Chess Game Tracking Using Computer Vision and Deep Learning

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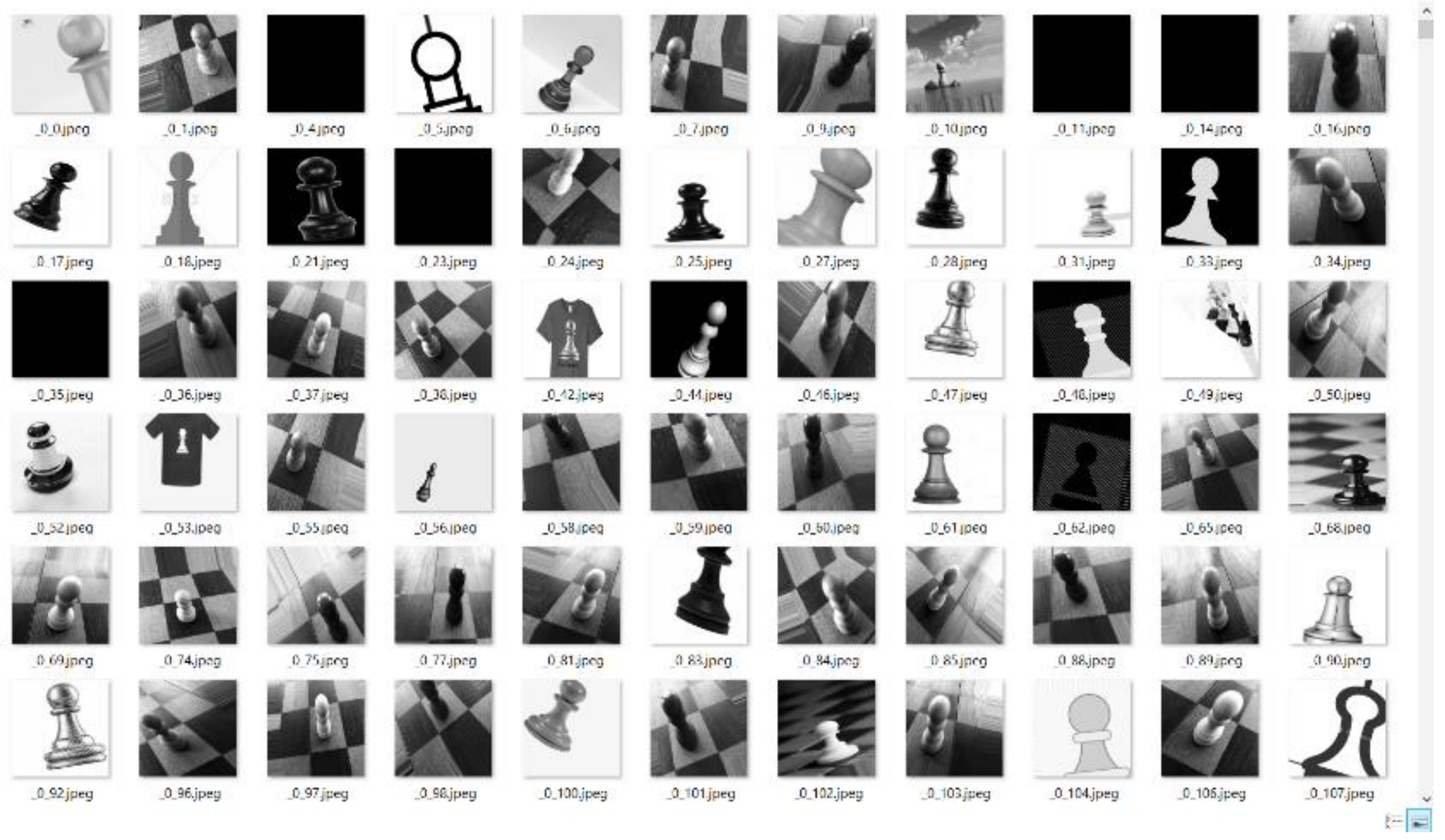
Piece Classification

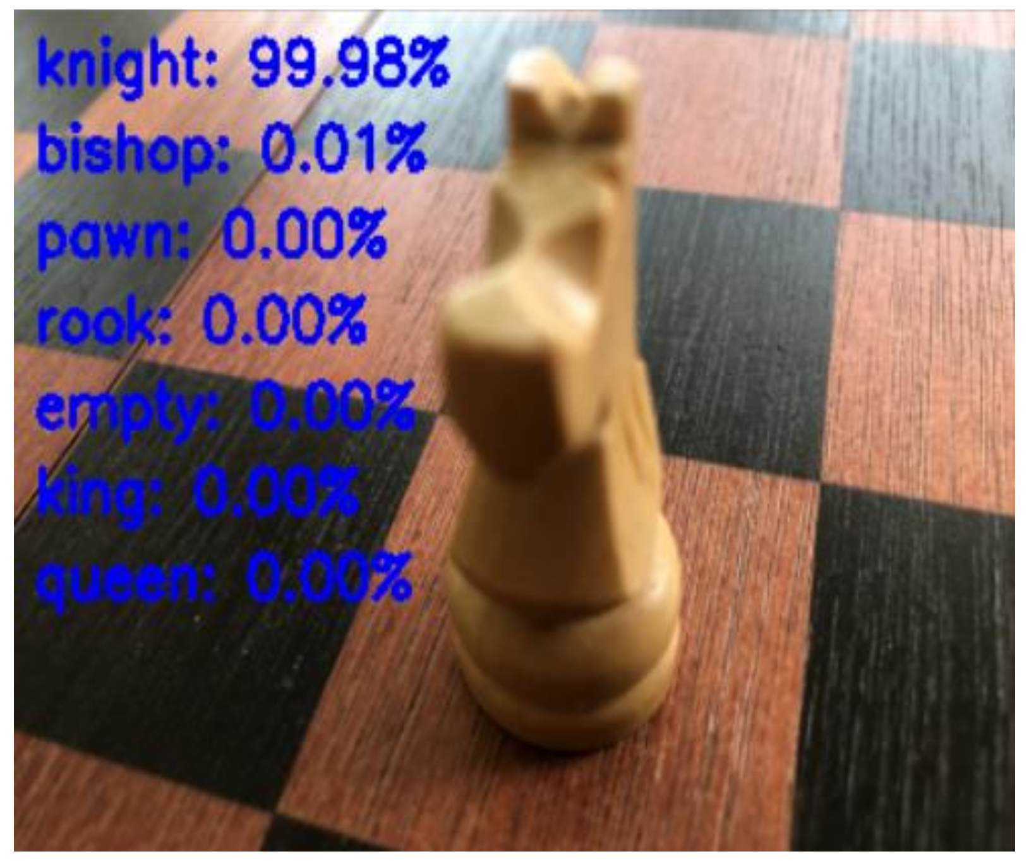
Database of pieces

For my project I generated a database of various chess pieces from Google Images and through manual collection. I packaged my training data into a pickle file for my convolutional neural network to train on.



Convolutional Neural Network

Using Keras, I created a convolutional neural network (CNN) to classify and distinguish pieces from each other. I used six convolution and max pooling layers with five dropout layers in between. The dropout layers ranged from 20% at the first layer up to 50% at the last one, going up by increments of 5% or 10%. The convolution layers are followed by a fully connected layer of 1000 neurons and then by a fully connected layer of 7 neurons. The convolution layers and the first fully connected layer used the RELU activation function and the last layer used the softmax activation function. After training my CNN to 92% accuracy, I saved it as an h5 file. I used my model to make a program that can classify pieces.

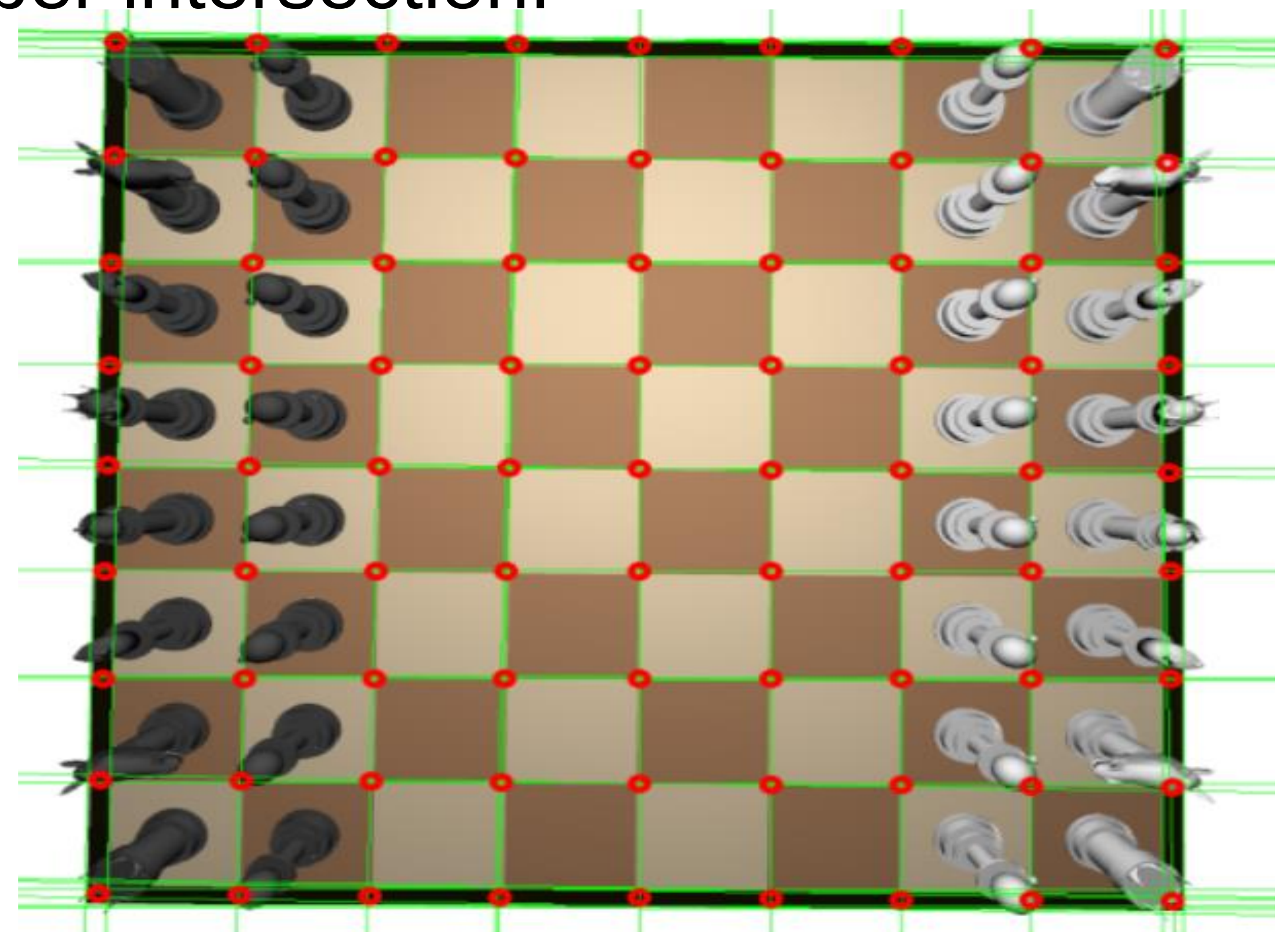


```
knight: 99.98%
bishop: 0.01%
pawn: 0.00%
rook: 0.00%
empty: 0.00%
king: 0.00%
queen: 0.00%
```

Board Detection

Corner Detection

To detect the corners of the chessboard, I used a method where I would find the intersections of perpendicular lines. This is so that I can find corners obstructed by chess pieces. I used the OpenCV canny edge detector and Hough lines transform to first find the lines of the chessboard. I then found the intersections of the perpendicular lines and applied a non maximum suppression to make sure there is one corner detected per intersection.



Perspective Transformation

I used a perspective transformation to project the angled chessboard onto a square. To do this, I first found the four far corners. Using these corners, I projected my board onto a plane. After that, I found the lines and corners of the new board so that I could crop out each square. I ran each of the 64 squares through my classifier to predict what piece was on which square. From here, I predicted the board.