Chess Image Recognition Using Traditional Computer Vision Techniques and Neural Networks

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Introduction

• Chessboard coordinates building: Grayscale → Gaussian blur → Hough transform → K-means clustering → Intersection.

• Chess piece classification: Separate the original image into multiple segments. Then try different vision networks such as VGG16, VGG19, ResNet and YOLO.

• Integrate the two steps and transform the original chessboard with pieces into digital positions.

Experiments

Figure 2: Grayscale and Gaussian blur.

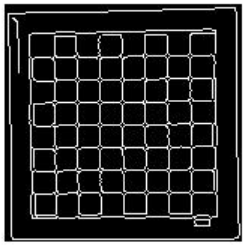

Figure 3: Canny edge detection.

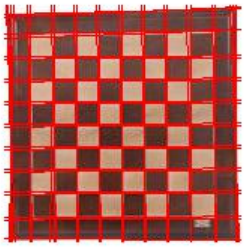

Figure 4: Hough transform.

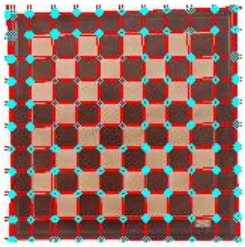

Figure 5: Clustering and intersections.

Fig 5: Final coordinates of a chessboard image.

Results

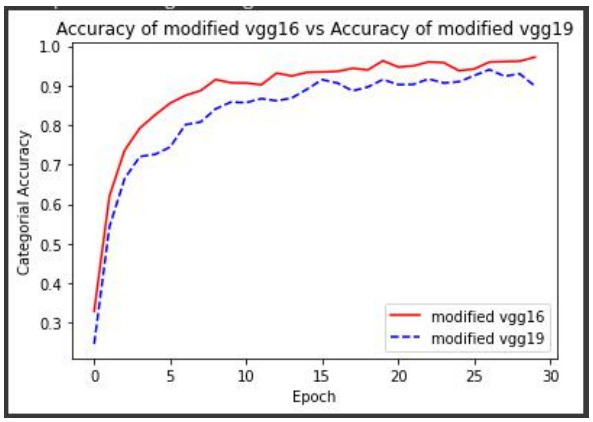

Fig 6: Performance comparing VGG16 and VGG19.

		Predicted classes													
		black bishop	black king	black knight	black pawn	black queen	black rook	empty	white bishop	white king	white knight	white pawn	white queen	white rook
Actual Classes	black bishop	18	0	1	0	0	0	0	0	0	0	0	0	1
	black king	1	17	0	0	1	1	0	0	0	0	0	0	0
	black knight	1	1	16	0	0	2	0	0	0	0	0	0	0
	black pawn	4	0	0	16	0	0	0	0	0	0	0	0	0
	black queen	5	0	0	0	14	0	0	0	0	0	0	0	1
	black rook	2	0	1	0	0	17	0	0	0	0	0	0	0
	empty	0	0	0	0	0	0	19	0	0	1	0	0	0
	white bishop	0	0	0	0	0	0	0	17	0	0	1	0	2
	white king	0	0	0	0	0	0	0	2	12	0	0	4	2
	white knight	0	0	0	0	0	0	0	1	0	14	1	0	4
	white pawn	0	0	0	0	0	0	0	2	0	0	18	0	0
	white queen	0	0	0	0	0	0	0	0	0	0	0	19	1
	white rook	0	0	0	0	0	0	0	0	0	0	1	1	18

Fig 7: The confusion matrix of the predictions on the validation data.

Reference

1. ChessVision: Chess Board and Piece Recognition. Jialin Ding. Stanford University.
2. Chess Piece Recognition Using Oriented Chamfer Matching with a Comparison to CNN. Youye Xie, Gongguo Tang, William Hoff.
3. Determining Chess Game State From an Image. Georg Wölflein, Ognjen Arandjelovi´c.