Card Game with Augmented Reality

Summary

The main objective of this project is to develop an application to assist the playing of a simple card game, like "whist" [1] or "hearts" [2], played by 2 or 4 players, using augmented reality. The application must acquire an image of the cards played on the rounds of the game, placed on a table, and "announce" the result of the each round, by augmenting the acquired image with some information. At the end of the game, the image must be augmented with a virtual 3D cup that has the identification of the winner(s) of the game.

Figure 1 - Examples of acquired images

General aims

To apply the knowledge about Augmented Reality techniques, acquired in the Virtual and Augmented Reality course, namely, image analysis, recognition and registration techniques, using the OpenCV library [3] as a development tool.

Specification

The application to be developed must allow:

- the acquisition of a an image of a table top, where the cards played in each round are placed (2 or 4, depending on the number of players), using a computer connected camera;
- the segmentation of the cards (2 or 4, depending on the number of players);
- the recognition of each one of the cards; ideally, some degree of superposition among the cards show be allowed;
- the announcement of the result of a round (winner or looser, depending on the rules of the chosen game), that consists of: a) drawing a rectangle over the border of the card of the winner/looser, b) writing the word "WINNER"/"LOOSER" over the center of the corresponding card; the announcement must be done only after all the cards are placed on the table;
- the announcement of the result of the game, by drawing a virtual 3D cup, at the center of the table; the virtual cup is just a parallelepiped, on the top of which there must be a photo/picture of the winner/winners; the parallelepiped and photo/picture must be drawn in perspective view, as if they were effectively placed on the table; a reference marker may be used for the cup.

The conditionning of the environment is acceptable, e.g., choosing an intensity or color of the table top that makes it easy the segmentation of the cards, and adapting the lighting and the position of the camera in order to obtain images as good as possible, taking into account the image processing and analysis operations that must be done in the following.

Ideally, the application should be able to recognize all the cards from a typical deck of 52 cards (see **cards_normal.zip**, available in Moodle), but if you experience hard difficulties for the recognition, you may use a simpler set of cards (see **cards_simple.zip**, available in Moodle).

An additional application may be needed to create a reference database of cards.

Notes on the development, submission and evaluation

- The work must be done by groups of 3 students.
- A short report (max. 4 pages) must be submitted, including:
  - any additional specifications (if needed);
  - the description of the proposed global solution, including illustrations of the results of the main intermediate steps;
  - relevant comments about the efficacy of the used methods, describing the main problems that were encountered and proposed solutions;
  - the status of the proposed solutions and the degree of fulfillment of the aims;
  - an analysis of performance of the developed system, illustrated with some results.
- The code, with meaningful comments, must be presented in a report annex. Other annexes may be included to show additional results that do not fit in the main report. A short user's manual of the application(s) must also be included in annex.
- The code, report and any additional data necessary to run the applications (images and other data) must be compressed into a "zip" file and submitted at the course Moodle page, until 2022/Oct/24, at 23h55m.
- The results of the project will be graded in the following way:
  - card segmentation: 20%
  - card recognition: 30%
  - card recognition with partial superposition of cards: 10%
  - image augmentation (winner/looser of a round, and virtual 3D cup): 20%
  - report: 10%.
  - interface and creativity: 5%
  - timely submission: 5%

References

1. "Whist" card game, https://playingcarddecks.com/blogs/how-to-play/whist-game-rules
2. "Hearts" card game, https://playingcarddecks.com/blogs/how-to-play/hearts-game-rules
3. OpenCV library, https://docs.opencv.org/4.6.0/index.html