Behavioral and Social Sciences (BEHA)

Investigation of the Learning Process Through Game Development

Kyle Vasallo

Topics: - Game-based learning - Learning analytics - Serious games

This project investigates the process of meta-learning by documenting the development of a game from scratch. It aims to analyze how learning occurs across various disciplines to identify long-term themes and improve the overall learning process.

Scroll Doomer

Ethan

Topics: - Mental health - Social media addiction - Digital well-being

This project introduces a YouTube browser extension designed to detect and mitigate doomscrolling using behavioral signals and machine learning. It employs graduated interventions, such as awareness banners and scroll resistance, to promote mindful consumption and healthier digital habits without blocking content.

Simulating Urban Evacuation Traffic Under Authoritative Hurricane Forecasting with Agent-Based Modeling

Michael Wang

Topics: - Agent-based modeling - Hurricane evacuation - Traffic simulation

This research uses agent-based modeling to simulate how urban populations respond to natural disasters like hurricanes based on psychological traits and external communications. The simulation analyzes the impact of government and media influence on evacuation patterns, traffic congestion, and overall system pressure.

Biomedical Engineering (ENBM)

Emotion Aware Music Recommendation (EAMR)

Brandon Zhang

Topics: - Music Recommendation - Facial Emotion Recognition - Artificial Intelligence

This project proposes a real-time music recommendation system that uses wearable device data (HRV, EDA, and HR) and a Random Forest Regressor

to track a user's mood and guide them toward a target emotional state. By automating emotion detection through physiological signals, the system aims to provide accessible, unobtrusive music therapy that adapts to the listener's needs without requiring active user input like photos or chatbots.

FitNet: A Website Application that Corrects Gym Form Based on Skeletal Points with MediaPipe

Aarav

Topics: - Computer Vision - Fitness Technology - Machine Learning

FitNet is a mobile application under development that utilizes machine learning and computer vision to provide real-time feedback on exercise form. By analyzing skeletal keypoints from user-provided videos, the system aims to prevent injuries and enhance workout effectiveness for gym-goers.

Heart Murmur Detection

Joey

Topics: - Cardiovascular health - Medical diagnosis - Heart valve disease

This project involves developing a machine learning algorithm and a mobile application to record and diagnose heart murmurs, improving accessibility to cardiac screening. While the models currently achieve accuracy and F1 scores in the high 0.6 range, ongoing work focuses on addressing data scarcity through synthesis and refining audio processing for functional recording.

NeuroQuest: Adaptive EEG-Based Brain-Computer Interface Gaming for Cognitive Enhancement in Neurocognitive Disorders

Arnav Gupta and Ashmith Yaramada

Topics: - Brain-Computer Interfaces - Cognitive Enhancement - Neurocognitive Disorders

NeuroQuest is a brain-computer interface system designed to enhance focus and attention for individuals with neurocognitive disorders like ADHD. It uses electroencephalography and machine learning to translate brain signals into game inputs, specifically for a testing game called FocusFactory.

SeizureSense: Wearable device that detects seizures

Pranika Gaddam

Topics: - Wearable Technology - Medical Diagnostics - Health Monitoring

SeizureSense: A wearable device utilizing an Apple Watch, EMG sensor, and accelerometer to detect tonic-clonic seizures and alert others for timely assistance.

Vocalize: A Smartphone-Based Multi-Disease Vocal Biomarker Detection System

Nandu Dammalapati

Topics: - Artificial Intelligence - Vocal Biomarkers - Medical Diagnostics

Vocalize is a smartphone-based platform that uses machine learning to detect neurodegenerative diseases like Parkinson's and Alzheimer's by analyzing vocal biomarkers. The system utilizes a unified detection pipeline and has achieved an AUC-ROC score of 0.84 in initial evaluations.

Computational Biology and Bioinformatics (CBIO)

Processing-Power-Efficient Multi-Agent Pathfinding

Ben

Topics: - Multi-Agent Pathfinding - Planning and Scheduling - Robotics

This paper evaluates whether aggressive memory-pruning techniques improve parallel processing performance for multi-agent pathfinding (MAPF). Researchers compared a standard CBS algorithm against a modified version across fifty trials to determine if pruning inactive path sets effectively mitigates memory bottlenecks.

SPECTRA: De Novo Broad-Spectrum Sepsis Inhibitor Design Across 27 Protease Targets via a Multi-Architecture Generative Adversarial Pipeline

Pranav Divichenchu

Topics: - Sepsis inhibitor design - Protease targets - Generative Adversarial Networks (GANs)

This study presents a multi-architecture generative adversarial network (GAN) pipeline designed to develop inhibitors for 27 proteases involved in sepsis, which currently lacks FDA-approved protease treatments. The pipeline successfully generated 28 high-affinity binders and 27-peptide panels with favorable drug profiles, validated through structural modeling and molecular docking simulations.

Earth and Environmental Sciences (EAEV)

Design and Implementation of a Residential Air Pollution Detector

Darsh Shetty

Topics: - Internet of Things - Environmental Monitoring - Engineering Design

This project involves developing a cost-effective, residential air filter and detector that uses a 1530 nm laser and photodiode sensor to identify ammonia levels. The system utilizes an Arduino and computer program to alert users of high pollutant concentrations to help prevent health issues like asthma and cognitive decline.

Tessera: A Global Framework for Geospatial Analysis

Ajay Vinjamuri

Topics: - Remote Sensing - Self-Supervised Learning - Geospatial Analysis

Tessera is a digital twin framework that integrates Urban Heat Island modeling, flood risk simulation, and synthetic city generation to support proactive climate policy planning. Using a hybrid ConvGRU model and procedurally generated data, it provides a scalable, multi-hazard decision-support tool for urban planners in both data-rich and data-scarce regions.

Wildfire Severity Prediction Using Vegetation Stress in Australia

Rhea Nirmal

Topics: - Wildfire severity prediction - Vegetation stress monitoring - Remote sensing and machine learning applications

The research aims to predict wildfire severity and spread in Australia by monitoring vegetation stress using satellite data and historical records. The researcher plans to improve their model's 60% accuracy by integrating weather data to develop a real-time interactive map for community preparedness.

Embedded Systems (EBED)

Smart Puck

Dresden

Topics: - Puck movement and location tracking - Live data for broadcast and fan engagement - Performance analytics for teams and players

The project involves developing an affordable “smart puck” that uses Matter and Thread protocols to upgrade existing “dumb” devices into integrated smart home components. This cost-effective, modular prototype aims to provide a user-friendly way to customize and modernize home automation systems.

Xbox Series P: Design and Implementation of a High-Performance Handheld Gaming Device Based on Xbox Series S Architecture

Atharv Bapuram

Topics: - Handheld gaming hardware - Xbox architecture - Console design and implementation

This project converts an Xbox Series S into a high-performance handheld gaming device using custom power management, thermal cooling, and integrated controllers. The prototype achieves 120 FPS, offering a cost-effective alternative to current high-end handhelds.

Energy: Sustainable Materials and Design (EGSD)

Converting Mechanical Energy to Electrical Energy via Piezoelectric/Electromagnetic Panels

Logan Taylor

Topics: - Renewable Energy - Energy Conversion - Electromechanical Engineering

The project develops a panel that converts mechanical energy from footsteps into electrical energy using a hybrid system of gears, springs, and piezoelectric crystals to power basic utilities.

Engineering Technology: Statics and Dynamics (ETSD)

Creating a Morphing NACA2416 Aerofoil to Dynamically Optimize the Lift to Drag Ratio of Aircraft Flight

Judah Abram

Topics: - Morphing Aerofoils - Aerodynamic Optimization - Computational Fluid Dynamics (CFD)

The research details the development of a morphing NACA2416 aerofoil 3D-printed with flexible TPU95A to dynamically optimize the lift-to-drag ratio.

By utilizing internal mechanics and servos, the aerofoil can adapt its shape to various flight conditions, overcoming the limitations of static aerofoil designs.

Mathematics (MATH)

Nutsolver: Computing Optimal Poker Strategies

Brian Tay

Topics: - Game theory - Poker strategy - Computational algorithms

This project involves developing an open-source solver for No-Limit Texas Hold'em that calculates Nash equilibrium strategies using Chance-sampling Monte Carlo Counterfactual Regret Minimization. The solver currently determines optimal play for any five-card board state based on stack and pot sizes, player ranges, and betting options.

Plant Sciences (PLNT)

Real-time Detection & Response system for Oidium neolycopersici using Electrochemical and VOC-based sensing.

Taha and Matthew

Topics: - Plant pathology - Sensor technology - Real-time monitoring

This project proposes an early detection system for Powdery Mildew using VOC and electrochemical sensing combined with a machine learning pipeline. Using MQ2 and BME680 sensors and a decision tree classifier, the system achieved 92% accuracy and was deployed on an M5Stack for real-time monitoring.

Robotics and Intelligent Machines (ROBO)

Improving the Efficacy of Visual Simultaneous Localization and Mapping (VSLAM) in Dynamic Environments

Rohit

Topics: - Visual Simultaneous Localization and Mapping - Dynamic Environments - Computer Vision

This research integrated YOLOv8-seg semantic filtering into a VSLAM pipeline to improve localization accuracy in dynamic environments. The approach reduced average Absolute Trajectory Error (ATE) by approximately 20%, enhancing navigation reliability in non-static scenes.

Robotics and Intelligent Machines (ROIM)

SafeSight

Aryan Patel

Topics: - Computer vision and deep learning - Real-time safety monitoring - Privacy-preserving scene analysis

SafeSight is a physical system using fisheye cameras and AI models to detect road hazards. It provides blind spot, collision, and lane departure warnings via a visual display of nearby vehicles.

Software Design (SFTD)

AI Closet

Alexander

Topics: - Digital wardrobe management - AI-powered outfit styling - Closet organization and design

AI Closet uses convolutional neural networks and supervised learning to classify clothing images and generate coordinated outfit recommendations. The project is expanding into a website interface to provide users with an accessible platform for daily fashion decisions.

Language Learning Browser Extension

Sanjana

Topics: - Software Development - Language Learning - Browser Extensions

This project is a Chrome extension that facilitates passive language learning by replacing English words on webpages with French equivalents. Testing demonstrated 100% accuracy and minimal performance impact, highlighting the feasibility of real-time text modification for contextual vocabulary building.

Tennis Form Analysis Algorithm

EJ

Topics: - Computer Science - Sports Science - Artificial Intelligence

This algorithm uses computer vision and large language models to analyze a player's tennis stroke, specifically the slice serve, by evaluating their trophy position from video. It provides numerical scores and verbal feedback to improve player form and assist instructors, with potential for expansion to other stroke types.

The Design and Implementation of a Library-Based Game Engine using C++

Luke Ma

Topics: - Game Development - Software Engineering - C++ Programming

This project aims to develop a portable, modular C++ library-based game engine designed for beginners and developers who prefer raw coding over visual tools. It currently features a math library, a central system, and a windowing system.

Systems Software (SFTD)

RegiMon: Monitoring the Windows Registry in Real-Time

Anik Bakshi and Arush Bodla

Topics: - Windows Registry Monitoring - Real-time Data Logging - Software Development Utilities

RegiMon is a lightweight, real-time registry monitoring application built in Rust that fills a gap in security by monitoring the volatile RAM copy of the Windows Registry. It successfully detects and remediates malicious changes, such as those from the Love Bug virus, with minimal performance overhead.

Technology Enhances the Arts (TECA)

Blender Extension

Nathaniel

Topics: - 3D Modeling - Animation - Game Development

This project develops a Blender add-on featuring posing assistance tools to help hobbyists and small productions create physically accurate, balanced 3D animations more efficiently.

Computer Critic

Alexandra

Topics: - Hardware and architecture - Software engineering - Human-computer interaction

This program uses image segmentation algorithms to identify object tangencies and overlaps in artwork, providing artists with concrete feedback to improve their composition skills.

Food Allergy Finder: Designing A Mobile Framework for Personalized Allergen-Safe Restaurant Menu Recommendations Using Ingredient Filtering and Geolocation Data

Om Karle

Topics: - Mobile App Development - Food Allergy Safety - Geolocation Services

This mobile application provides personalized, allergen-safe restaurant recommendations by cross-referencing user allergy profiles with menu ingredient data. It utilizes geolocation services to help users find safe dining options nearby and reduce anxiety related to food allergies.

FragrAI: The Future of Fragrance Technology

Aarav Vangipuram & Aarish Bharatam

Topics: - Artificial Intelligence in perfumery - Smart home scent technology - Sustainable fragrance innovation

FragrAI is a fragrance recommendation platform designed to improve upon Fragrantica with a cleaner interface and AI-driven personalization. Using an OpenAI API, the model analyzes databases to suggest scents and affordable alternatives based on specific user preferences and detailed fragrance profiles.

Housing Access & Equity: Digital Solutions for Affordable Housing

Hadassah Dakin-Davis

Topics: - Housing Access and Equity - Digital Solutions - Affordable Housing

A digital real estate platform designed to connect individuals with affordable housing by utilizing HUD and local data to navigate zoning, eligibility, and cost barriers.

Killing Time: Developing a 2D RPG Video Game in the Godot Engine

Sean Morrison

Topics: - 2D RPG development - Godot Engine - Game programming techniques

Killing Time is a 2D RPG built in Godot where players control a sticky note doodle battling sentient office supplies to defeat an evil chronomancer. The game features original pixel art and includes an introduction, questing area, and boss fight.

Pulse + Petals

Anna Wardin

Topics: - Environmental education - Community building - Creative arts and crafts

This project explores fashion technology through a bio-responsive dress featuring 3D-printed flowers that bloom in response to real-time heart rate data. Using a pulse oximeter and microcontrollers, the garment translates the wearer's physiological state into varying speeds of mechanical motion to demonstrate nonverbal communication and affective computing.

Translational Medical Science (TMED)

Music Light Visualizer

Tyler Shih

Topics: - Electronics and Circuitry - Audio Engineering - Computer Programming

A real-time music visualizer using a Python program to control spotlights and LEDs, displaying colors that react to the tone, notes, and rhythm of live audio input.

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