NAME : Jigar Shailesh Siddhpura

SAP ID : 60004210155

DIV: B 2

BRANCH : COMPS

EXPERIMENT 1 : Identify PEAS for different Applications

Problem statement 1 :

Create an AI-driven system to detect fraud in financial transactions, improving security and minimizing financial losses by identifying suspicious activities accurately and efficiently.

Description :

An AI-based fraud detection system uses a two-step approach. Firstly, it processes a range of financial transaction data using feature engineering techniques to extract relevant patterns and features. Secondly, a machine learning model is trained using the preprocessed data to differentiate between genuine and fraudulent transactions based on known fraud patterns. During real-time operation, the model evaluates new transactions and calculates a fraud probability score for each transaction. If a transaction surpasses a predefined threshold of risk, it is flagged for further investigation by fraud analysts. The system continuously refines its model using updated data to adapt and improve its accuracy in detecting evolving fraud patterns.

Peas factor:

- **Performance measures :**
  - Accuracy of fraud detection on how accurately identify fraudulent transactions to protect users and financial institutions from financial losses.
  - Minimizing false positives is crucial to avoid inconveniencing legitimate users with unnecessary security checks or transaction declines.
  - Real-time or near-real-time processing is essential to detect fraud as transactions occur.

- **Environment**:
  - The financial transaction data and the systems processing it.
  - Online banking sites, payment gateway, online trading platform.
  - Various transaction types, amounts, and account details.
- **Environment types**

  The environment functions within a stochastic and partially observable environment. It relies upon historical transactional data, user profiles, and real-time transactional information to formulate probabilistic predictions regarding the legitimacy of transactions. The environment is discrete in

nature since it involves scrutinizing discrete transactional events; however, it also deals with continuous data streams for real-time processing purposes. This system operates as a multi-agent entity where multiple components work together harmoniously - including machine learning algorithms, data analysts, and fraud investigators - to collectively identify and respond to fraudulent activities. The environment is dynamic due to its ability to adapt continually in response to evolving fraud tactics and shifting user behavior patterns within the ever-changing landscape of financial transactions.

- **Actuators**:
  - The system's actions include flagging transactions for review.
  - Model updating and refinement based on new data.
- **Sensors** :
  - Sensors collect data from financial transactions (e.g., amounts, timestamps, account details).
  - The system's output, indicating whether a transaction is flagged for review.

Problem statement 2 :

Design and implement a reliable, safe, and efficient automated self-driving taxi system for urban transportation, considering real-time traffic management, pedestrian safety, regulatory compliance, and user satisfaction.

Description :

The automated self-driving taxi system is an urban transportation solution integrating cutting-edge technologies such as artificial intelligence, computer vision, and sensor fusion. Utilizing LiDAR, cameras, and radar, the vehicles continuously analyze their surroundings in real-time, allowing AI algorithms to make informed decisions regarding route optimization, traffic analysis, pedestrian safety, and compliance with traffic rules and regulations. Ultimately, this system aims to transform urban mobility by offering a reliable, comfortable, and environmentally friendly alternative to traditional human-driven taxis, thus addressing congestion and enhancing transportation efficiency.

Peas factor:

- **Performance measures :**
  - Safety
  - Efficiency
  - Customer satisfaction
  - Adhere to regulation
- **Environment:**
  The environment includes the urban roads and streets, traffic, weather conditions, pedestrians, other vehicles, traffic signs, and signals. The system must adapt to a dynamic and sometimes punpredictable environment, considering factors like heavy traffic, adverse weather, diverse road conditions, and varying pedestrian and vehicle behaviors.
- **Environment types :**
  The Environment here is predominantly observable, employing an array of sensors to perceive its surroundings. It manifests deterministic aspects in adhering to traffic rules and planned routes while accommodating stochastic elements through the unpredictability of other agents like pedestrians and varying weather conditions. The environment is a mix of discrete and continuous variables, considering both distinct factors like traffic signals and continuous factors like vehicle speed. The system operates as a single agent, the self-driving taxi, interacting with multiple agents such as other vehicles and pedestrians in a dynamic environment where conditions and entities are

subject to change, necessitating real-time adaptability for safe and efficient travel.

- **Actuators:**
  - Steering and Drive Control: For navigating the vehicle along the planned route and adjusting to traffic.
  - Brakes and Acceleration: To maintain safe distances from other vehicles and adhere to speed limits.
  - Turn Signals and Lights: For signaling intentions and ensuring safe lane changes.
- **Sensors :**
  - LiDAR, Cameras, and Radar: These sensors detect obstacles, lane markings, pedestrians, and other vehicles.
  - GPS: Provides location data and aids in navigation and route optimization.
  - Vehicle Speed Sensors: Help in maintaining appropriate speeds and safe distances.

Problem statement 3 :

Developing an AI-powered poker player that strategically analyzes hands, opponents, and risks to enhance its performance and competitiveness in poker games.

Description :

The automated poker player will operate as an artificial intelligence system trained on extensive poker data. By using machine learning algorithms, it will evaluate its own hand strength, calculate pot odds, and predict opponent strategies based on historical gameplay patterns. This analysis will guide its decision-making during the game, enabling it to make optimal bets, raises, or folds. The AI will continuously learn and adapt, refining its strategy with each game to improve competitiveness and proficiency in diverse poker scenarios. Through a combination of data-driven insights and strategic acumen, the AI-powered poker player aims to maximize winnings while minimizing risks.

Peas factor:

- **Performance measures :**
  - Win rate or profitability in poker games.
  - accuracy in predicting opponent moves.
  - adaptability to different play styles.
  - Amount of points earned.
- **Environment:**
  - Poker game setup, comprising aspects such as the table dynamics (e.g., number of players, their playing styles)
  - The opponent behaviors (e.g., aggressive, conservative), the dealt hands, the community cards, the pot size, and the historical moves made during the current game.
- **Environment types :**

  The environment will be partially observable, stochastic, discrete, multi-agent, and dynamic. It's partially observable because the AI has access to limited information, primarily its own hand and the public cards, while the private information of opponents remains hidden. The stochastic element arises from the uncertainty in opponent strategies and the dealing of cards, introducing a level of chance into the decision-making process. The environment is discrete, given that actions like betting and raising occur in distinct, quantifiable units. Moreover, the poker game involves multiple players, making it a multi-agent

environment. Lastly, the dynamics of the game change with each round as new cards are revealed and players act, making the environment dynamic, constantly evolving with the progression of the game.

- **Actuators:**

  The actions it can take during the game. These primarily involve deciding the bet amount, making raises, and choosing to fold based on the AI's analysis of its own hand, opponent behaviors, and the game state.

- **Sensors :**

  Data such as observed opponent moves, the current state of the game (e.g., the current bets, the community cards), and the AI's own hand. These inputs guide the AI in determining its actions and adjusting its strategy accordingly.

Problem statement 4 :

Design an AI-powered automated online proctoring system that ensures exam integrity by detecting and preventing cheating behaviors such as plagiarism, unauthorized assistance, or use of prohibited resources during online exams.

Description :

An AI-based automated online proctoring system is a sophisticated technology that aims to uphold the integrity of online exams. It employs artificial intelligence and computer vision to consistently scrutinize and assess test-takers. This involves facial recognition for identity verification, monitoring video and audio feeds for any suspicious activities, analyzing screen content to detect unauthorized app or browser usage, identifying patterns in keystrokes, as well as detecting plagiarism. The system generates instantaneous alerts for any anomalies observed during the exam process and produces comprehensive reports for evaluation by instructors or administrators, thus ensuring a secure examination environment.

Peas factor:

- **Performance measures :**
  - Determine the accuracy of the system in verifying the exam taker's identity using facial recognition, ensuring that the right individual is taking the exam.
  - Measure the system's accuracy in identifying and flagging suspicious behaviors accurately, such as unauthorized collaboration or use of prohibited resources during exams.
  - Timely alert generation for intervention.
  - Evaluating the system's ability to minimize false alerts, ensuring that innocent actions or non-cheating behaviors are not mistakenly flagged as violations.
  - Efficiency in processing and analyzing data to provide real-time monitoring.
- **Environment**:
  - Various online platforms like unstop, hackerx, leetcode which are compatible with up-to-date os.
  - Students, exam candidates devices(laptop, pc, mobile).

- Internet Connection Variability which can affect the session of exam.

- **Environment types :**

  The environment in which the system operates is non-deterministic, multi-agent, dynamic, and partially observable. It is difficult to completely examine students' physical surroundings because it collects data remotely using webcams, microphones, and screen sharing. Nondeterminism is introduced through the variability of student conduct and technological configurations. It creates a multi-agent situation by placing numerous autonomous agents (students) under monitoring. Exam integrity must be maintained through constant monitoring and adaption when the environment changes as a result of student behaviours.

- **Actuators**:
  - Alert generation for suspicious behavior detected during the exam.
  - Real-time notifications to exam administrators or instructors.
  - Automated actions to pause or flag the exam if significant cheating is detected.
  - Logging and reporting mechanisms for further analysis.
- **Sensors** :
  - Identification of candidates using facial recognition through webcam.
  - Webcams and microphones to capture video and audio during exams.
  - Screen capture or snapshot of screen in frequent intervals of time to monitor no suspicious action are done.
  - Plagiarism check.

Problem statement 5 :

Create an AI-driven automated bowling machine that replicates diverse bowling conditions to aid batsmen in adapting and improving their skills for various playing environments, offering customized practice sessions and real-time feedback.

Description :

The AI-driven automated bowling machine is a game-changing innovation designed to transform cricket training. Functioning at its core as an advanced bowling simulator, this machine employs artificial intelligence to precisely deliver balls with varying types, speeds, angles, and pitches, closely copying real-world bowling actions. Batsmen get benefit from customized practice sessions, adjusting parameters to their specific needs and skills, and receiving real-time feedback on their performance. The system's integrated sensors and cameras capture and analyze crucial data, providing insights into the batsman's technique and helping adapt their gameplay. This technological marvel not only enhances adaptability to diverse playing environments but also optimizes training, making it an indispensable tool for elevating batting skills and overall performance on the cricket field**.**

Peas factor:

- **Performance measures :**
  - Accuracy in simulating different real world bowling actions based on speed, angle, action.
  - Test machine's ability to replicate desired bowling conditions for reliable and repeatable training.
  - Accurately evaluating the data analysis of batsmen and giving proper insights of it.
  - Measure the efficiency of the AI in tailoring practice sessions, ensuring they are optimized for the batsman's skill level and specific training goals.
- **Environment**:
  - The environment encompasses the simulated cricket pitch or training area where the bowling machine operates.
  - It includes the various playing conditions, such as different ball types, speeds, angles, and pitches that the machine replicates to challenge and train the batsmen.
- **Environment types :**

The Environment operates in a deterministic and observable environment, where it precisely controls the delivery of cricket balls to batsmen with known initial conditions and predictable outcomes. It is a continuous system,

producing a continuous stream of balls with varying speeds and trajectories. In this scenario, it functions as a single-agent system, with the machine serving as the sole decision-maker and performer. The logical environment is relatively static, as it maintains consistent conditions on the cricket pitch but may introduce dynamic elements, such as varying ball speeds or types, to challenge batsmen. The machine's performance depends on its ability to accurately simulate the behavior of different bowlers, offering a realistic and effective practice experience for batsmen.

- **Actuators**:
  - Ball Propulsion Mechanism that propel the cricket ball, regulating the speed, angle, and type of delivery, such as spin, swing, or pace.
  - Variable speed control for adjusting the power and force applied to the ball, enabling a range of ball speeds to be delivered, from slow to rapid, to challenge the batsman.
  - Adjustment in pitch length while bowling
- **Sensors** :
  - High speed camera sensor capturing batsmen bat movement and foot movement.
  - Speed sensor to track the velocity of the ball when released.
  - Inclinometer to measure the angle and swing of ball.
  - Pressure sensitive sensors on stumps to detect the impact of ball hitting.
  - Gyroscope to read how spin does the ball made.

Problem statement 6 :

Designing an automated drone system for agricultural operations, encompassing seed planting, precise irrigation, pesticide and fertilizer distribution, optimizing resource usage, and ensuring efficient crop growth while minimizing manual labor and environmental impact.

Description :

The automated drone system for agriculture operates by utilizing advanced sensors and AI algorithms to assess soil conditions and crop needs. The drone is equipped with modules for seed planting, precise irrigation, pesticide and fertilizer dispersion based on the real-time analysis. Initially, the drone scans the field to identify optimal planting spots and deploys seeds accordingly. During the growth phase, it monitors the crop health, analyzing moisture levels and pest threats to adjust irrigation and apply pesticides accordingly. It also dispenses fertilizers to optimize plant nutrition.

Peas factor:

- **Performance measures :**
  - Crop yield compared to traditional methods.
  - Water usage for irrigation
  - Amount of pesticides, fertilizer used through Target application and environmental impact
  - Labour saving
- **Environment:**
  - Soil type and health to determine appropriate seed planting depths and fertilizer requirements.
  - Weather conditions (temperature, humidity, rainfall) for optimizing irrigation and pesticide application schedules.
  - Crop types and growth stages to tailor actions like seed planting and nutrient distribution accordingly.
  - Topography and terrain to adjust flight patterns and ensure safe navigation and operation of the drone.
  - Identification of obstacles or hazards to avoid collisions and damage during flight.
- **Environment types :**

  The environment is observable, allowing the drone to perceive and gather data from sensors regarding soil conditions, crop health, and environmental

factors. It is deterministic, meaning actions and outcomes are predictable based on the gathered data and AI algorithms, allowing the drone to make

informed decisions. The environment is a mix of discrete and continuous elements, where discrete actions like seed planting and pesticide application occur, while continuous factors such as varying soil moisture levels and crop health need continual monitoring and adjustment. The system operates in a multi-agent environment, as multiple drones could potentially work together to cover a larger agricultural area efficiently. The environment is dynamic, as conditions like weather, crop growth, and soil properties change over time, requiring the drone to adapt and optimize its actions accordingly.

- **Actuators:**
  - Automated seed planting mechanism for precise and consistent seed distribution.
  - Adjustable irrigation system for varying moisture needs of different crops and soil types.
  - Pesticide spraying mechanism with adjustable nozzles for targeted application.
  - Fertilizer dispensing system to regulate nutrient distribution based on crop and soil requirements.
- **Sensors :**
  - Soil moisture sensors to gauge moisture levels and optimize irrigation.
  - GPS for accurate mapping and navigation within the field.
  - Multispectral cameras to monitor crop health, identify diseases, and assess growth stages.
  - Temperature and humidity sensors to track environmental conditions affecting crop growth.
  - Obstacle detection sensors for safe navigation and collision avoidance.

Problem statement 7 :

Design an AI music recommender that uses machine learning algos and user preferences to offer personalized recommendations, improving user satisfaction and engagement in the music streaming world.

Description :

The AI music recommender system is a automated software that gives you music recommendations based on your personal preferences. It uses machine learning algorithms to analyze your listening history, favorite genres, and artist choices to create a user profile. Then it compares your profile with other users' profiles in a vast music database to find similarities and patterns. This helps the system generate a list of recommended songs, albums, or playlists that match your musical taste. The recommendations are updated based on real-time user interactions and feedback, making the experience more personalized and enjoyable. The system works seamlessly with popular music streaming platforms while prioritizing privacy and data security throughout the process.

Peas factor:

- **Performance measures :**
  - Accuracy of recommendation on how accurately it recommends the music based users mood.
  - User satisfaction with recommendations to check how much user is satisfied.
  - Engagement levels based on interaction with recommendations.
- **Environment**:
  - Music Streaming Platform: Operate within the context of music streaming apps, such as Spotify, Apple Music, or similar platforms.
  - User Profiles: Utilize user profiles, historical listening data, and implicit feedback to understand individual preferences.
- **Environment types**
  - Operates in a probabilistic and non-deterministic logical environment where user preferences may evolve and change over time.
  - Uses past user interactions and behaviour to make recommendations but acknowledges that musical tastes can be influenced by various factors, including mood and context.
- **Actuators**:

- Music Playback: Trigger the playback of recommended songs and playlists within the music streaming app.

- Playlist Creation: Create personalized playlists for users based on their preferences.
- Recommendation Display: Present song and playlist recommendations within the user interface.

➢ **Sensors** :

- Listening History: Collect data on users' past listening history, including song choices, skips, and time spent on each track.
- User Feedback: Incorporate explicit user feedback, such as likes, dislikes, and user-generated playlists.
- Contextual Information: Utilize contextual data, like time of day, location, and user activity, to refine recommendations.
- Music Metadata: Access information about songs, including genre, artist, tempo, and mood.
- Social Data: Consider social connections and recommendations from friends when available.

Problem statement 8 :

Developing an automated medical diagnosis system that utilizes machine learning algorithms to analyze patient symptoms and medical history, providing accurate and timely diagnoses for a range of common medical conditions.

Description :

An advanced robotic or application-driven system designed to accurately diagnose a patient's medical condition and provide tailored treatment recommendations by meticulously analyzing the patient's data. Harnessing the power of AI, this technology showcases immense potential, transcending conventional boundaries. Its application in the medical domain goes beyond diagnosis, extending to predictive capabilities for imminent critical events like heart attacks or strokes. These AI-driven systems proactively forecast such events, potentially serving as life-saving interventions.

Peas factor:

- **Performance measures :**
  - Through diagnosis how healthy does patient become
  - Diagnosis happening in minimum cost
  - Measure the effectiveness and relevance of treatment recommendations based on the diagnosed condition.
  - Evaluate the system's speed in processing data and delivering diagnoses and recommendations.
- **Environment**:
  - Patient medical data including medical report,symptoms, medical history, test results, and other relevant information.
  - Medical knowledge and research i.e access to a wide range of medical literature, research, and databases to stay updated and informed about various medical conditions and treatments.
- **Environment types** :

  The logical environment of this system is characterized by being observable, stochastic, discrete, multi-agent, and dynamic. The system can observe and gather data from various sources such as patient records, medical tests, and real-time monitoring, forming an observable environment. Due to the inherent variability and uncertainty in medical conditions and the interpretation of symptoms and test results, the environment is stochastic. The data collected, including symptoms, test results, and medical history,

are in discrete and distinct forms, contributing to a discrete environment. The system interacts with multiple agents,

including healthcare professionals and patients, making it a multi-agent environment. Moreover, the environment is dynamic as patient data continuously changes over time due to updates in health status, new test results, or changes in symptoms, requiring the system to adapt and stay updated with evolving medical knowledge and research.

- **Actuators**:
  - Questionnaire to analyse the patient problem/disease.
  - Treatment recommendation interface for providing tailored treatment recommendations to healthcare professionals based on the diagnosis.
  - Communication with medical staff, healthcare providers to share the diagnosis and recommendations.
- **Sensors** :
  - Patient data acquisition I.e. collect data from various sources, such as medical tests, monitoring devices, and electronic health records, to gather information about the patient's condition.
  - Real-time monitoring for continuous monitoring of the patient's vital signs and other relevant health parameters to keep the system updated with the latest information.
  - Text and image analysis to process and analyze textual reports, medical images, and other diagnostic data to extract meaningful information for diagnosis.

Problem statement 9 :

Developing an AI-enhanced interactive English tutor that provides personalized, engaging language learning experiences, focusing on grammar, vocabulary, pronunciation, comprehension, and conversation, while adapting to individual learning styles and levels.

Description :

The AI-enhanced interactive English tutor is a sophisticated digital platform designed to assess users' language proficiency and provide a good learning experience. Through advanced natural language processing, the tutor evaluates users' grammar, vocabulary, pronunciation, comprehension, and conversation skills. It crafts a personalized learning path with interactive lessons and exercises, offering real-time feedback and correction. The platform adapts to individual progress and learning styles, employing speech recognition for pronunciation practice. Users can track their progress, and gamification elements keep them motivated. Overall, it aims to make language learning engaging, efficient, and effective, catering to diverse learning needs and preferences.

Peas factor:

- **Performance measures :**
  - Effectiveness of language skills improvement in users.
  - Metrics like accuracy of grammar usage, expansion of vocabulary.
  - Improvement in pronunciation, comprehension accuracy, and the ability to engage in fluent conversations.
- **Environment**:
  - Digital platform
  - Mobile phone, tablet, laptop, pc

- **Environment types :**

  The logical environment of this system is observable, allowing users to interact with the platform and perceive feedback and learning material. It belongs to determinism, with predefined algorithms governing responses and interactions, yet incorporates stochastic elements, particularly in user progression and adaptive content adjustments. The environment is discrete, presenting structured lessons, exercises, and user progress tracking. It involves a single agent, the AI tutor, engaging users in one-to-one interactions. The environment is dynamic, adapting to user interactions

, progress, and learning patterns, and features gamification elements to sustain engagement and motivation throughout the language learning journey.

- **Actuators**:
  Actuators here would include various elements of the platform that act upon the environment based on the AI's decisions. For example, actuators would be responsible for generating responses to user inputs, adapting the learning path, presenting lessons and exercises, providing real-time feedback, and controlling the gamification elements that motivate and engage users.
- **Sensors** :
  - Speech recognition of user speaking.
  - Text analysis for understanding written inputs
  - User activity tracker.

Problem statement 10 :

Developing an autonomous drone navigation system optimized for efficient search and rescue operations.

Description :

The challenge of automatic drone navigation for search and rescue missions demands the fusion of cutting-edge artificial intelligence (AI) technologies with real-time critical decision-making. The primary objective is to enable drones to autonomously navigate through complex, dynamic environments to locate and assist individuals in distress. This entails developing AI algorithms that can process sensor data, adapt to changing conditions, and make decisions that prioritize safety and mission success. This AI-driven solution aims to revolutionize search and rescue operations by enhancing the capabilities of autonomous drones, ultimately saving lives and improving the efficiency of emergency response efforts.

Peas factor:

- **Performance measures :**
  - Navigation Accuracy like it must demonstrate precise and safe navigation in various terrains, including urban areas, forests, and disaster-stricken regions.
  - Survivor Detection i.e. the accuracy of identifying and locating survivors is paramount for successful rescue missions.
  - Obstacle Avoidance.
- **Environment:**
  - Disaster prone areas.
  - Complex and dynamic outdoor environment.
  - Weather conditions like strong winds, rain, or fog that can impact drone operation is crucial.
- **Environment types :**

  The Environment here is a dynamically evolving and often non-deterministic landscape with partial observability, inherent stochasticity, a blend of discrete and continuous elements, multiple interacting agents, and rapidly changing conditions. Drones operate in situations where visibility can be limited, factors like survivor movements and weather are unpredictable, and decision-making involves a mix of discrete choices within continuous spaces. This complex and non-deterministic multi-agent environment demands real-time adaptability, effective coordination, and precise navigation from AI systems, holding the

potential to revolutionize rescue operations and enhance the chances of successful outcomes in critical scenarios.

- **Actuators:**
  - Drone Motors and Controls: The AI system controls the drone's propulsion and maneuvering systems.
  - Camera and Imaging Systems: The drone's cameras are utilized for survivor identification and obstacle detection.
  - Communication Systems: Enable communication with rescue teams and command centers.
  - Payload Deployment: The system may deploy medical supplies or life-saving equipment.
- **Sensors :**
  - Cameras: Capture real-time visual data for navigation and survivor detection.
  - LiDAR and Ultrasonic Sensors: Measure distances and detect obstacles.
  - GPS: Provides location data for navigation.
  - Inertial Measurement Unit (IMU): Measures drone's orientation and motion.
  - Weather Sensors: Collect data on atmospheric conditions.
  - Thermal Sensors: Identify heat signatures, potentially indicating survivors.