

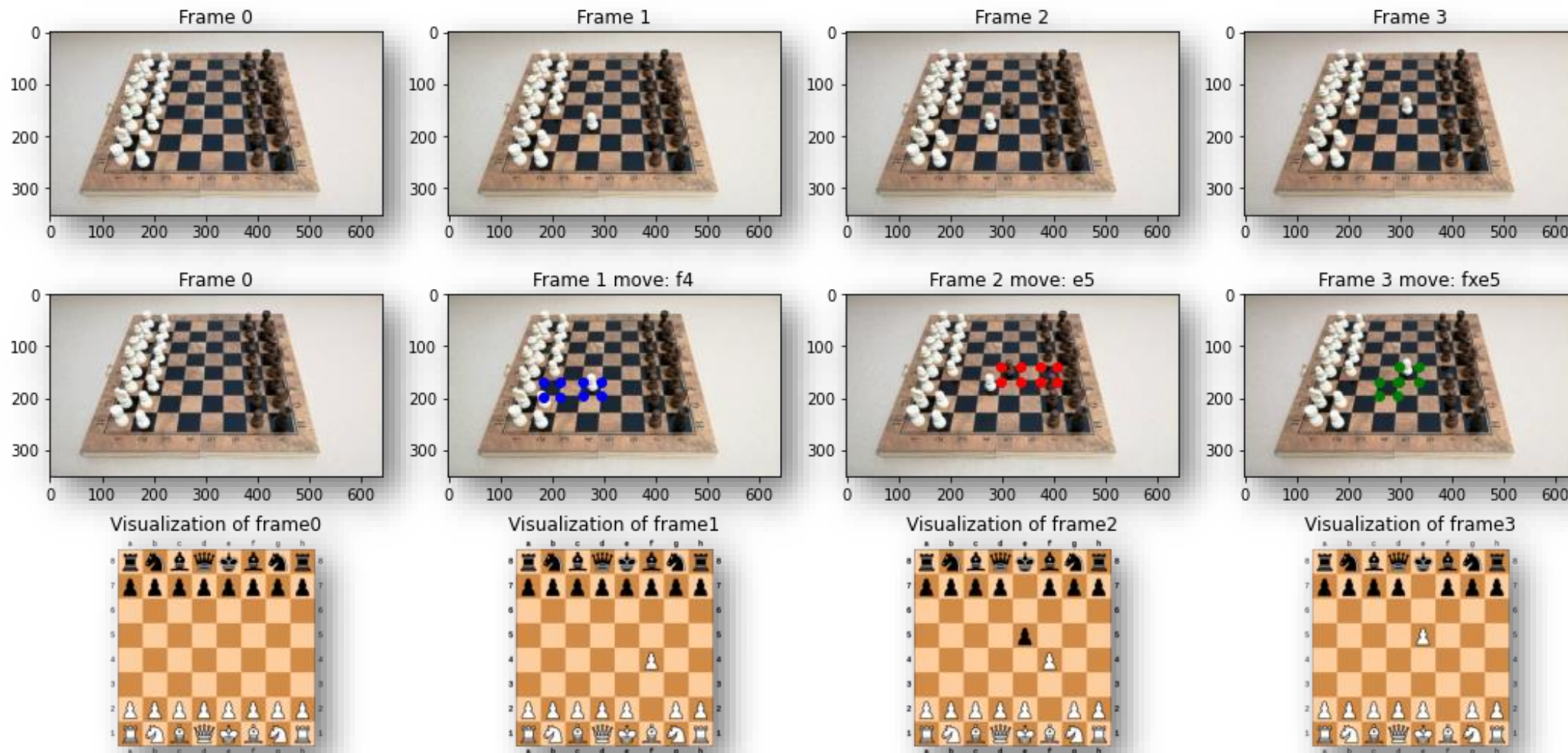
SPEED CHESS

Change how we learn chess.

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Our method: example over 3 moves.



Our method stages:

01

Detect chess board corners.

We use several computer vision methods to detect the chess board corners and coordinates.

02

Extract moves from video.

We extract from the video only frames when a piece moves on the board.

03

Detect piece move.

For every two consecutive frames, we detect the piece location and destination using image subtraction.

04

Find move algebraic notation

Using data structures we build to the board coordinates, we can examine the piece move and find its algebraic notation.

05

Present moves visualization

Using the algebraic notation we found, we can display the game moves using synthetic chessboard images.



01

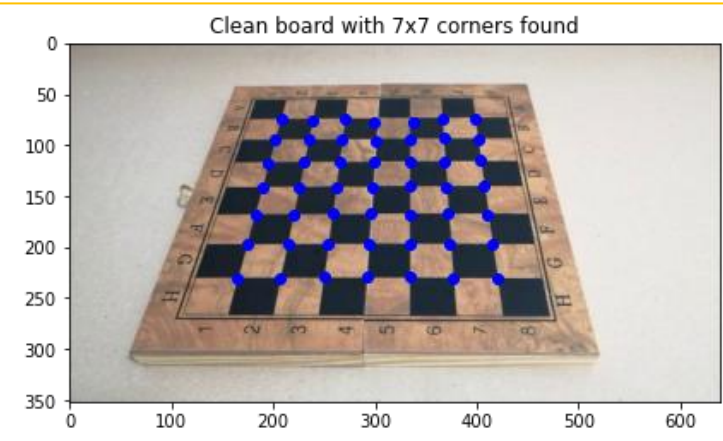
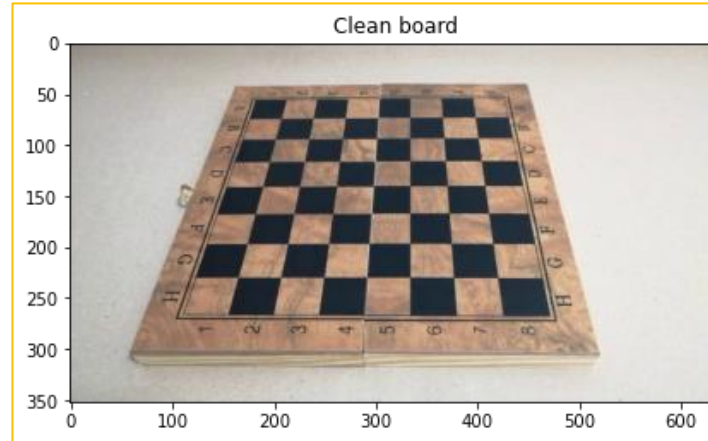
Detect chess board corners:



A

Extract 7x7 corners of the board

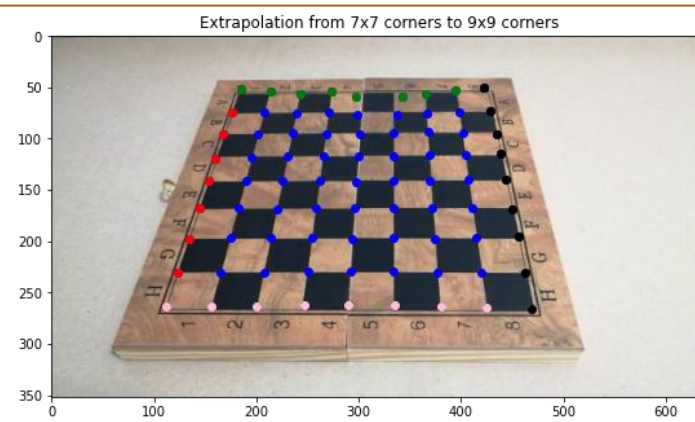
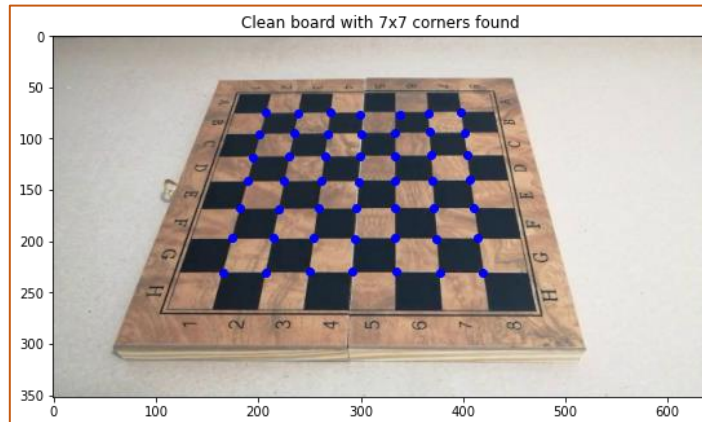
We extract from clean board image 7x7 corners coordinates using open cv.



B

Extrapolate corners

Using 7x7 corners found, we project the inside corners' coordinates outside to get the full board corners coordinates 9x9.



01

Detect chess board corners:

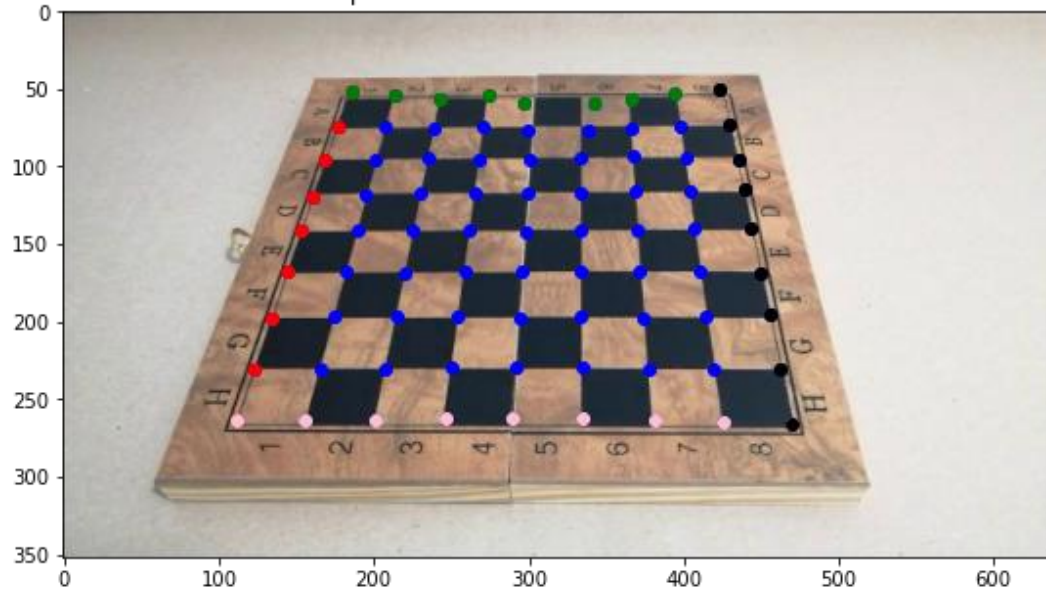


C

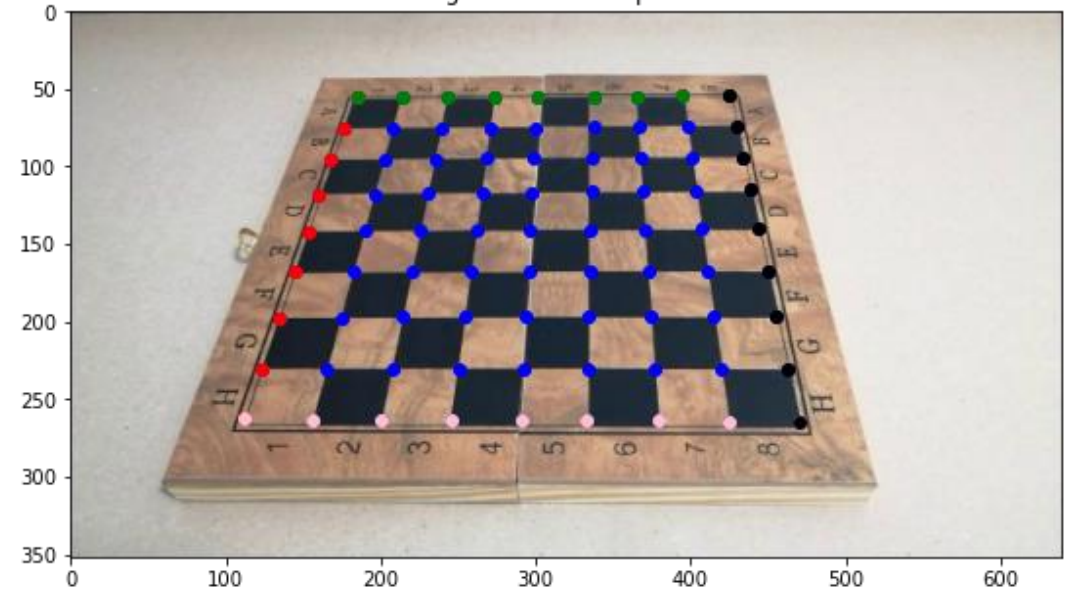
Refined tuning

The corners found using the extrapolation process are not precise. We are using Linear Least Squares over the vertical and horizontal lines created by the board's corners. And find a better approximation of the lines.

Extrapolation from 7x7 corners to 9x9 corners



Fined tuning over the extrapolated corners



01

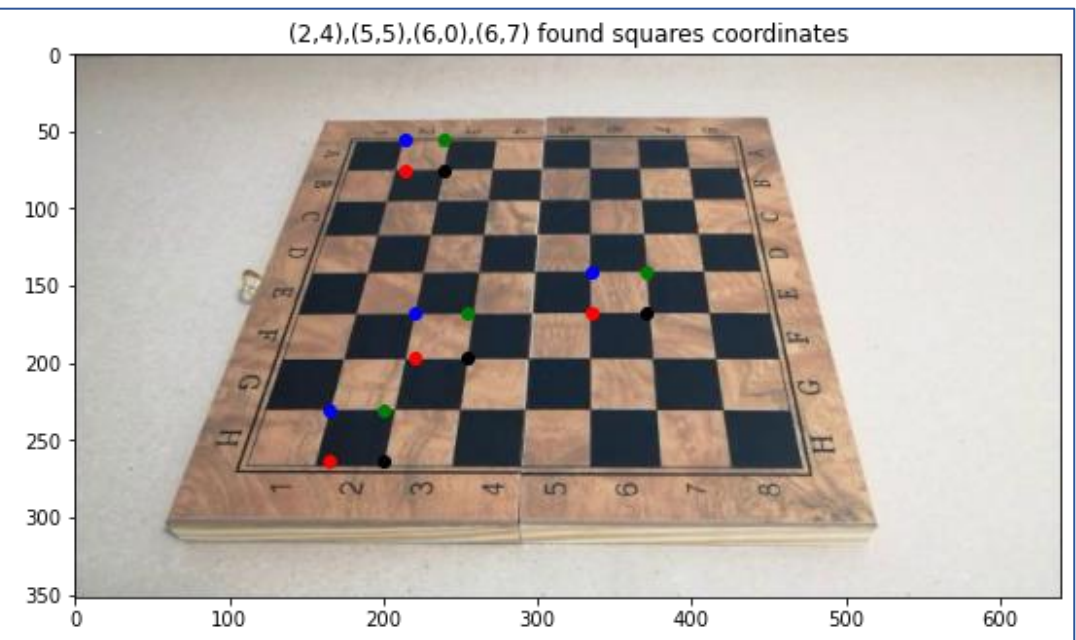
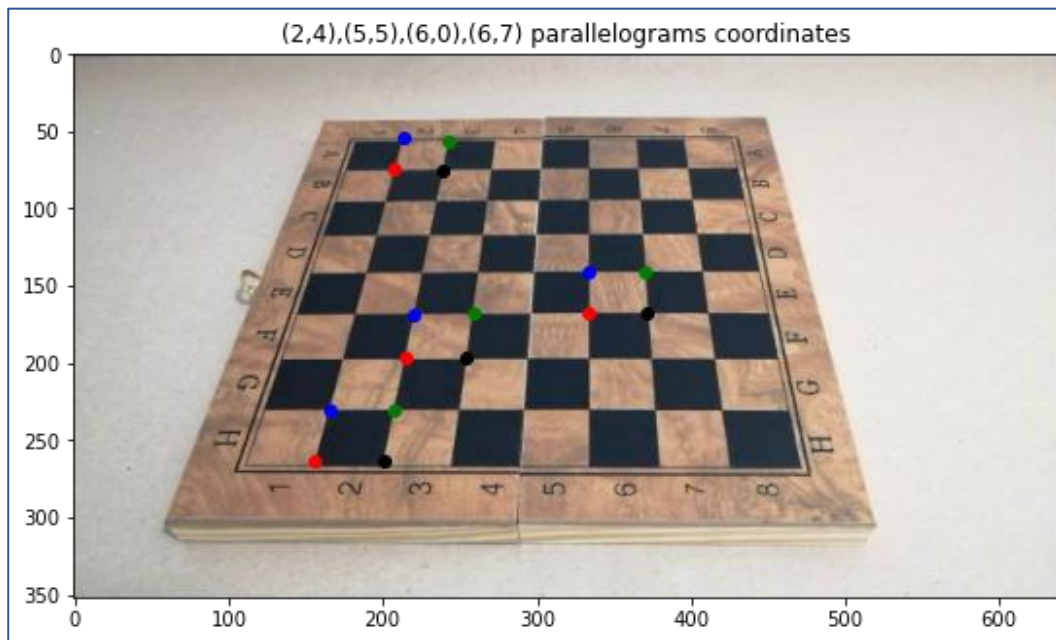
Detect chess board corners:



D

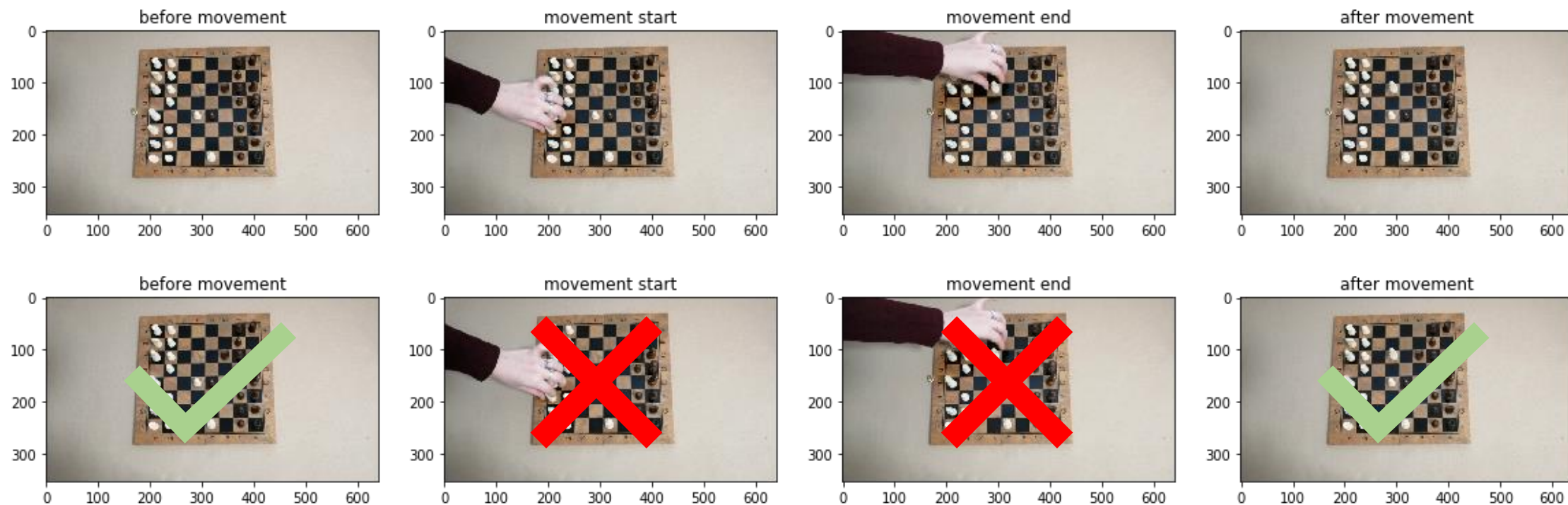
Squares Extraction

Every four corners we found create together a parallelogram. We will later want to use the chessboard squares' mean color, so we extract the minimum square contained in the parallelogram.



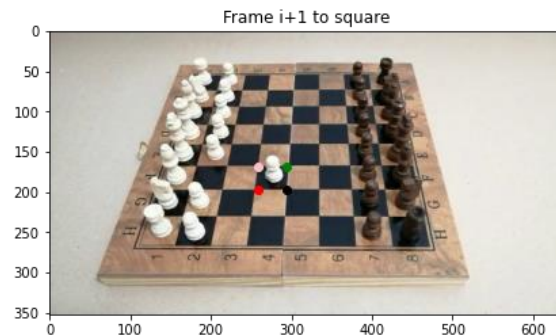
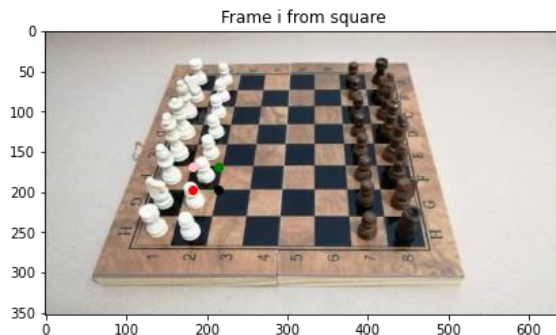
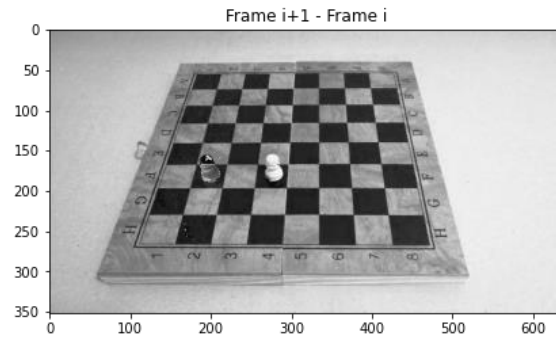
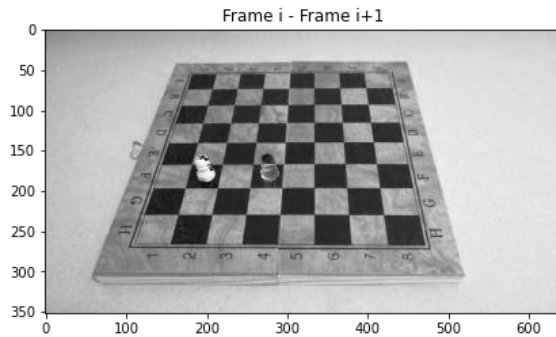
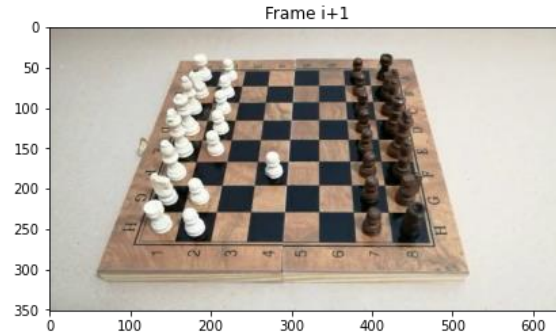
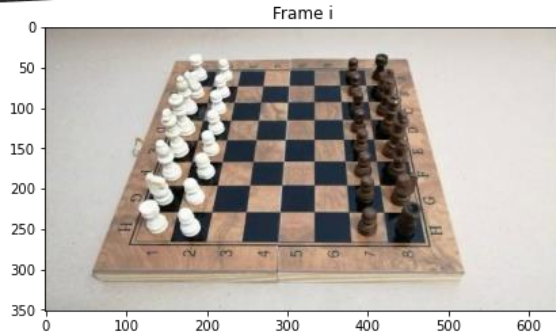


We can extract moves frames using the absolute difference between the current frame and the previous frame and the changed pixels percentage. We determined a movement between the two frames if the percentage change was greater than a certain threshold (0.1%).



03

Detect piece move:



A

For every two following frames, from stage. We want to find the chess move that has been made in this turn.

B

We will calculate the difference between the frames. And the mean color of each square and compare it to the mean color of the empty board.

C

The maximum change in color frames would be the origin and destination coordinates.

04

Find move algebraic notation:



- Algebraic notation is the standard method for recording and describing the moves in a chess game.
- Each square of the chessboard is identified coordinate pair, a letter and a number, from White's point of view.
- The vertical columns of squares, are labeled 'a'-'h'.
- The horizontal rows of squares, are numbered 1-8.
- Name of the pieces, upper case letter (except of pawn):

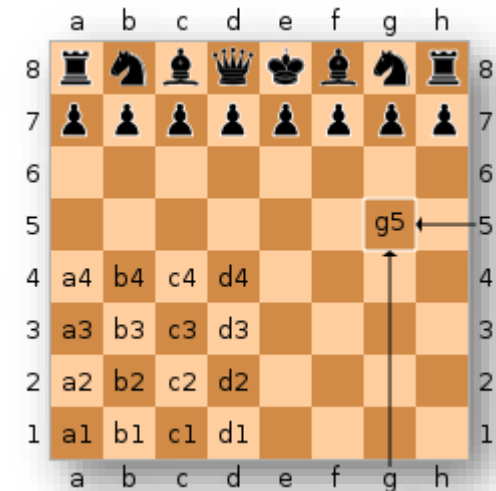
K-king

Q-queen

R-rook

N-knight

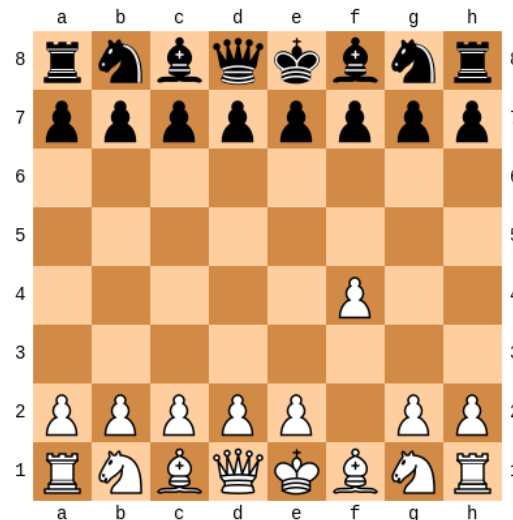
B-bishop



04

Find move algebraic notation:

- Move: Each move of a piece is indicated by the piece's uppercase letter, plus the coordinate of the destination square. For pawn only the destination square is given. For example, in the right figure: f4

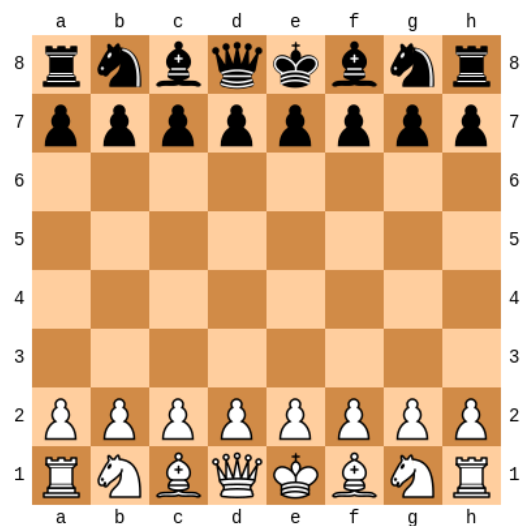


- Capture: When a piece makes a capture, an "x" is inserted immediately before the destination square. When a pawn makes a capture, the file from which the pawn departed is used to identify the pawn.

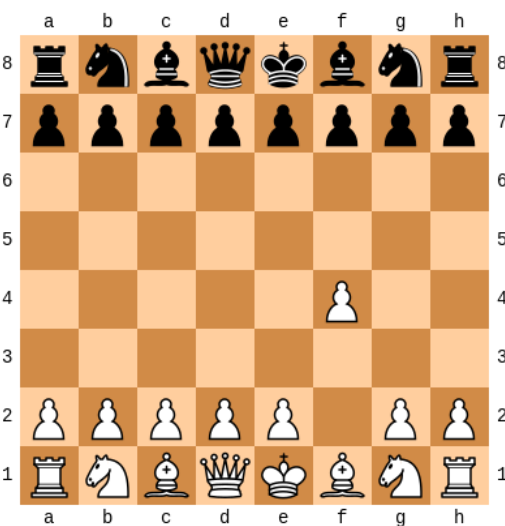
exf5
Bxa6
Nxb3
hxc6



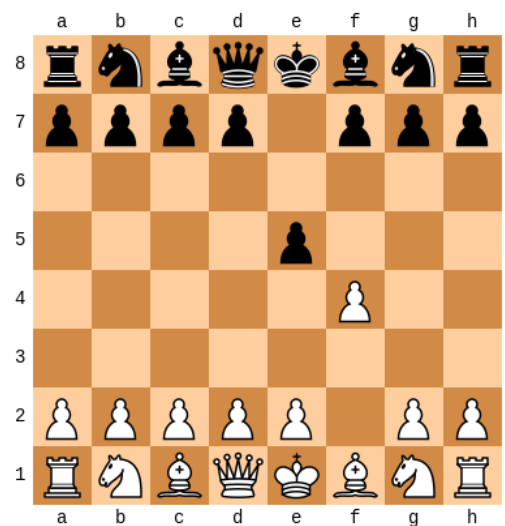
We present the algebraic notation we found using the python-chess library.



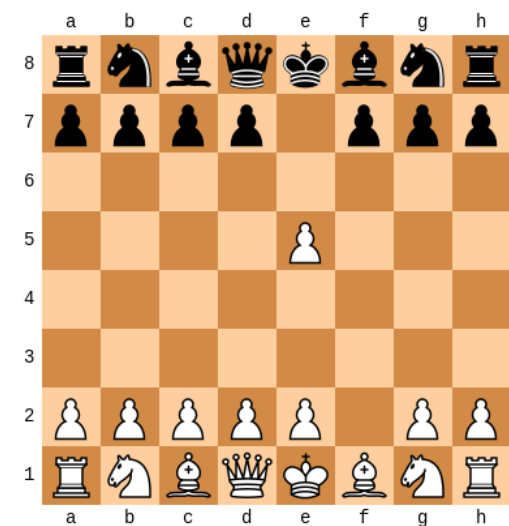
Start



f4

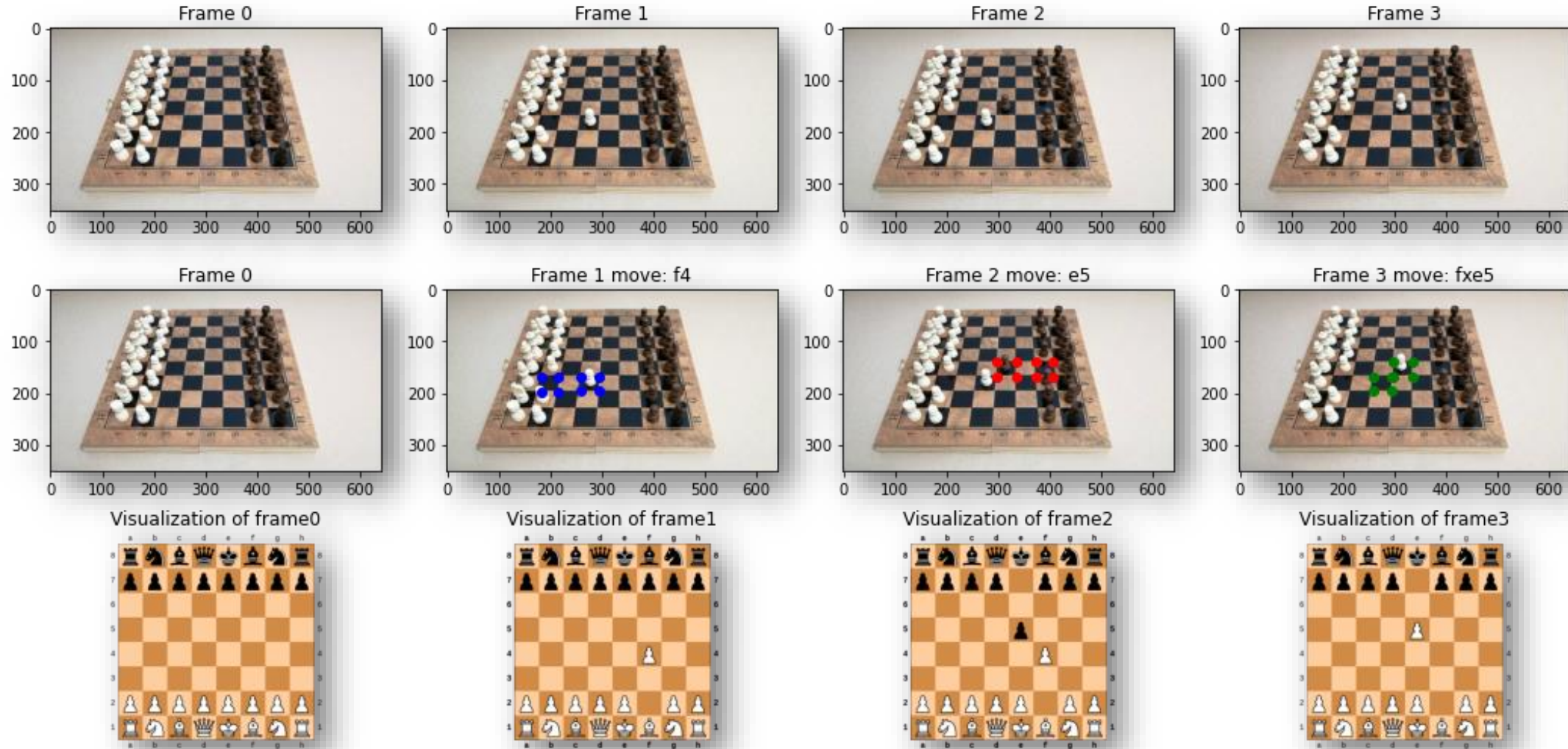


d5



fx e5

Results:



Results:



Our algebraic notation:

E4

E5

Qh5

Nc6

Bc4

Nf6

Qxf7



Further work:

- Improving the chess move detection by extracting the "suspicious" squares that have moved and decide on the chess move by exploring possible moves for each piece or square.
- Performing the chess move detection in real-time (for example, with the computer's camera) and add recommended moves for each player (which can be useful for people who wants to learn)

THANK YOU

