Mini-project group 17 (Computer vision/analysis chessboard)

Adam Hall, Bhargav Panchal, Zhiyang Cheng

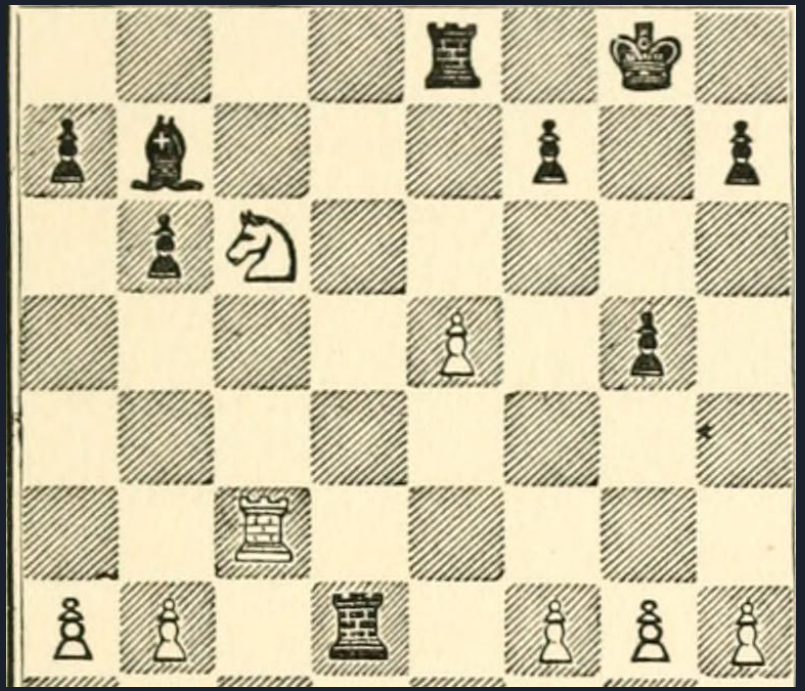
Intro

Computer Vision Chessboard

- Help people recognise stronger positions
- People can upload a picture of the chessboard and the program will suggest the best move

Goals and visions

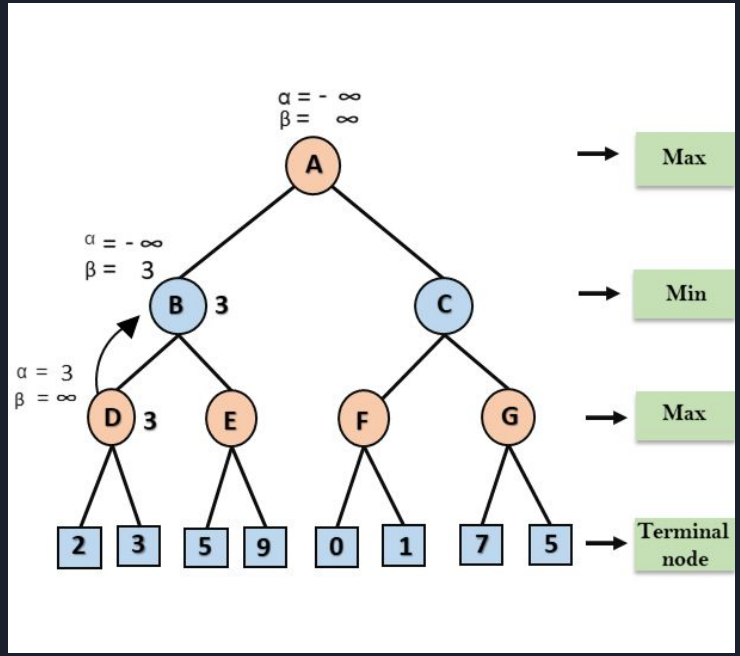
- Calculate a score for the given board state
- Find the best possible move for the given board state



Demo

Board Analysis

- Boardstate analysis based on python chess
- Alpha Beta pruning with reordering based on capturing
- Board evaluation based on quality of pieces on the board



https://www.javatpoint.com/ai-alpha-beta-pruning

Computer Vision

1. Chess Pieces Classification
2. Chess Location Detection

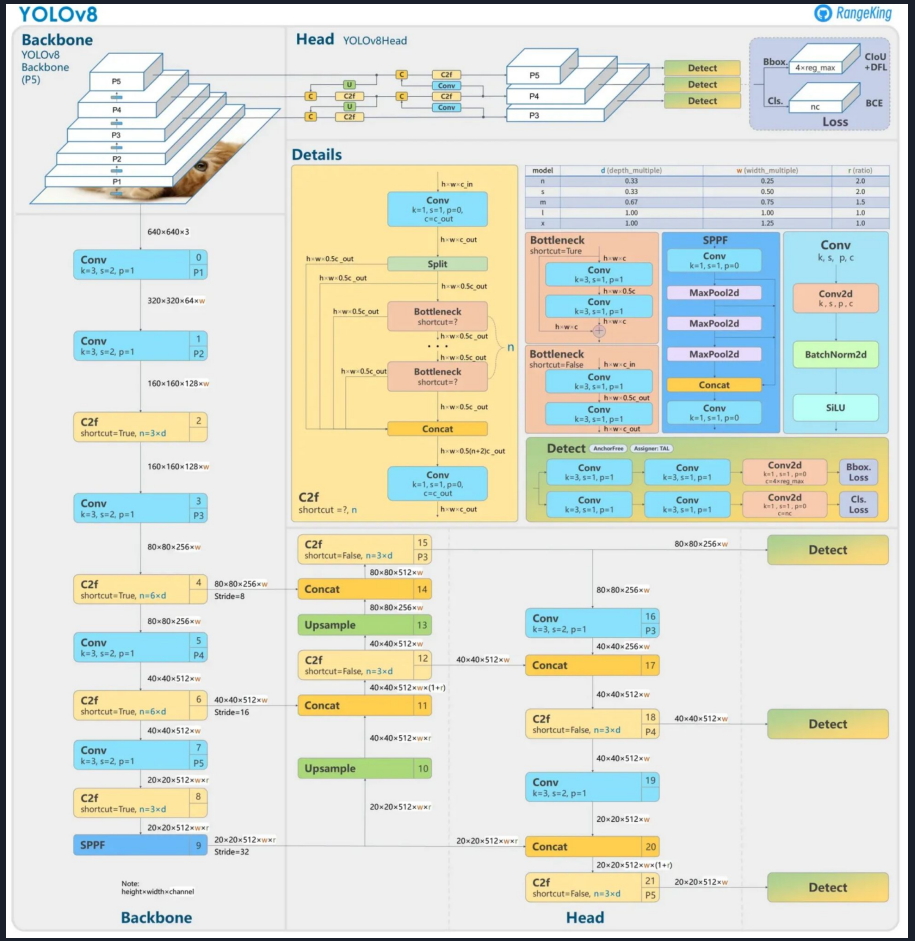
Deep learning

Using YOLO(You Only Look Once) v8 to Train the model

YOLO is based on CNN

Mean layers:

- Conv2D layers
- Batch Normalization layer
- Max Pooling Layers



Data Sets

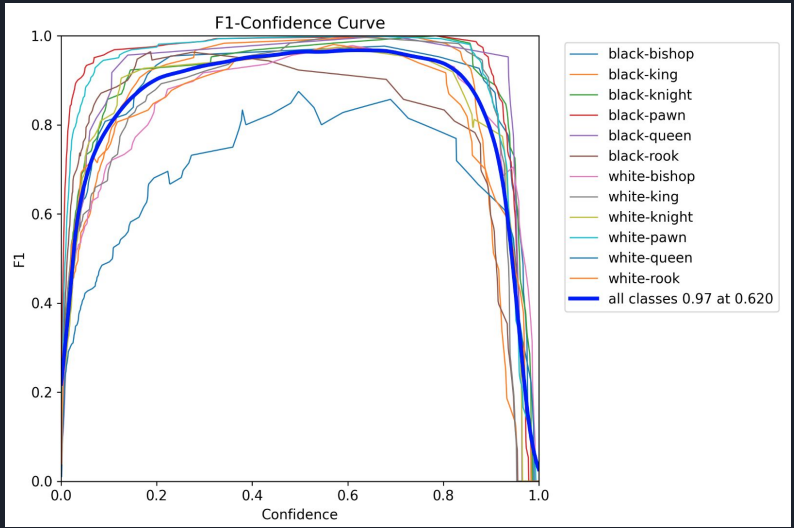
roboflow

Raw data set only contain 289 pictures

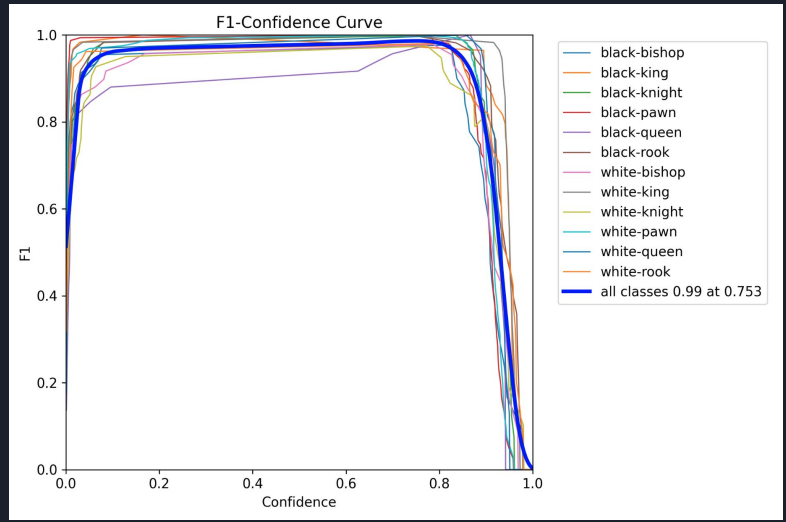
Data Augmenting

```
hsv_h: 0.015
hsv_s: 0.7
hsv_v: 0.4
degrees: 0.4
translate: 0.1
scale: 0.5
shear: 0.0
perspective: 0.0
flipud: 0.0
fliplr: 0.5
bgr: 0.0
mosaic: 1.0
```

Training Result



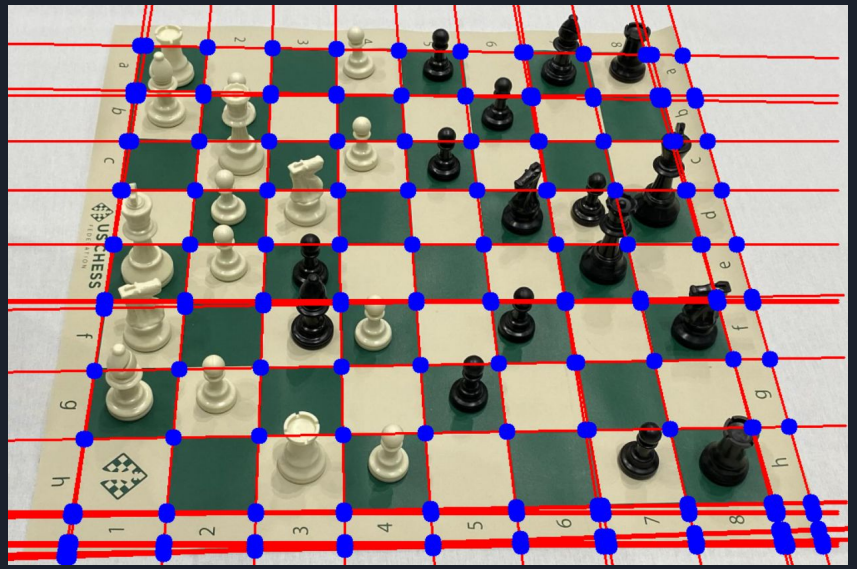
F1 Score After 10 epoch



F1 Score After 50 epoch

Chess Pieces Location Detection

Chess Square Detection



1. Use Hough Transform to detect lines
2. Initialize corner list
3. For each pair of detected lines:
   - Calculate and validate intersections as corners
   - Draw corners on image for visualization

Hough Transform

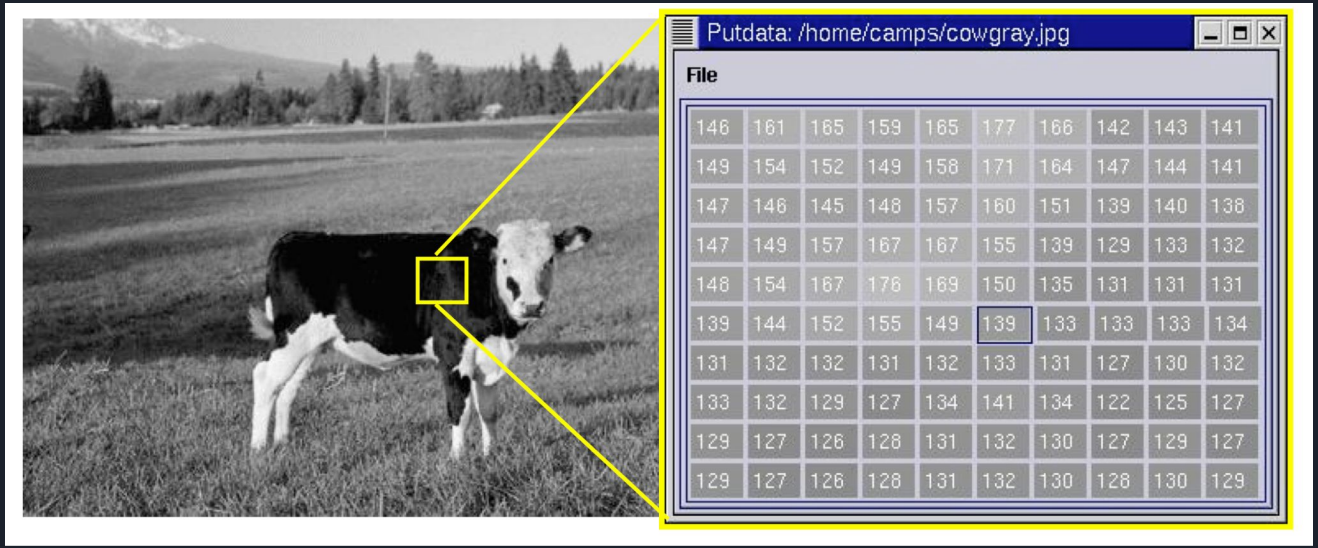
-Shape Detection Algorithm(Detecting Line)

- Edge Detection —----> Line Detection

- Canny Edge Detection

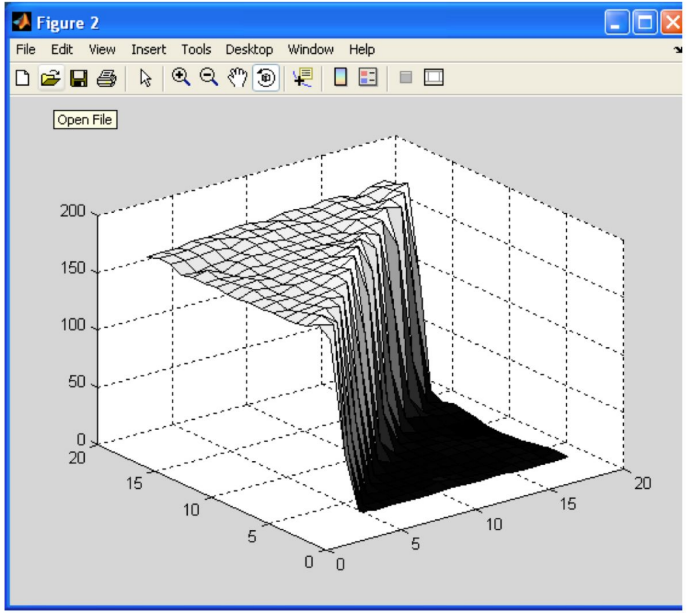
Canny Edge Detection

1. Convert Image to grayscale



Canny Edge Detection

2. Detecting edge based on the gradient intensity



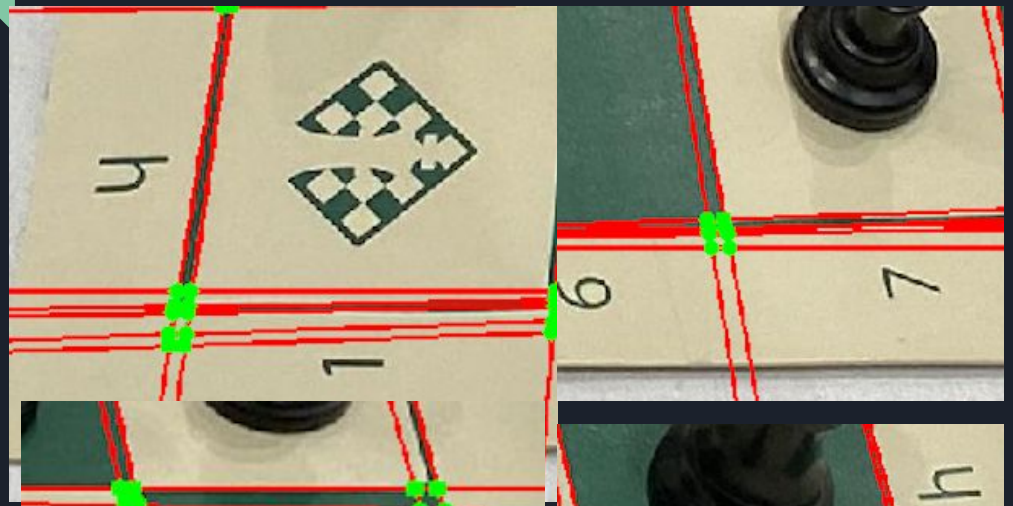
Hough Transform

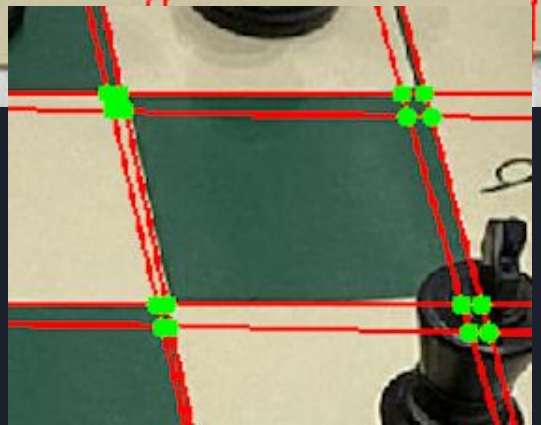
-Voting Procedure:

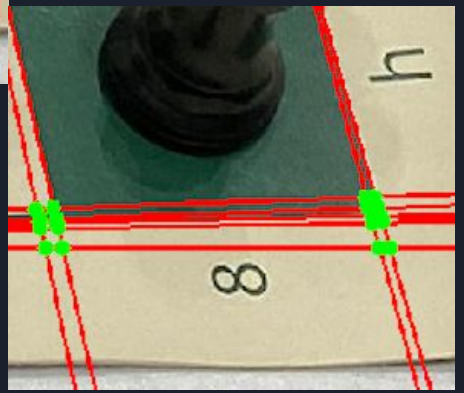
Each edge points will vote on the line they belonged

Lines have enough edge points will be consider as a valid line

Noise Points on the Line Detection





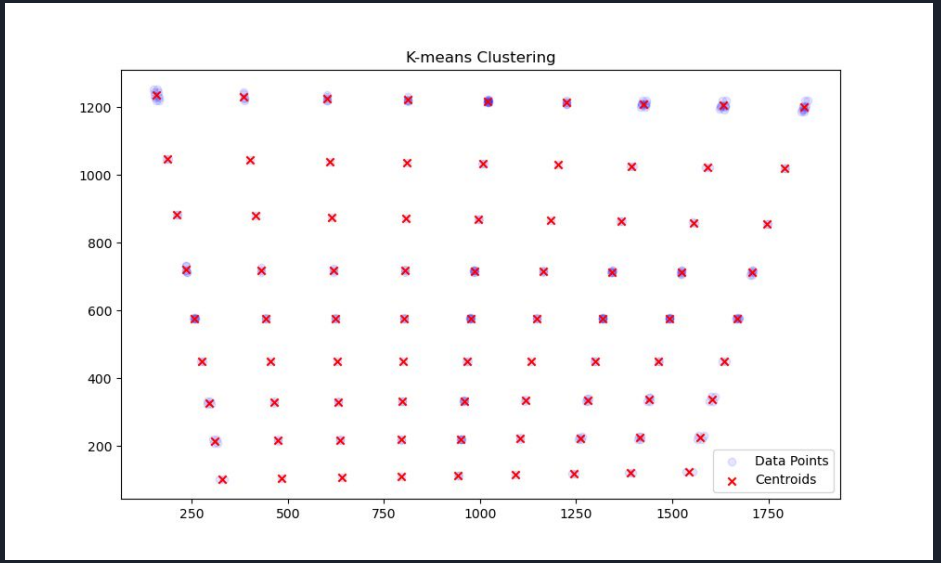


Clustering Algorithm

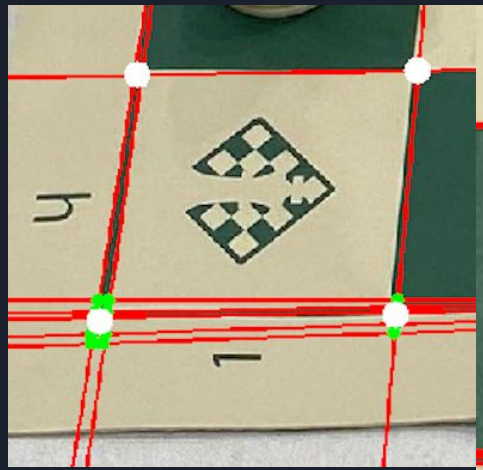
There will only have 81 intersection on the chess board

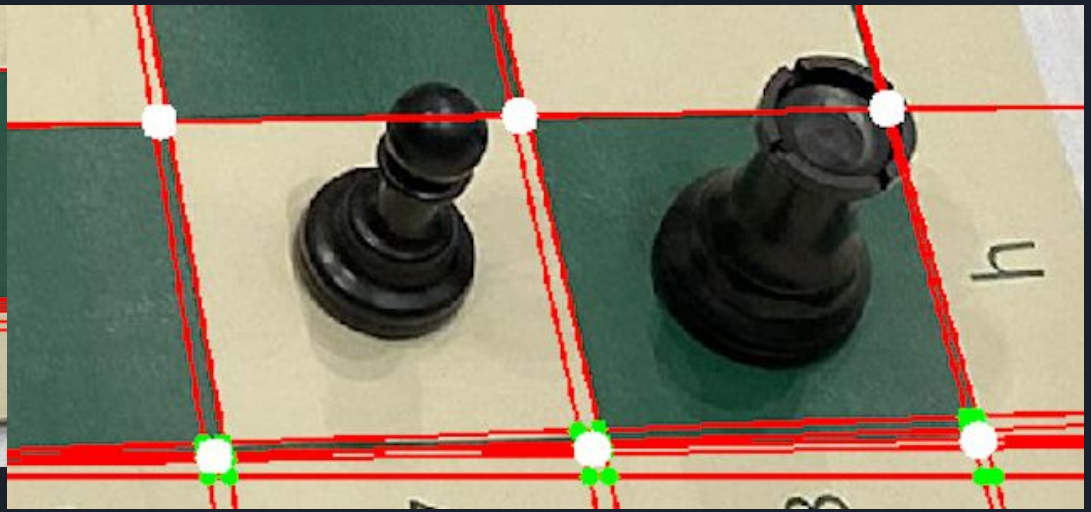
So I used K-means Clustering

81 Clusters.



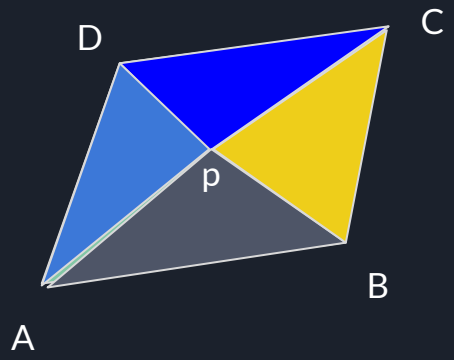
True Corners



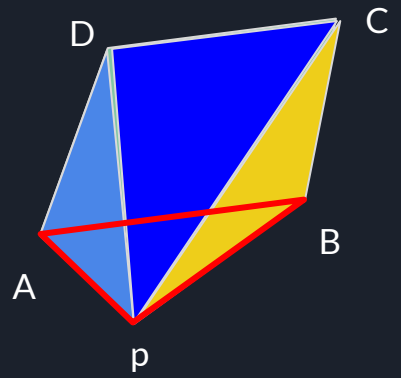


Assign Chess Pieces on Chessboard

1. Sort 81 corners in to a 9 x 9 array
2. Iterate through all quadrilateral in 9 x 9 array to assign the coordination of chess pieces on chessboard.

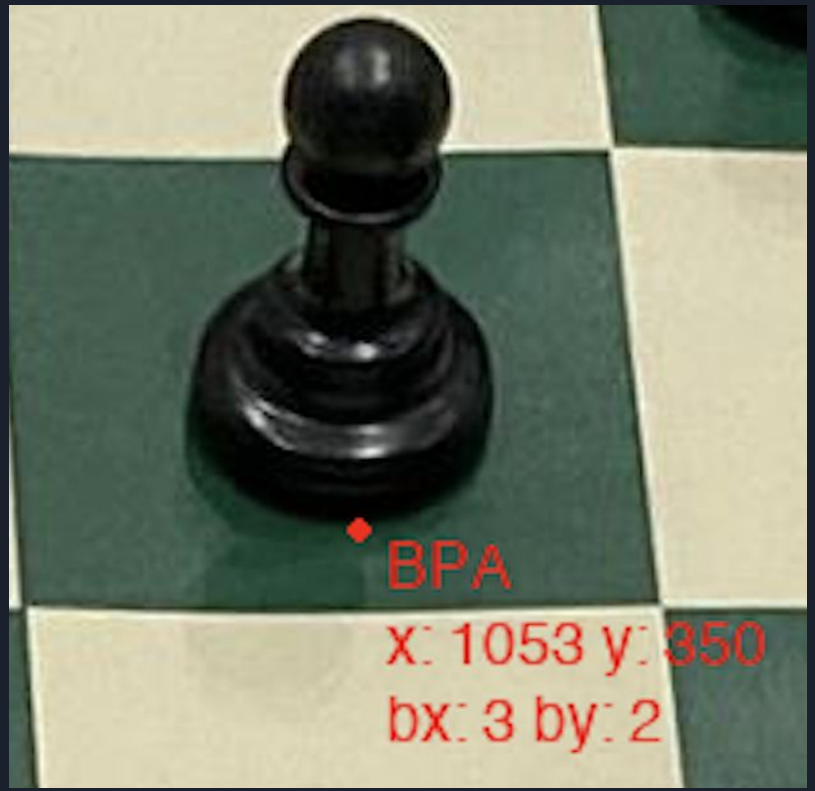


Point p inside the quadrilateral



Point p outside the quadrilateral

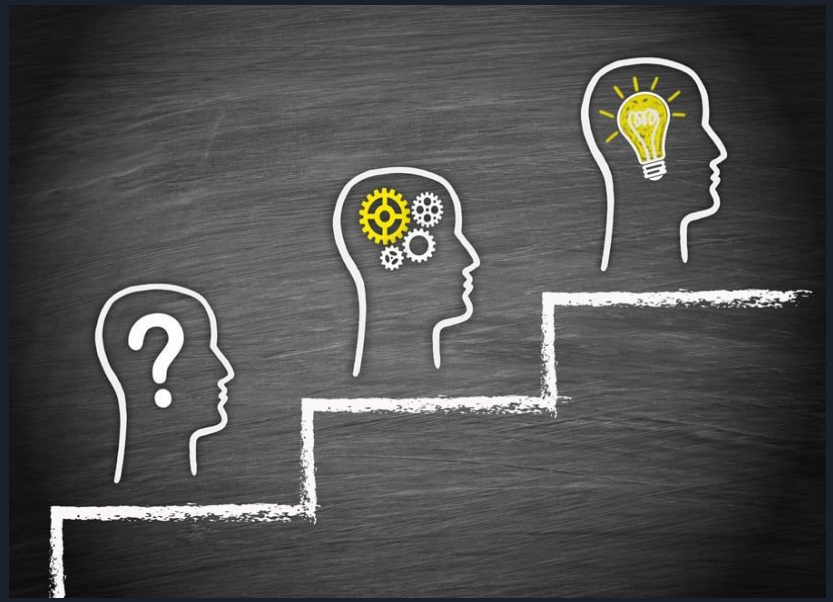
Assign Chess Pieces on Chessboard



What we learned

- Creating deep network and the troubles that may occur

- Chess board creation from scratch with efficient results is very difficult



https://www.futurelearn.com/info/courses/train-the-healthcare-trainer/0/steps/97612

What we learned

Increasing the batch size for training will improve the speed of training, but not always.