Automatic recognition of real time chess Game Using Image processing techniques.

A Thesis is submitted in partial fulfillment of the requirements for the degree of

Bachelor of Technology

In

Computer Science & Engineering

By

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CERTIFICATE

This is to certify that the thesis entitled, **"*Automatic recognition of real time chess game Using Image processing techniques*"** submitted by Botta Durga Deepak(110cs0122) in fulfillment of the requirements for the award of Bachelor of Technology Degree in Computer Science & Engineering at National Institute of Technology, Rourkela is an authentic work carried out by them under my supervision and guidance.

To the best of my knowledge, the matter embodied in the thesis has not been submitted to any other University/Institute for the award of any Degree or Diploma.

Date:

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ABSTRACT

By using image processing techniques and mat lab the live chess game that will
Will be played on the board will be recorded, stored and converted in to portable game
Notation form (pgn) using mat lab and Image processing techniques and thus enabling the
Live Telecasting of the game more reliable and more easily .Recording the also helps players
For Analysis, strategy and to find out there weaknesses and for the opening preparation.

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CHAPTER 1

INTRODUCTION

1. INTRODUCTION:

Chess is a popular board game played between two players .Worldwide about 10% of the People plays chess. In this internet era the popularity of the chess had been increased and There is certainly need of new tools to analyze and broadcast the chess games .The present Method now that is being used to telecast the games uses the electronic board Embedded Below the wooden board and based on the electronic equipment and pressure sensors the Board detects the moves and the moves will be telecasted .But this boards costs 400 pounds And not feasible to broadcast amateur gms and ims games .so, we are trying to identify the Chess game by using web camera and some image processing techniques

To reduce the cost of equipment to broadcast the games or to record for the further Analysis of the game

CHAPTER 2

LITERATURE SURVEY

2. LITERATURE SURVEY

2.1 CHESS BOARD AND SETUP

Chess board contains 64 squares 32 black 32 white and aligned like a checker board with 16 white pieces and 16 black pieces .a white player usually moves a piece from one square to another square which may be result in changing the position of that piece or changing the Position followed by capturing the opponent's piece followed by blacks move and then White's move and this will continue till the end of the game each side contains 1king,1 Queen,1 knight,1 bishop,8 pawns.

2.2 2.1.2 IMAGE PROCESSING

In imaging science, Image processing is a two dimensional signal processing technique in which image and related parameters to the image are input and output is the desired image with modifications are the parameters related to it.

Image processing is usually a digital signal processing, but analog signal processing is also possible.

Portable game notation:

Portable game notation (pgn) is a computer understandable format that will be supported by many chess programs. It is used for recording the chess games and related data like time took for each step and time format and venue and year and date of game etc game related data and to process it and analyze it on computers.

Pgn was first invented by steven j Edwards in 1993 and got popularized by Usenet newsgroup recycles corporation. PGN is designed "for easy reading and writing by people and for easy parsing and generation by computer programs. The chess moves are in algebraic notation.

There are two types of pgn formats 1) import and export.

The export format for every chess program should be same to same for every byte.

The export format describes data prepared under strict programmed control, similar to a printed source program reformatted by a compiler.

In pgn format the upper column will have blank spaces for information like venue ,time ,date and time format of the game and white players name and black players name and white's elo and black's elo.

And usually the algebraic symbols for pieces are as follows

King - K

Knight -N

Queen-Q

Rook –R

Pawn-P

And the squares are labeled from a1 to h8.

Suppose if a knight moves from b1 to c3.

Then the equivalent notation is Nc3 .

The equivalent notation for short castling is o-o

The equivalent notation for long castling is o-o-o

Suppose if a white queen captured black rook on h8 from a1

The equivalent pgn notation is Qxh8

Suppose if a pawn is promoted to queen on b8

Then the equivalent pgn notation is b8=q.

If a queen from f2 come to h4 and gives check then the equivalent pgn notation is

Qh4+ and if it gives checkmate then the equivalent notation is Qh4#.

Example of a pgn chessgame is as follows

[Event "internit chess open"]
[Site "?"]
[Date "2012.25.2"]
[Round "7"]
[White "deepak, B."]
[Black "aravindh J."]
[Result "1-0"]
[ECO "B30"]
[PlyCount "65"]
[EventDate "2012.25.2"]

1. e4 c5 2. Nc3 e6 3. d3 Nf6 4. g3 Nf6 5. Bf2 Be7 6. O-O-O O-O 7. Nbd2 Rb8 8. Re1 d6 9. c3 b6 10. d4 Qc7 11. e5 Nd5 12. exd6 Bxd6 13. Ne4 c4 14. Nxd6 Qxd6 15. Ng5 Ncd7 16. Qa2 Ng6 17. h4 Nf6 18. Nxh7 Nxh7 19. h5 Nb4 20. Ba4 Qd8 21. gxh4 Rb7 22. h6 Qxh4 23. hxg7 Kxg7 24. Rc4 Qh5 25. Rh3 f5 26. Rh3 Qe8 27. Be5+ Nc6 28. Qd2 Kf7 29. Qg5 Qe7 30. Bxb6 Qxf6 31. Rh7+ Ke8 32. Qxf6 Rxh7 33. Bc6+ 1-0.

Edge

In an image an edge is usually referred when there is a intensity drop in only one direction. That is while traversing the image and edge is intensity drop or intensity change in either x-Direction or y-direction but not both. That is dy/dx=0 or dx/dy=0.

Corner:

In an image a corner is usually referred when there is an intensity change in both the x-direction and in y-direction.

Square:

In a chess board a square is a enclosed with four corners and will be labeled from A1 to h8.
Total 64 squares.32 black and 32 white.

CHAPTER 3

PROCEDURE

1) Loading the video.
2) Converting the rgb image to grey scale image
3) Converting the grey scale image to binary image using the THRESHOLDING technique
4) Crop the photo by detecting the boundary of chess board
5) obtain the corners using suitable corer detection algorithm
6) Label the squares by using the corners surrounding them.
7) detect the movement of the pieces
8) convert the move in to pgn format

3.1 Loading the video:

A web camera is placed above the chessboard and we

Have to make sure that there is no disturbance between

Chess board and the camera that is there should be no

Interference between them and the camera will take photo

After player completes the move as he hits the clock and

The photo will be sent to laptop for processing the image.

3.2 Converting the rgb image in to grayscale image:

After loading the rgb image we have to convert it in to

Grayscale by using the formula i= (r+g+b)/3.

3.3 Converting the grayscale image in to Binary image:

After converting the rgb image in to grayscale image now

we have to convert the grayscale image in to binary

image by thresholding the image at (0.45-0.55).

This will convert all the Light squares in to white

And dark squares in to black.

Orginal image

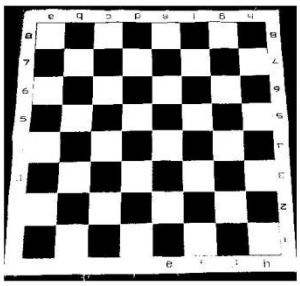


Image modified after grey scale, thresholding, cropping.

3.4
Crop the photo by detecting the boundaries of the chessboard:

Now along with the chessboard several unwanted portions will also present on the video.

Processing those date will be waste of time and resources.

So, the chessboard will be cropped by detecting the boundaries of the chessboard by

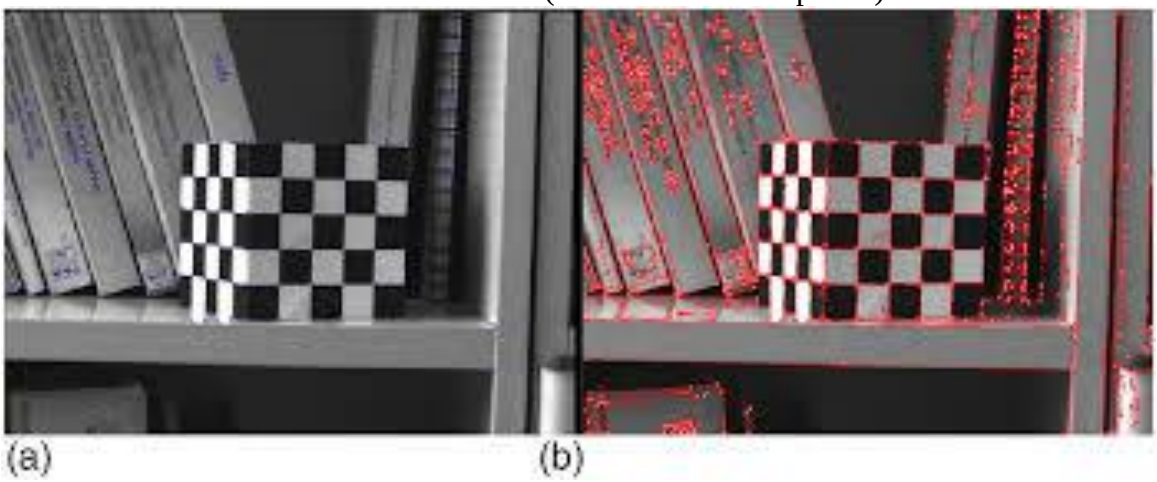
Traversing from top to bottom.

3.5
Obtaining the corners using suitable corner detection algorithm:

There are several corner detection algorithms namely:

- → Harris corner detection algorithm
- → Shi and tomasi
- → Level curvature
- → Susan fast corner detection
- → Morvac corner detection

Harris Corner detection (Unwanted interest points)



In practice most of the corner detection algorithms detect all the interest points and

Undesired corners .so, we have to do the local analysis of detected interest pointes

To determine which are real corners.

So, for the identification of chess board corners the local analysis are to be made

Such as corners obtained are parallel to each other and approximately should be

Aligned in the same line and the distance between the neighbouring corners

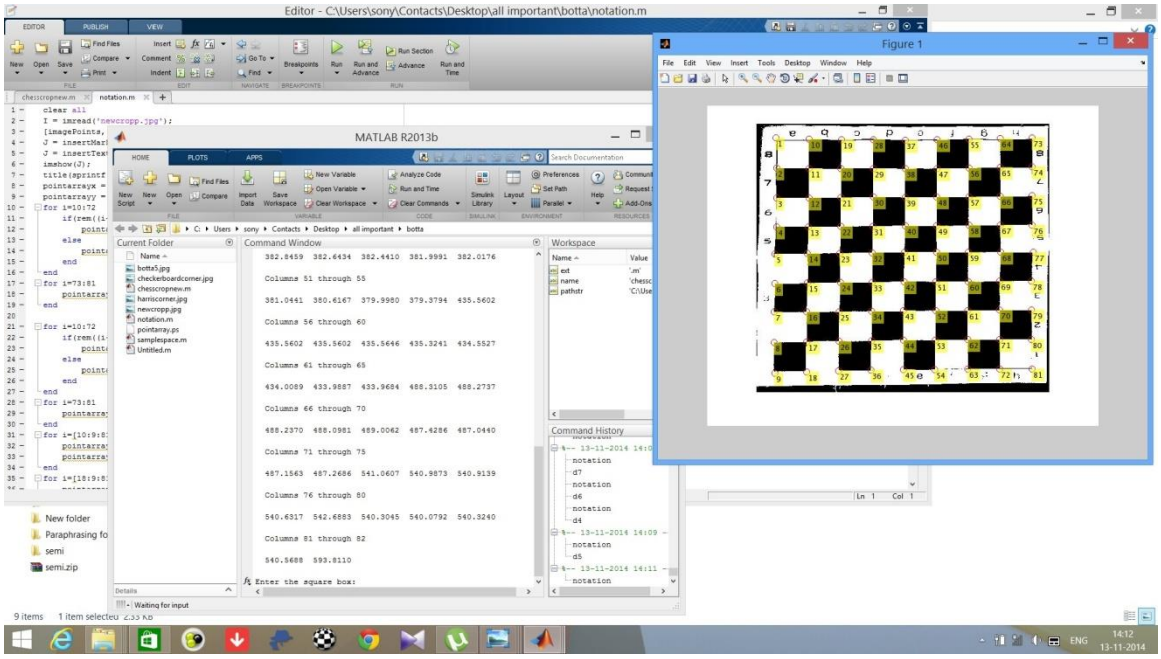
Should take the values in the range.

Unwanted interest points in harris corner detection algorithm.

So, by applying all these local constraints and rules and by obtaining all the points whose change in intensity level is drastic in both directions and filtering them we will obtain all the inner corners. , now to obtains

Outer corners we have to apply geometry
Let us suppose an outer corner (x, y) is to be obtained and the three neighbouring
Corners aligned in same line are (x1, y1) (x2, y2) (x3, y3)
We will get (x, y) by the formula
X= (x2-x1) *[(x3-x2)/(x2-x1)]
y=(y2-y1)* [(y3-y2)/(y2-y1)]

so, now we are able to obtain all the corners in the chess board that is (8x8).



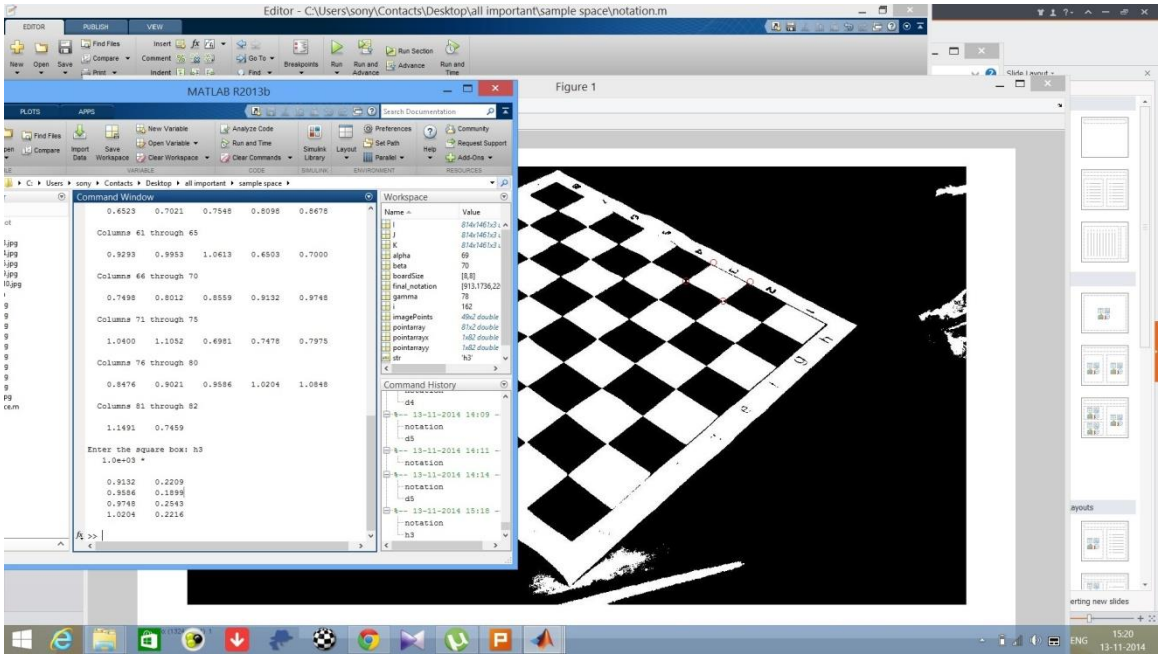
All the 64 corners detected.

3.6
Label the squares by using the corners surrounding them:

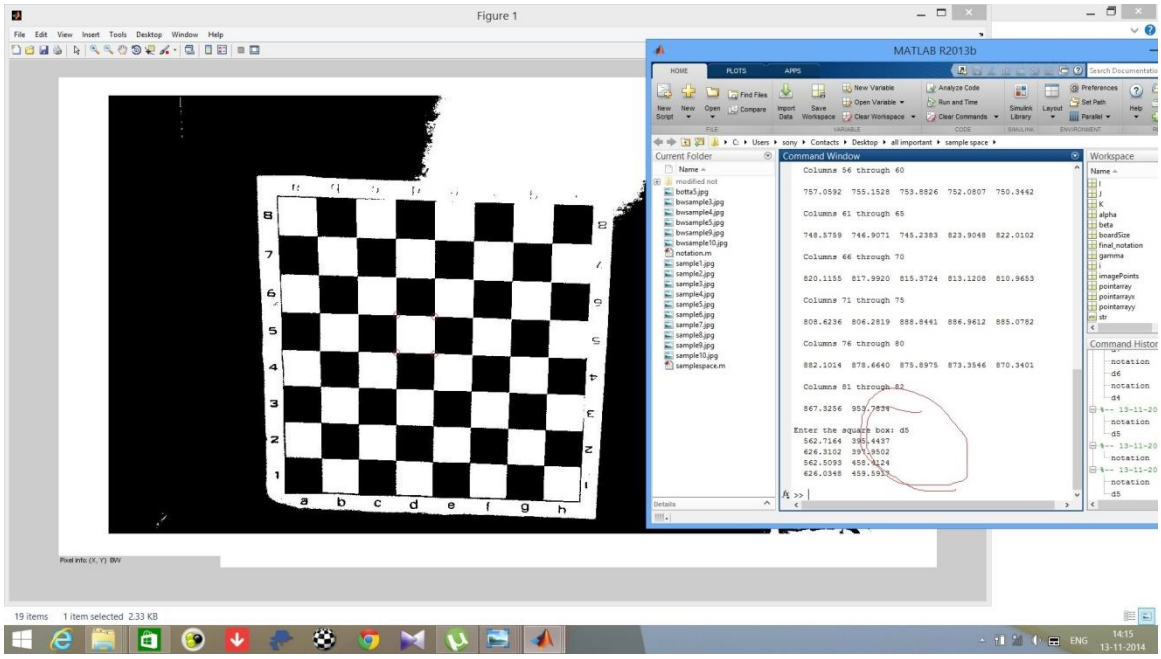
Now, as we obtained all the corners we have to label them with their respective squares

By seeing which array of points are surrounding them. Thus, for every square we will

Have all the four corners surrounding it.



Detection of squares (h3 in this case)



Detection of square d5 in this case.

3.7
Detecting the movement of the pieces:

Algorithm:

Steps:

1) Initialize all the squares with pieces in a two dimensional array.

2) After the move is played, take the picture and subtract the image from initial image.

3) Identify the squares in which changes had taken place.

4) Display the move played

5) Update array

6) Go to step2

First, we have to initialize all the squares with their initial positions that is an array which will

Initialize the pieces and squares which has no pieces with the null. Now, after the move will be

Played. We will subtract the initial image from the final image or vice versa.so, as one step is

Played and rest of the image is static we will have only changes in two parts of the

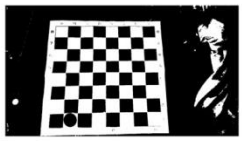
Chessboard. We will then calculate the sum of pixels by traversing the parallel lines of every

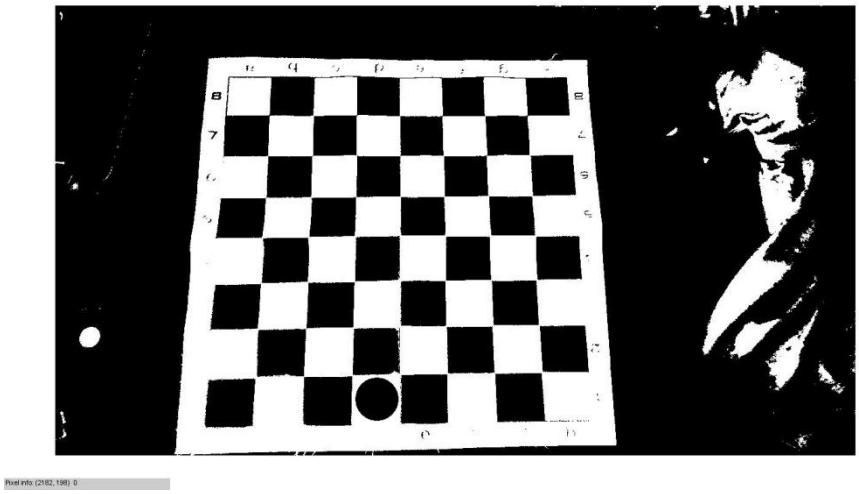
Square to know which squares had changes .as, we initially know previously which pieces are

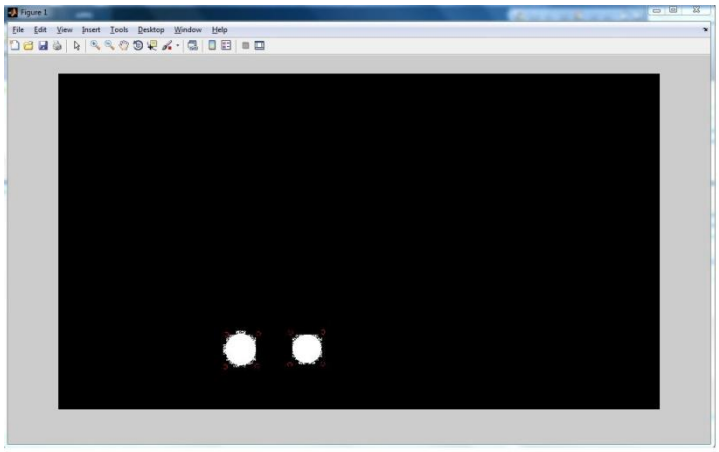
Present in that squares we will now record the changes and we will update the array with new

Piece positions.

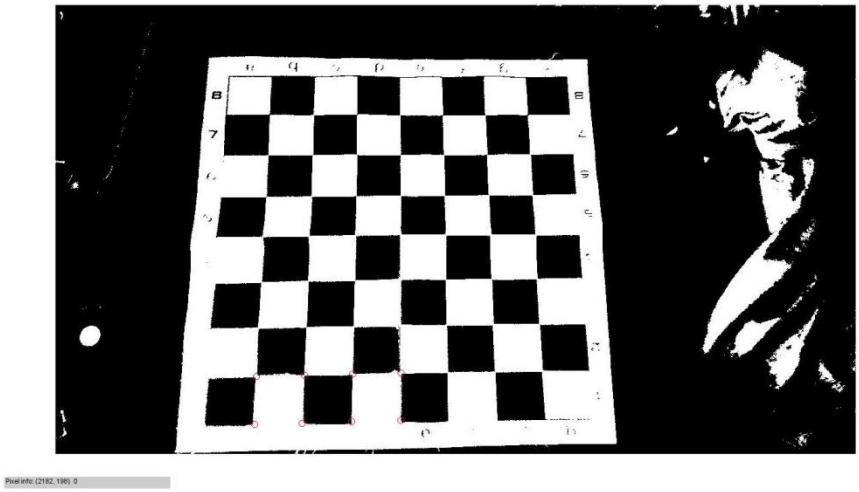
Results:
input







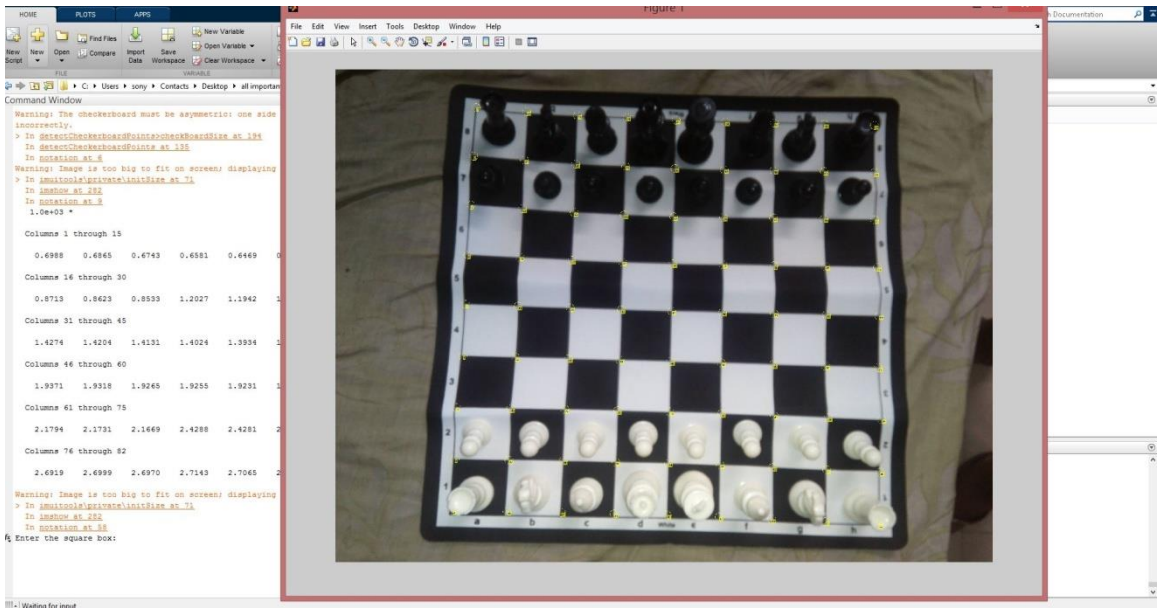
Intermediate output



Output

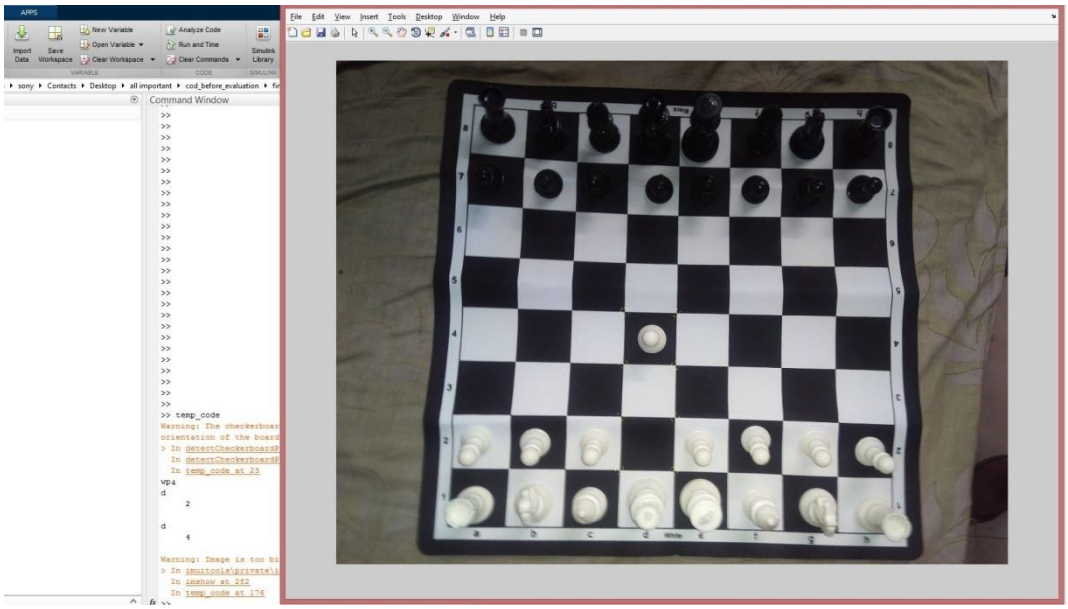
3.8
Converting the move in to algebraic pgn format:

Using the rules of the pgn as prescribed in literature review, we will update the move and print the pgn notation of the move.

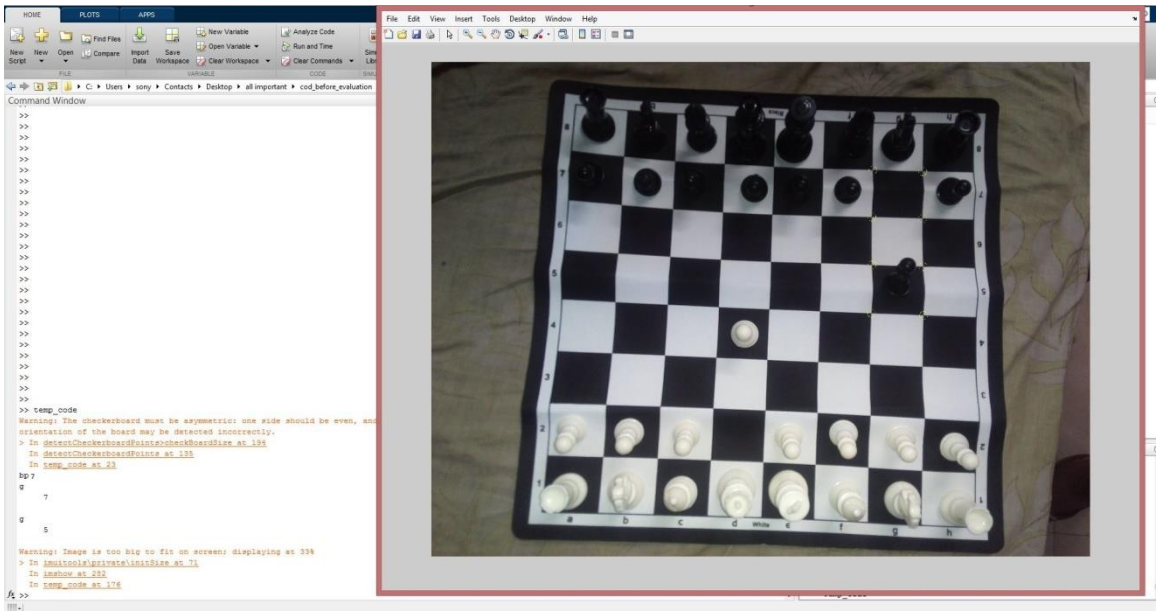


Detecting the corners and initial position

.



Output is generated for the pawn movement from d2 to d4 (wp4
d2 d4)



Output as shown in figure (bp7 g7 g5)

CHAPTER 4

CONCLUSION & FUTURESCOPE

4.1. CONCLUSION & FUTURE SCOPE

Using the similar algorithms and with the help of artificial intelligent we can design Mobile apps (android apps) which will record the chess game using mobile phone Played manually between kids or adults and after the end of the game it will give Detailed evaluation and analysis and tactical misses and positional errors of the Players in English language and also with high resolution cameras we can plan to Automatically detect the whole games in tournament (200 or more live games) Using only 10 cameras which is not only used for live analysis and broadcast But also used by arbiter to help in cheat detection and touch to move rules etc..

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-Rafael C. Gonzalez