

Sports Motion Detection & Viewport Tracking

CVI620 Final Project, Summer 2025

Course Instructor: Ellie Azizi

Project Overview

In this project, you will create a Python based motion detection and viewport tracking system for a short sports video clip. The idea is to simulate a "virtual camera" that follows the main action in the scene, something similar to what professional sports broadcasts do to keep the viewer focused on the play. The goal is not to produce a perfect system, but to demonstrate your understanding of video processing, motion detection, and camera tracking logic using basic computer vision techniques.

To complete

You will write a Python program that processes a 10 second sports video located in data folder. First, you will extract frames from the video at a fixed rate (around 5 frames per second) and resize them to a standard resolution for consistent processing. You will then implement motion detection by comparing consecutive frames to identify areas of movement, using simple differencing techniques combined with some basic filtering to remove noise.

Once motion is detected, your program should identify the primary region where the most significant movement occurs. Using this information, you will define a fixed size rectangle (like a camera frame, for example 720x480 pixels) that tracks this moving area. The virtual viewport should move smoothly to follow the action, so you will also need to add a smoothing mechanism, such as interpolation or a simple moving average, to avoid abrupt camera shifts.

For visualization, your output should show two things: one is the original video frame overlaid with the detected motion areas (using bounding boxes) and the current viewport rectangle; the second is the cropped portion of the frame inside that viewport, representing what the "virtual camera" sees. These should be saved as both individual images and compiled into output videos.

Evaluation Criteria

Projects will be evaluated based on the clarity and organization of your code, the accuracy and robustness of your motion detection, the quality of your viewport tracking logic (especially how smoothly it follows the action), and the overall clarity of your documentation. Your ability to handle noisy motion data or multiple moving regions will also be considered.

Submission Instructions

Please create a private GitHub repository for your project and commit your code with meaningful commit messages. Make sure your README.md is included and up to date. When you are ready, share the repository with my GitHub account: Ellie749.

Deliverables

- All Python scripts.
- The final output video.
- The resulting data frames.
- Git repository, including: Clear commit history showing individual contributions, Proper project structure and organization
- Any documentation to clearly explain how to run your code, describe the approach you used, highlight key decisions you made, and reflect on any challenges you encountered along the way. If you have ideas for improving your system beyond the current scope, feel free to include those too.

If you run into any issues or would like clarification on any part of the project, feel free to contact me via email.

The project can be completed in groups of up to 3 individuals.