# Texas Hold 'em Hand Recognition and Analysis

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Texas Hold'em is a popular poker variant that has attracted a wide following.  While the game is easy to learn, it is difficult to master. Because there are 1,326 possible starting hands, and 19,600 possible flops for any given starting hand, an intuitive understanding of hand strength is typically built upon the experience gleaned by playing thousands of hands.

Our goal is to ease this learning curve by providing statistical insight into the strength of the player's position at any point in the hand. This information will help even novice players gain a deeper understanding of the game.

This learning tool will take the form of an android application that uses the device's internal camera to recognize cards and display statistics in real time.

At the core of this project lies card detection and recognition. A brief survey of the literature uncovered many techniques for accomplishing this task. We expect to use contour detection to determine the location and orientation of each card. Next, the card image will be rotated to a common vertical orientation. Both of these methods are described in [1]. Now, we will determine whether the image is of a face card by counting edge pixels within the center of the card as Zutis and Hoey employed in [2]. To find the suit we will use color histogram information calculated across the entire card as in [3]. This will tell us if the card is of a black or red suit. We can further classify the suit by examining the upper left and bottom right regions of the card. The rank of the card can be found by using region counting for value cards and key point matching for facecards. We will exploit OpenCV [4] as much as possible to execute these image processing techniques.

Our application will need to recognize both flopped cards lying unobstructed on a table and hole cards. In the latter case, the player will only show the upper corner of the cards. This could be problematic as previous card recognition algorithms relied upon the full card. Optimally, this challenge will be mitigated by the close proximity of the camera to the hole cards.

[1].    C. Zheng, R. Green, 'Playing Card Recognition Using Rotational Invariant Template Matching' *Proceeding Image of Vision Computing New Zealand 2007,* pp. 276-281, Hamilton, New Zealand, December 2007

[2].    K. Zutis, J. Hoey, 'Who's Counting?: Real-time Blackjack Monitoring for Card Counting Detection' http://www.computing.dundee.ac.uk/staff/jessehoey/papers/zutis_hoey_blackjack09.pdf

[3].    G. Hollinger and N. Ward, "Introducing computers to blackjack: Implementation of a card recognition system using computer vision". http://www.andrew.cmu.edu/user/gholling/home/IEEEHollinger.pdf

[4].    Open Source Computer Vision http://opencv.willowgarage.com