

ChessBaxter

Lorenzo Betto



Was the goal of the project clear from the video?

Detect the state of the chessboard and output the next move

How to do that?

Was the goal of the project clear from the video?

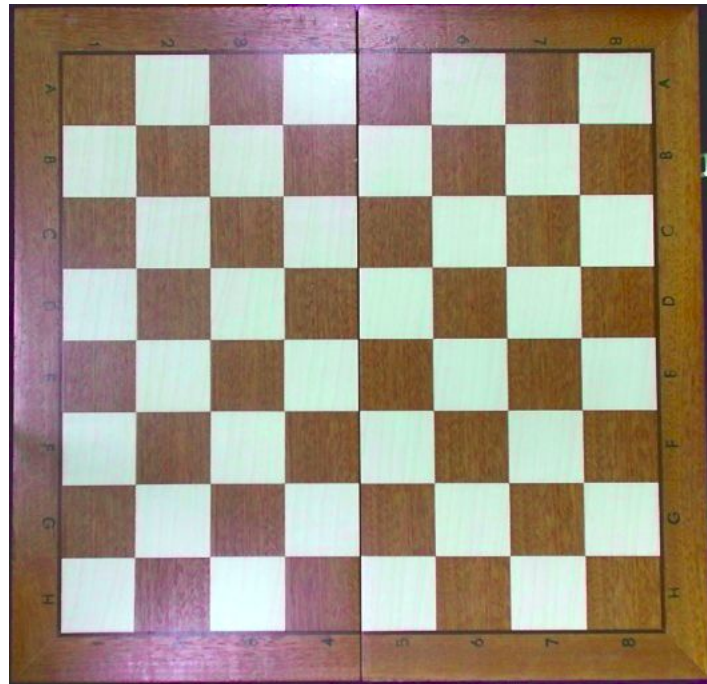
Detect the state of the chessboard and output the next move

How to do that?

- 1. Detect the chessboard in an image**
- 2. Detect the pieces that sit on it**
- 3. Pass the state of the chessboard to a chess engine for the next move**

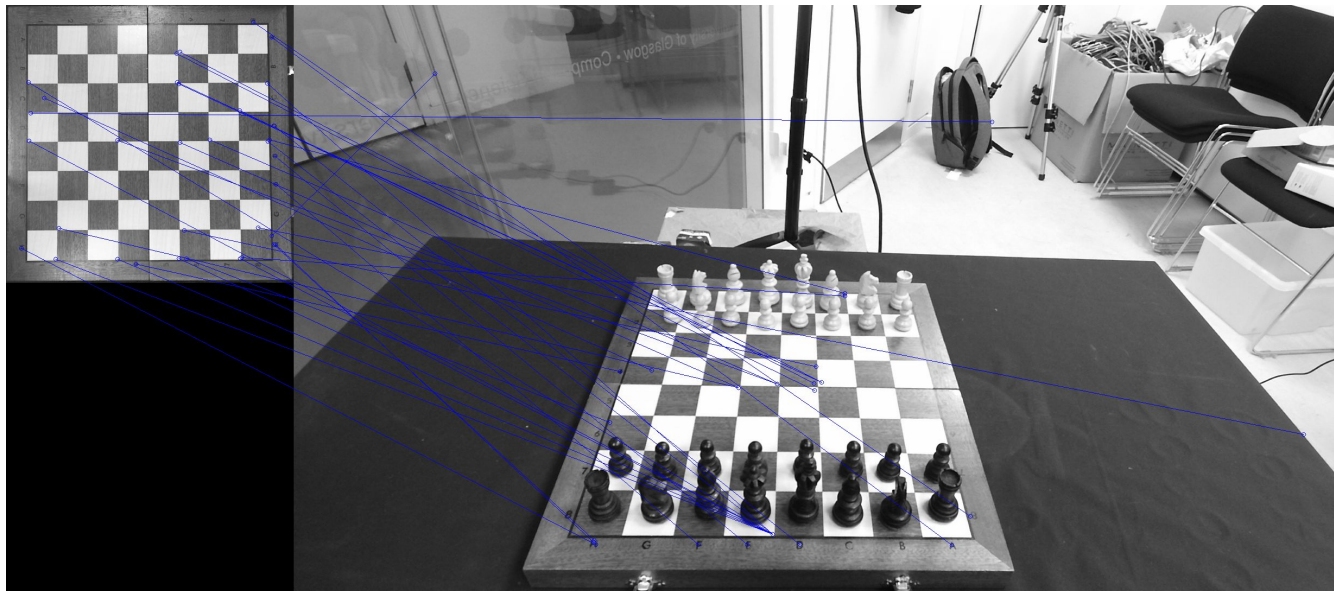
1- Detect the chessboard in an image

Feature matching (SIFT)



1- Detect the chessboard in an image

Feature matching (SIFT)



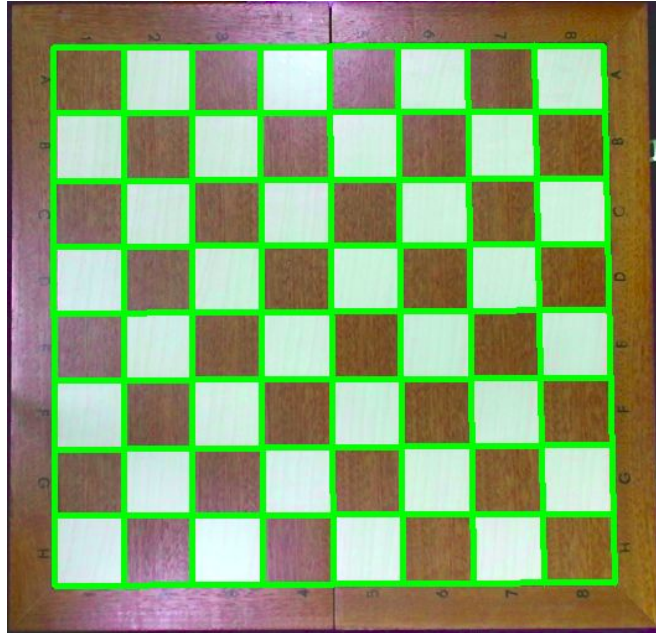
1- Detect the chessboard in an image

Homography



1- Detect the chessboard in an image

Segmentation



1- Detect the chessboard in an image

Segmentation



2- Detect the state of the chessboard

Sliding window



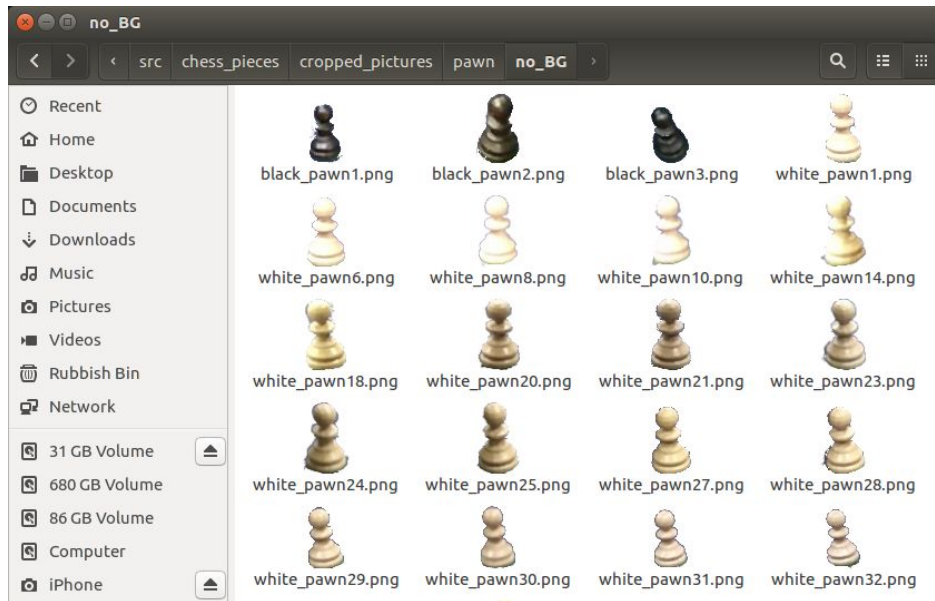
2- Detect the state of the chessboard

Piece classification

Training data:

Total = 260 samples for now

(later 1070 in the whole training set)



2- Detect the state of the chessboard

Piece classification

Features

SIFT

ORB

HOG

Classifiers

Support Vector Machine

Logistic Regression

K-Nearest Neighbours


... And many others ...

2- Detect the state of the chessboard

Everything was going pretty bad until...



2- Detect the state of the chessboard

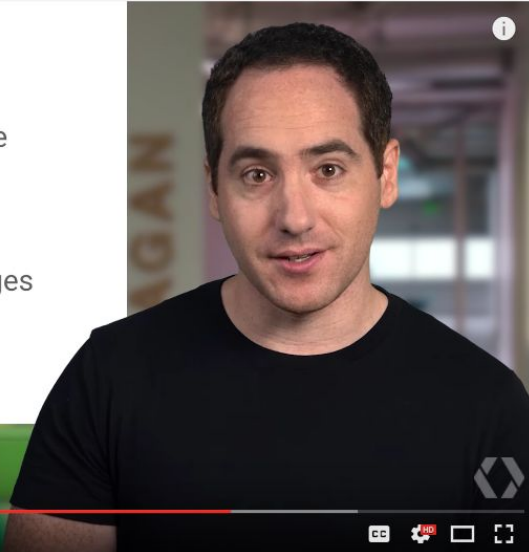


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Inception

- One of Google's best image classifiers
- Open source
- Trained on 1.2 million images



4:55 / 7:06

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92,100 views

101,833 views

2- Detect the state of the chessboard

Finally good results!



Prediction

king (score = 0.72568)
pawn (score = 0.16083)
queen (score = 0.08605)
bishop (score = 0.02181)
rook (score = 0.00539)
knight (score = 0.00024)

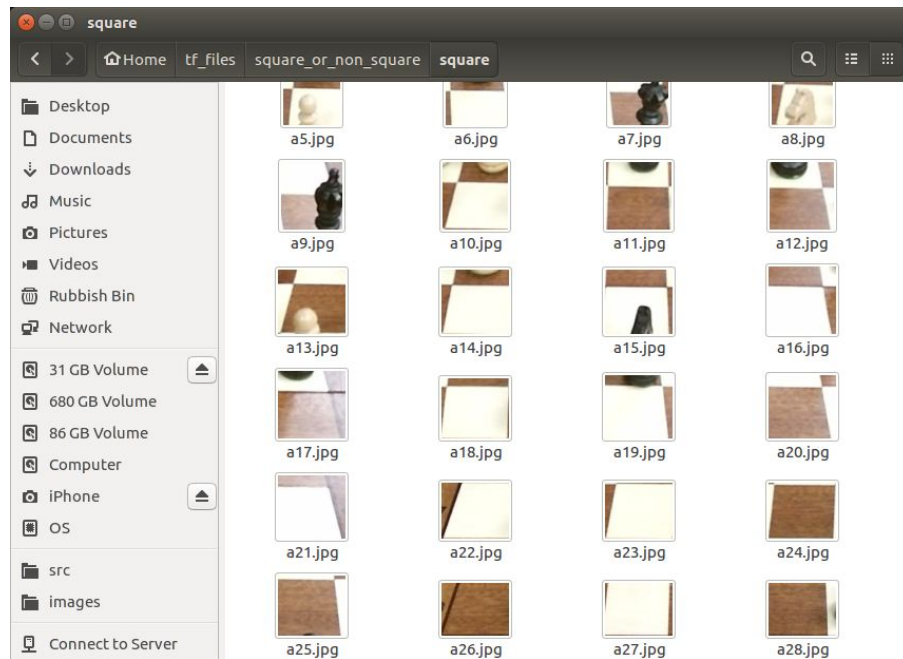
2- Detect the state of the chessboard

What now?

-> Empty square classifier

Colour classifier

Classify each square and
convert to FEN notation



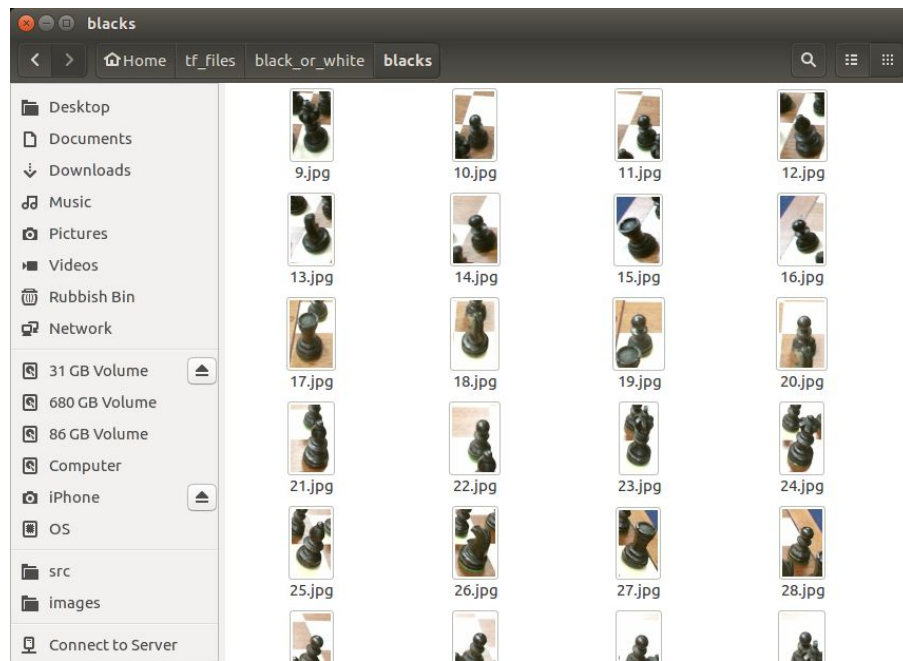
2- Detect the state of the chessboard

What now?

Empty square classifier

-> Colour classifier

**Classify each square and
convert to FEN notation**



2- Detect the state of the chessboard

What now?

Empty square classifier

Colour classifier

-> Classify each square and
convert to FEN notation

```
lorenzo@lorenzo-K501UX: ~/catkin_ws/src/chessboard_detection/src  
rook 0.993343  
knight 0.554791  
pawn 0.732899  
queen 0.489002  
king 0.882322  
bishop 0.690908  
knight 0.966274  
rook 0.9825  
  
pawn 0.54423  
pawn 0.893944  
pawn 0.997611  
pawn 0.847944  
pawn 0.738665  
pawn 0.943868  
pawn 0.671859  
empty 0.389606  
  
empty  
empty
```

rnbqkbnr/pppppppp/8/8/8/PPPPPPPP/RNBQKBNR w KQkq - 0 0

3- Output the next move

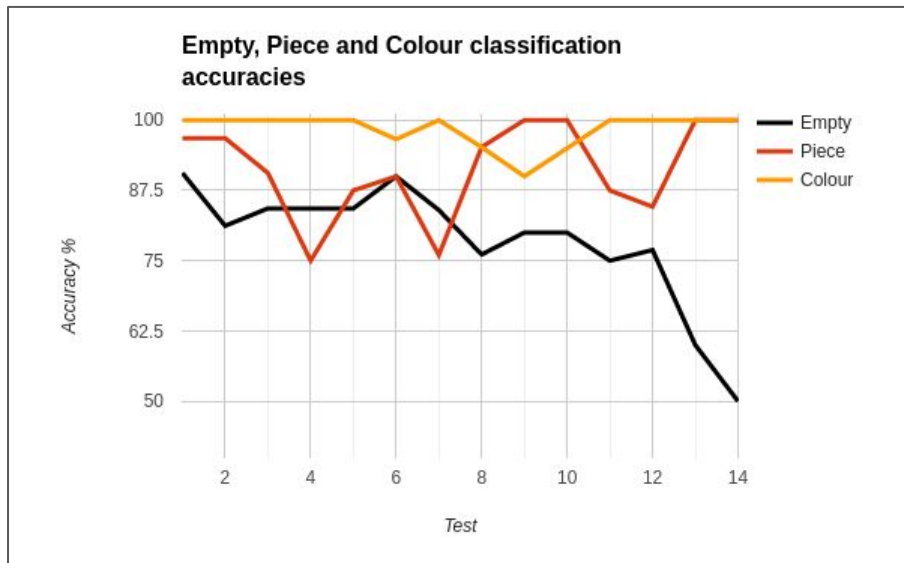
Finally, pass the state of the chessboard to the chess engine and output the next move

```
lorenzo@lorenzo-K501UX: ~/catkin_ws/src/chessboard_detection/src
pawn blacks
pawn blacks
pawn blacks
pawn blacks
pawn blacks

rook blacks
knight blacks
pawn blacks
king blacks
king blacks
empty
knight blacks
rook blacks

R N P Q K B N R
P P P P P P .
. . . . .
. . . . .
. . . . .
. . . . .
p p p p p p p
r n p k k . n r best move: g8h6
```

Evaluation



Empty	78.33
Piece	91.42
Colour	98.34

Thank you

Any questions?

