber security. Our research gap focuses on the question, "is there one true solution towards preventing cyberattacks?". Our research aims to provide security solutions against the threats of cyberattacks and answer long-standing questions towards cyber security. Our methodology uses case studies and descriptive research. Our main message is to stay safe on the internet as a single click can ruin your life.

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Abstract: Science and Engineering Fair of Houston

3441

NutriTrack: An AI-Powered Nutrition App for Improved Cognizance of Food Safety

Bowen Xie

Hitesh Mallula

Glenda Dawson - HS

Category

Systems Software

Over 33 million Americans live with life-threatening allergies causing a patient to be sent to the emergency room every ten seconds on average. Furthermore, today's food revolves around artificial additives and preservatives, contributing to negative health developments such as increased body weight. This goes hand in hand with religious dietary restrictions thereby highlighting the need for a comprehensive and free personalized nutrition tool to empower safe and healthy decisions. This project addresses these gaps by developing an all-in-one personalized nutrition app using the Flutter framework. The mobile application, NutriTrack, enables users to track their food consumption through barcode and whole meal scanning, providing warnings and feedback on allergens, nutrition, and dietary considerations from reliable sources including the USDA and Open Food Facts. Additionally, given the plethora of food items in various religions and cultures around the world, the app leverages AI to generate personalized health insights via prompt engineering when data may not be available. Backend functionality is powered by Firebase, ensuring secure user authentication, data storage, and analytics tracking. The user workflow includes intuitive onboarding, a daily nutrition tracker, and detailed feedback for each scanned item. Full meal and barcode scans return information such as NutriScore, ingredients, allergens, and personalized health advice. User information is securely stored in Firestore, with analytics capturing feature usage to guide future enhancements. This app offers an accessible and scalable solution to improve public health by empowering individuals cognizance of artificial food preservatives and allergens with actionable insights into their dietary choices.

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Abstract: Science and Engineering Fair of Houston

3442

SynapseHub: Development of a Novel Platform for Creating Enhanced Reasoning AI Agents

Maaz Kattangere

Conroe ISD /AST: Academy of Science and Technology

Category

Systems Software

2025 was declared by various companies as the year of AI Agents - powerful models capable of operating on a degree of autonomy, performing a wide range of tasks by utilizing the tools at their disposal. Unlike LLMs that passively generate responses, AI Agents actively plan and execute actions. For Example, an AI Agent could autonomously coordinate earthquake disaster relief, by collecting various streams of satellite data and deploying drones all by itself. However, there are various issues that prevent this technology from being used today. (1) These agents are not easy to access, have a high technical barrier to usage and are often generic, not specialized for domain specific use, (2) Training the models behind such technology also requires a massive amount of compute power (200 billion \$ estimated for 2025), (3) These Agents also possess weak reasoning capability as shown across various benchmarks. SynapseHub seeks to solve these issues by providing a novel application that (1) Allows anyone to create their own AI agents, providing their own tools to the agent, (2) Optimize algorithms used behind the agents to increase reasoning capability by utilizing a novel deep learning architecture for the models, (3) Contains a library of AI Agents specialized for various domain specific tasks. The agent was evaluated on multimodal benchmarks including The Massive Multitask Language Understanding dataset, ImageNet, and CommonVoice. A statistical t-test was conducted to measure the agent's abilities, and on each benchmark the agent was shown to yield statistically significant improvement on the model's abilities.

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Abstract: Science and Engineering Fair of Houston

3443

Heart Safe AI Mobile App

Nikhil Muvva

Houston ISD /Carnegie Vanguard HS

Category

Systems Software

The Heart Safe AI mobile app is designed to help individuals monitor their heart health without the need for expensive wearable devices. Utilizing a K-Nearest Neighbors (KNN) supervised learning algorithm, the app processes a range of input data, including the user's age, BMI, cholesterol levels, and other key health metrics. Based on these inputs, the app analyzes the risk of heart conditions and provides personalized results to the user. This allows people to assess their heart health and take proactive steps to prevent cardiovascular issues, all through a simple, accessible mobile platform. The app is especially valuable for individuals who cannot afford wearable devices or continuous heart monitoring systems. By leveraging the power of AI and accessible data, Heart Safe AI democratizes heart health monitoring, making it available to a broader audience. The KNN algorithm works by comparing the input data with historical medical data to identify patterns and predict potential risks. The app not only offers insights into a user's heart condition but also suggests preventive measures, empowering users to take control of their health. As a result, the Heart Safe AI mobile app provides an affordable and efficient alternative for heart health management, particularly for those with limited access to advanced medical technology.

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Abstract: Science and Engineering Fair of Houston

3444

RoadWise: Road Damage Assessment through Image Recognition, Cost Analysis, and Risk Evaluation

Ria Patel

Conroe ISD /AST: Academy of Science and Technology

Category

Systems Software

Every day, Americans take 1.1 billion trips, often encountering road damage that poses safety risks to citizens but financial burdens to local governments. Current research on road maintenance addresses isolated aspects, such as image recognition, cost analysis, or risk forecast, but fails to integrate these components into a unified system. This research addresses this gap by developing a program that categorizes road damage into five types—potholes, seam damage, edge damage, alligator cracking, and rutting—while providing cost predictions and assessing risk levels to prioritize repairs. The researcher used Roboflow to compile images of road damage into datasets which were then divided into 80% for training and 20% for testing. The refined algorithm was finalized in YOLOv8 where it could be deployed as an application allowing users to input road damage images for classification, cost estimates, and risk analysis of potential worsening if left untreated. The program was tested through five trials using different datasets. Initial trials yielded accuracies of 91.1% and 95.4%, with improvements in subsequent iterations reaching 96.4%, where performance stabilized. Data was analyzed using a Chi-Square Test for Independence to identify significant discrepancies in accuracy across damage types. Analysis revealed that the program excelled at distinguishing between distinct categories like potholes and cracking but faced challenges differentiating similar types, such as seam damage and edge damage. Ultimately, the program demonstrated its potential to help underfunded municipalities, including many in Houston, allocate budgets more effectively by prioritizing high-risk, cost-effective repairs to begin progressing towards safer roads.

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