Computer Vision

CA2 Assignment Proposal Form

Student No: L00182374 **Date:** 10/11/2025

Course Name: BSc (Hons) in Computer Science

Module Name: Computer Vision

Proposed working title of assignment:

Utilising computer vision to recognise cards and poker hands in order to determine game state in real time.

1. Why have you chosen your particular topic?

I decided on this topic as I have a significant interest in card games. The idea of a computer vision app that analyses playing cards and determines a games context via the player hands should have adequate complexity to display computer vision techniques and applications effectively.

2. What Computer Vision techniques do you propose to use in your assignment?

The fundamental techniques that will be used in this project will be:

- Feature matching – for things like Object detection
- Blurring
- Thresholding
- Multi Object tracking
- The use of Convolutional neural networks such as yolov8 – for real time classification
- Contour/shape matching

3. Do you have any experience relevant to your proposed assignment?

I do not have any experience relevant to the computer vision techniques associated with this assignment other than simple things such as thresholding and blurring, the preprocessing steps, but I do not have any experience with using CNN models like yolov3, v5 or v8 although I have experience with card games such as poker and I am familiar with poker hands.

4. In thinking/reading about this assignment identify a primary source and some secondary sources (e.g.: a peer reviewed paper and/or book)? References required here.

I started off by looking at the paper - Poker card recognition with computer vision methods (Hu *et al.* 2021), they discuss using a variety of computer vision techniques such as thresholding in order to effectively categorise and identify playing cards, although they do not utilise any neural networks they solely use computer vision techniques to classify cards which may be inadequate on for real time poker applications. Then I read - Integration of Robotics, Computer Vision, and Algorithm Design: A Chinese Poker Self-Playing Robot (Yu 2023) which discussed utilising Yolov5 for card recognition in real time video for the purposes of allowing a robot to play Chinese poker with human players, this paper demonstrates the effectiveness of yolo models for this specific application. The final and most relevant paper I read was Poker Game State Detection (Hung *et al.* 2024) which discussed poker specifically and detecting the state of the game, it finds that while yolov8 is effective it may have a few shortcomings such as differentiating between 6 and 9 cards accurately.

Hu, X., Yu, T., Wan, K., and Yuan, J. (2021) 'Poker card recognition with computer vision methods', in *2021 IEEE International Conference on Electronic Technology, Communication and Information (ICETCI)*, Presented at the 2021 IEEE International Conference on Electronic Technology, Communication and Information (ICETCI), 11–15, available: https://doi.org/10.1109/ICETCI53161.2021.9563607.

Hung, J., Moberly, L., and Souliman, M. (2024) 'Poker Game State Detection'.

Yu, K.-H. (2023) 'Integration of Robotics, Computer Vision, and Algorithm Design: A Chinese Poker Self-Playing Robot', *arXiv.org*, available: https://arxiv.org/abs/2312.09455v1 [accessed 11 Nov 2025].

5. Please include a 500-word draft assignment proposal here.

Indicate <u>clearly</u> what your assignment application is going to be.

(Include: how you will measure the success of your application; The expected results)

Application description:

The assignment application is going to be a computer vision playing card detection and recognition system that identifies and categorises poker hands from a top-down tabletop perspective in order to determine the game context. The system will function in real time, detecting and classifying individual card rank and suits, as well as keeping them identified via multi object tracking. If time permits, the amount that a player bets/the value of the chips bet may also be determined utilising computer vision.

The current hand of the players will be determined based on the cards that they are holding and the cards on the table, the hand of the player can then be calculated based on the cards that are recognised. For example, if a player is holding an ace along with their other cards and there is an ace on the table, the application will determine that the hand of the player is a pair, naturally this will be executed for all players.

The application will be created and trained for poker games involving two players in order to reduce the amount of people needed and to avoid having more than two people participate in multiple poker games for testing purposes, although three and four player functionalities may also be implemented if time permits.

Training:

The yolov8 model will be trained on a dataset of still card images and then judged on how accurately it can recognise cards from video feed in real time, if the results are poor additional training will be conducted using video data of cards to bolster accuracy.

Implementation:

Post training, a video frame will be captured and then the necessary preprocessing techniques such as thresholding and blurring will be applied to that frame. Next, a pre tuned Yolov8 model will be utilised for card detection. Then, cards will be classified into rank and suits based on what is detected, afterwards player hands will be determined utilising the retrieved card information.

CNN Model:

Yolov8 will be utilised to recognise card objects, it was selected due to its single stage nature and thus swift latency as well as its sufficient accuracy at low latency.

Definition of success:

The project is classed as successful if

- Card classification accuracy is greater than 90%
- Multiple cards can be classified accurately in real time
- Hands can be determined via classified cards
- There is a latency of less than 500ms for classification

Expected results:

- The application will be utilised to accurately and quickly detect and recognise playing card numbers/characters and suits.
- The application will be able to classify poker hands and thus determine the state of the game by recognising multiple cards.
- The application will have a relatively high degree of accuracy when detecting cards.

Poker hands:

High card, pair, two pair, three of a kind, straight, flush, four of a kind, straight flush and royal flush.

Definition of poker states:

An example of game states would be player1: pair, player2: high card.

And if time permits the bet may be tracked.

6. Please indicate clearly what data/dataset your assignment application is going to use.

The primary dataset my assignment application is going to use is Playing cards object detection dataset off Kaggle, which has a cc0 license which means anyone can use it for any purpose.

Link: https://www.kaggle.com/datasets/andy8744/playing-cards-object-detection-dataset

I may also create video data of playing cards myself for more accurate training data.