Project Proposal

Project Title: Blackbeard

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1. MOTIVATION AND LITERATURE RESEARCH

In academia, Blackjack is "solved" using Markov Decision Process, MDP assumes the player's decision is a function of the player's cards and the dealer's shown card. However, we can build a more advanced model that adds another dimension to a player's decision function, card history. By incorporating card history, theoretically, a player should outperform the classical optimal strategy because the player now has more relevant information.

Website:

- https://google.github.io/mediapipe/solutions/hands.html
- https://github.com/DevGlitch/botwizer/
- https://www.wired.com/2007/12/st-howto-20/
- https://wizardofodds.com/

Movie:

- Minority report's hand gesture control

Paper:

- Coltin, K., 2012. *Optimal strategy for casino blackjack: a markov chain approach.* Tech. rep.
- Redmon, J., Divvala, S., Girshick, R. and Farhadi, A., 2016. You only look once: Unified, real-time object detection. In *Proceedings of the IEEE conference on computer vision and pattern recognition* (pp. 779-788).

Class:

- Cornell University's Blackjack with Artificial Intelligence (CS 473)

Real life application:

- MIT-Harvard Blackjack Team

We are motivated to create a project that pushes the boundary of "optimal" blackjack strategy while incorporating the latest hand gesture CV.

2. PROJECT CATEGORIES

- Computer Vision Application
- Gesture recognition
- Object recognition
- Artificial Intelligence Application
- Real time data analysis

3. DESCRIPTION

Team Jaqen wants to build Blackbeard, a world class blackjack AI, that trains your ability to play blackjack from a wearable device in real time.

Blackbeard can:

- Obtain real time data via a Raspberry pi camera
- Read user commands via gesture recognition
- Detect cards using object recognition
- Detect card numbers using CNN model to train on digits classification
- Bet Strategy: recommends best betting amount based on card counting method
- Action strategy: recommends best action based on optimal strategy.

4. OBJECTIVES

The goal is to make Blackbeard the best blackjack AI possible that lives on a wearable device so users can use it for training anywhere.

5. EQUIPMENT & ARCHITECTURE

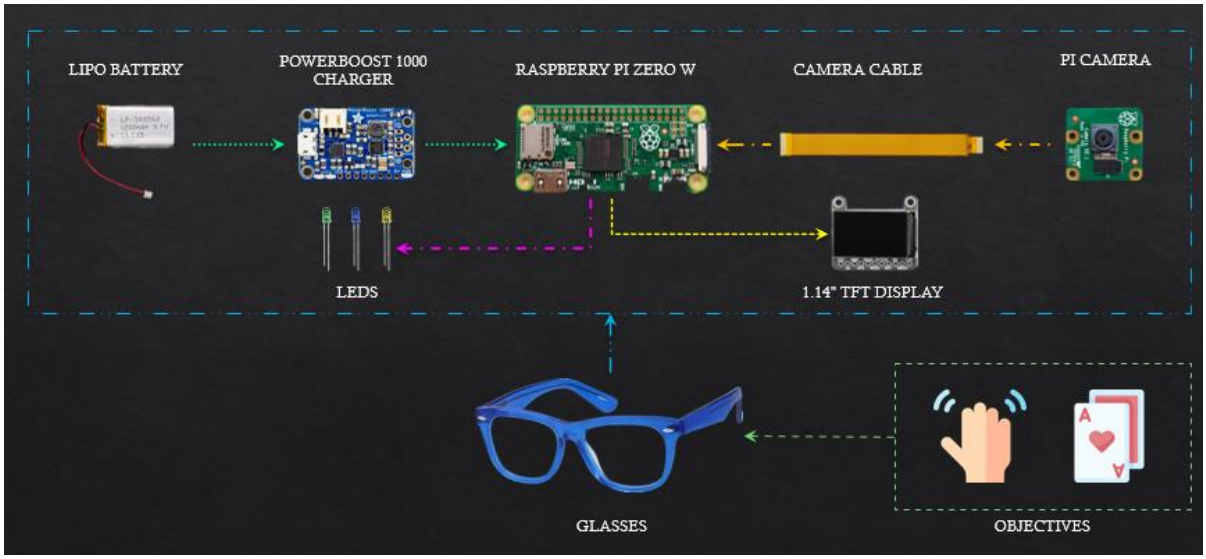
Software & Packages:

- Python
- OpenCV
- Yolo
- NumPy
- GitHub

Hardware:

- Raspberry Pi Zero W
- Raspberry Pi Camera Board v2 - 8 Megapixels
- Raspberry Pi Zero v1.3 Camera Cable
- 64 – 128 GB Micro SD Card
- PowerBoost 1000 Basic - 5V USB Boost @ 1000mA from 1.8V+
- Lithium-Ion Polymer Battery - 3.7v 1200mAh
- Diffused 5mm LEDs (Red, Yellow, Green, Blue, and White)
- Adafruit 1.14" 240x135 Color TFT Display

Architecture:



6. PROOF OF CONCEPT

The object detection with computer vision has been done through YOLO package. We will refit the model with card detection and gesture detection.

Digit classification has been done with MNIST's handwritten digit recognition dataset. We can refit the model to detect card digits.

The optimal boilerplate blackjack strategy has been computed and is widely available. We will improve the strategy by incorporating additional real time information using card counting method.

Raspberry pi zero has 1GHZ CPU, 512 MB ram, 64GB (micro-SD), 1080p video output. It should be more than capable of running our AI.

7. MILESTONES & SCHEDULE

Week	Date	Milestone
4	20-Sept	Setting up software and hardware
5	27-Sept	Testing hardware features and functionalities
6	4-Oct	Writing project proposal
7	11-Oct	Project proposal submission (12-Oct)
8	18-Oct	Phase 1: Object detection; Blackjack strategy – Demo
9	25-Oct	Phase 1 features – Finalized
10	1-Nov	Phase 2: Object classification; Hand motion recognition – Demo
11	8-Nov	Phase 2 features – Finalized
12	15-Nov	Phase 3: Integration & Testing – Planning
13	22-Nov	Phase 3 features – Demo
14	29-Nov	Phase 3 features – Finalized
15	6-Dec	Presentation preparation + Bonus phase
16	13-Dec	Project submission and presentation

Appendix - Checklist:

☒ The project applies any of the knowledge presented in class or related.

- Computer vision, AI, ML, Object detection, Gesture recognition.

☒ The project does not require very expensive equipment

- Total Price: $80

☒ The project has a future application in real life

- Blackjack trainer
- Pharmacy pills counter and classification
- Tickets counter

☒ The project stays away of any possible ethics and privacy issues and it is intended to improve human life

- No privacy issues, no private data are stored or shared.
- No ethnical issues because the device is intended to be used for training and academic purposes only, so users should not wear it on Casino grounds. Also, card counting is not illegal in Federal, State, and Local level.
- The device can improve the user's ability to play blackjack; and thus improves the user's quality of life in gaming scenarios.

☒ The project does not compromise the safety of any member of the team at any time

- This project doesn't practice any behavior that could compromise the safe of its operator.

☒ The project delivered should demonstrate the process of design, testing and proving the concept of the idea proposed.

- This project's proof of concept and schedules are listed in this proposal under section 6 and 7. The deliverables will be submitted by mid-December in accordance to the guideline.

☒ The project falls in one or various of the following categories:

- The categories are listed in this proposal above under section 2.