

Texas Holdem Poker state recognition using visual information

EE368 Digital Image Processing

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1 General Idea

In board games or card games, artificial intelligence is often used to simulate an opponent or to calculate the optimal moves for the player to win. Most of these programs, however, rely on a known game state and are often implemented for digital games. Our idea is to implement an interface that can use a camera to determine the state and the flow of a game of live Texas Hold'em Poker.

2 Challenges

2.1 Perspective

Depending on the implementation, the perspective will play a huge role in our application. If it's going to be used in a live Poker robot, the camera would most likely be placed on the head of the robot, making the perspective of the table similar to a human's. However, if the application would be used to cheat in live Poker (we don't encourage this, of course), the camera would probably have to be hidden in a shirt button or a tie pin, making the perspective a lot more difficult.

2.2 Cards and chips

The first challenge will be to detect and recognize all cards on the board and in the hand. This includes recognizing many different decks and structures of card faces. These two sets of cards (board and hand) then have to be separated, probably using the perspective or distance as the biggest factors. For the application to determine the exact state of the game, it must be able to detect the back of the cards and the stacks of chips to determine which players are still in the game, for example. However, due to the great variety of chip values and possibly also card decks, the chip colors and their corresponding values will probably have to be pre-entered.

2.3 States

There are lots of different indications on what state the game is in. To recognize when a new hand is dealt or when the game is over, will be one of our major challenges. We will for example have to determine how many more cards will turn up that can make the player's hand better and whether the player can check, call or raise.

3 Scalability

We realize that the full implementation of this application will not fit in the scope of this class. On the other hand, the different functionalities can easily be inserted into a dependency tree and we can decide on the different priorities.

3.1 Decks

Instead of being able to detect any type of cards out of the box, the application can assume some knowledge about the deck. One solution could be that the application assumes there is only one deck in the world and the layout of the cards is constant. Another solution would be to take a picture of some different cards of the deck before each game, for the application to recognize the layout of the deck to be used.

3.2 Game State

The first implementation will probably include the user entering the game state and the application simply telling what to do next. Then we can add states to be automatically detected, or easier rules for setting the state.

3.3 Game Play vs. Local

To start with, the application could concentrate on the local game, i.e. what cards are on the hand, what cards are on the table and what the probability of getting a certain hand is.

4 Platform

In order to make this application flexible and mobile, we will build it for Android devices. If the application is not complete and able to take decisions only based on the information it has, an early solution could be to use Text-to-Speech to simply read the probabilities of certain hands to the user.

5 Prior Research

A common way to extract the suit and rank of images of playing cards [1] [2] is to first find the corners of a playing card and then find a rotation which aligns the images properly. Once this has been done, the corners contain all information about the rank and suit of a playing card. In order to extract the rank from the corners of the card, at least one character has to be recognized. This should, however, not be a problem since there is plenty of research on optical character recognition [3].

References

- [1] Martins, Paulo, Lus Paulo Reis, and Lus Tefilo, *Poker vision: playing cards and chips identification based on image processing* 2011.
- [2] Zheng, Chunhui, and Richard Green, *Playing card recognition using rotational invariant template matching* 2007.
- [3] Rajavelu, A., Mohamad T. Musavi, and Mukul Vasant Shirvaikar, *A neural network approach to character recognition* 1989.