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End Sem Project

Real time tracking and detection of chess piece movement

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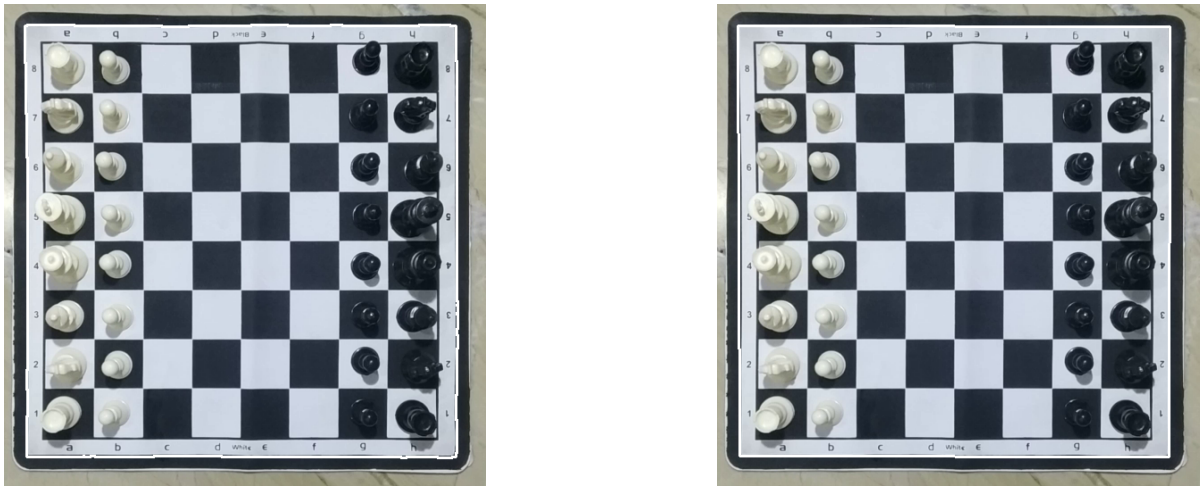
End Sem Project: Real time tracking and detection of chess piece movement

We have developed a chess piece movement detection model which will track and detect chess piece movements and display them in a virtual chess board. Our aim was to develop a real-time model but we couldn't complete it in the given span of time. We have recorded a part of a chess match and the movements we made in the chess board are tracked and displayed in the virtual chess board.

Part A: Detection of boundary of the Chess Board

The initial frame of the match recording is used for boundary detection. The reference image is gaussian blurred followed by canny edge detection to detect all the edges. The edges are enhanced using dilation followed by thresholding to either 0 or 255. The contours of the edges are obtained and those having area above a threshold are detected, among which the one with the smallest area corresponds to the chess board boundary.



(a) Contour of the boundary

(b) Contour approximated to 4 points (4 corners)

Figure 1: Boundary Detection

Part B: Detection of corner, edge and intersection points

The corner points of the chess board boundary is determined. The neighbouring corner points are joined and divided each line into 16 divisions and 17 edge points. The even edge points of the divisions of parallel lines are connected. The intersection of these parallel lines will be the center points of each cell / grid points.

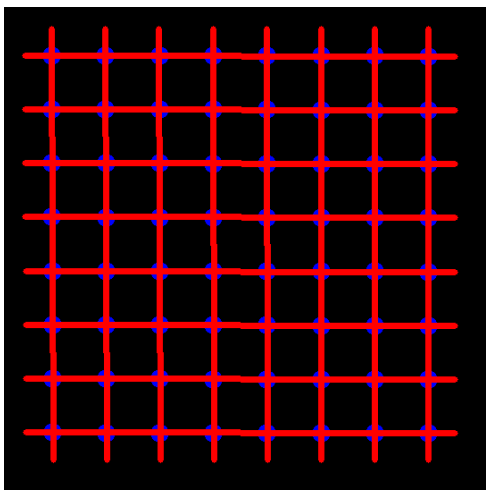


Figure 2: Intersection points (Blue dots), Grid lines (red)

Part C: Detection of Stable frames

The area of the chess board boundary in the initial frame is taken as the reference value. We have traverse through each frame and found the area of contour corresponding to the chess boundary. The difference between area of the reference and each frame will be compared to a threshold. If this difference will be higher than the threshold, it will indicate the presence of hand over the board and if the difference is less than or equal to the threshold ensures there is no new movements made since hand haven't come over the board. A total of 50 consecutive frames without the presence of hand are found, and the middle frame (25) among them is taken as the stable frame. This process is repeated till we have traversed through all the frames.

Part D: Detection of chess piece movement

The stable frames identified above are gaussian filtered, canny edge detected, dilated and thresholded. Consecutive stable frames are subtracted from each other and median filtered. The contours of the median filtered image are obtained and center of the biggest contour of the filtered image is identified and mapped to its closest point in the grid. The grid points are mapped to a corresponding column and row index.

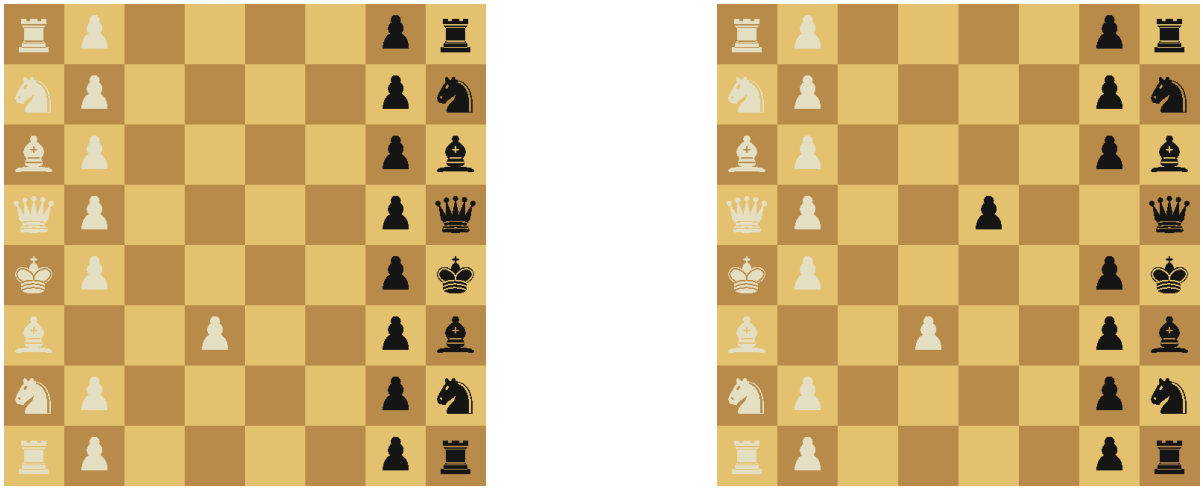
(a) Stable frame 1 - Stable frame 2

(b) Stable frame 2 - Stable frame 1

Figure 3: Movement Detection

Part E: Displaying the movements in Virtual Chess Board

Each chess pieces are mapped to a unique number, which is positive for white piece, negative for black and zero if a cell is empty . Images of each pieces are collected which will displayed on the board for visualization. The movements are updated on the virtual board.



(a) Movement 1

(b) Movement 2

Figure 4: 2 consecutive moves

Conclusion

Thus we have developed a chess piece movement detection model (in python) which tracks and displays the movement we made on the real chess board on the board. Detailed explanation of the working and results of the algorithm is included in Resources section.

Resources

Drive : link

GitHub : link