Static Hand Pose Recognition

Summary

The objective of this work is to develop an application to recognize static hand poses, representing the digits from 0 to 5, using computer vision techniques applied to images similar to those in figure 1.

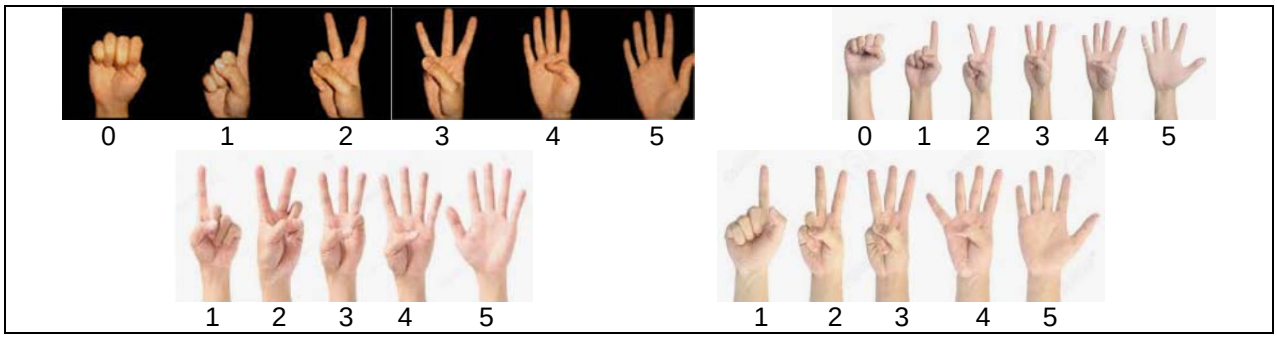

Figure 1 – Examples of hand poses for representing digits 0-5

General aims

To apply the theoretical knowledge about Image Processing and Analysis, acquired in the Computer Vision course, namely, feature detection and segmentation techniques, using OpenCV library as development tool.

Specific aims

The program must (basic version - 80% of the grade):

- allow the acquisition of a color image containing one hand, using a computer connected camera, or the selection of a pre-acquired image;
- segment the acquired image, isolating the hand from the background;
- recognize the hand pose from a set of admissible poses, using different datasets.

For the basic version, you may use some simplifying assumptions such as:

- there is only one hand in the acquired image;
- the image of the hand is acquired in almost frontal view (the palm is facing the camera, as in fig. 1);
- the arm is in vertical position (pointing upwards, as in fig.1);
- the background is almost constant;
- the hand occupies a significant portion of the image;
- the hand is not occluded by other objects.

Possible improvements (20% of the grade): remove one or more of the above referred simplifying assumptions, for example: deal with two hands in the same image, deal with arms in horizontal position, recognize other poses, deal with cluttered background, … (some examples in fig. 2).

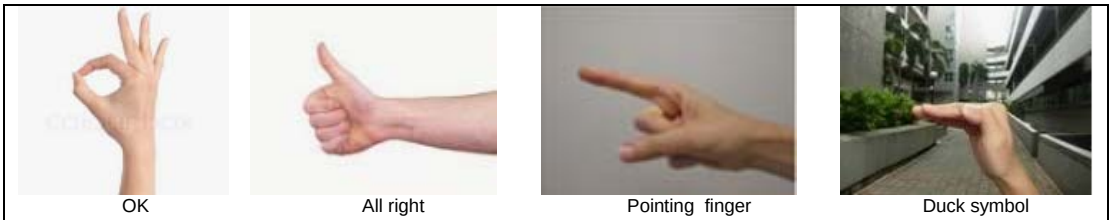

Figure 2 – Possible poses to be recognized in an improved version

Project development, report and delivery

The work must be done by groups of 3 students.

A short report (max. 3 pages) must be delivered, including:

- any additional specifications (if needed);
- the description of the proposed global solution;
- relevant comments about the efficacy of the used methods, describing the main problems that were encountered and any proposed solutions;
- the status of the proposed solution and the degree of fulfillment of the aims;
- an analysis of performance of the proposed method, illustrated with some results.

The code, with meaningful comments, must be presented in annex.

The work must be submitted at the Computer Vision page, in Moodle, until the end of 2018/Nov/2nd.

References

- Hand Gesture Recognition for Human-Machine Interaction, E. Sánchez-Nielsen, L. Antón-Canalís, M. Hernández-Tejera, Journal of WSCG, Vol.12, No.1-3, ISSN 1213-6972 WSCG'2004, February 2-6, 2003
- Region Based Hand Gesture Recognition, A. Birdal, R. Hassanpour, WSCG'2008 Communication papers, pp.1-8
- Hand Gesture Recognition for Human Computer Interaction, M. Panwar, P.S. Mehra, Proceedings of the 2011 International Conference on Image Information Processing (ICIIP 2011)
- A Novel Fnger and Hand Pose Estimation Technique for Real-time Hand Gesture Recognition, Y. Zhou, G. Jiang, Y. Lin, Pattern Recognition no. 49, 201, pp. 102-114
- Vision Based Hand Gesture Recognition for Human Computer Interaction: a Survey, S. S. Rautaray,A. Agrawal, Artif Intell Rev, no. 43, 2015, pp. 1–54

IMPORTANT NOTES:

1) *some of the references above (namely the survey paper) deal with gesture recognition; others present some basic techniques; in spite of that, they may have some helpful information or references on hand pose recognition, which is the scope of your project.*
2) *these references are available at VCOM site, in Moodle-U.Porto*