Real-time Tic-Tac-Toe Game Using Computer Vision and YOLO for Hand Gesture Recognition

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Abstract

This paper presents the development of a real-time Tic-Tac-Toe game using computer vision, powered by YOLO-based hand gesture recognition. The project covers data collection, model training, and game implementation, as well as testing and evaluation. We outline the approach taken, the methodology applied, and the results achieved, while also addressing challenges encountered throughout the project.

1 Introduction

Tic-Tac-Toe is a widely recognized game due to its simplicity and strategic appeal. In this project, we extend its traditional form by implementing a real-time version using computer vision. Hand gestures are detected via YOLO (You Only Look Once) object detection, translating physical gestures into in-game moves. This paper explores the project's approach, methodology, results, and challenges encountered during implementation.

2 Data Collection

Each team member uploaded different pictures of their hands doing the signs in different positions and in different lightness, then each member uploaded their images on drive, finally, the whole data was uploaded and labelled using "make sense" to ease the labeling process.

3 Model Training

First, the collected data was split into a 70:30 ratio training: validation using the "split-train-test" function, then the data sets were uploaded in drive and using Yolo to train the data set

4 Game Implementation

The Tic-Tac-Toe game was developed using Python. At first, an ordinary game engine was designed to test the game logic as well as the implementation using the GUI, then after the integration with YOLO, Hand gestures were detected using the YOLO model, which mapped gestures to moves on the grid. A custom algorithm was designed to handle gesture interpretation, grid management, and game state updates.

5 Testing and Evaluation

6 Challenges

1. uploading the images folder consumed a lot of time although they were compressed and couldn't be uploaded eventually, which led to uploading dividing the images and uploading them manually, that process took about 8 hours to upload all the images.

2. integrating the game engine with the detection code led to run time errors

7 Conclusion

The real-time Tic-Tac-Toe game using YOLO-based hand gesture recognition was successfully developed. Despite challenges with uploading data and integrating the game engine, the project achieved its goal of translating hand gestures into game moves.

8 References

1. Yolo Tutorial

2. Real Time Object Detection