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Comparative Study of Skeletonization and Radial Distance Methods for Automated Finger Enumeration

Authors : Mohammad Hossain Mohammadi, Saif Al Ameri, Sana Ziaei, Jinane Mounsef

Abstract : Automated enumeration of the number of hand fingers is widely used in several motion gaming and distance control applications, and is discussed in several published papers as a starting block for hand recognition systems. The automated finger enumeration technique should not only be accurate, but also must have a fast response for a moving-picture input. The high performance of video in motion games or distance control will inhibit the program's overall speed, for image processing software such as Matlab need to produce results at high computation speeds. Since an automated finger enumeration with minimum error and processing time is desired, a comparative study between two finger enumeration techniques is presented and analyzed in this paper. In the pre-processing stage, various image processing functions were applied on a real-time video input to obtain the final cleaned auto-cropped image of the hand to be used for the two techniques. The first technique uses the known morphological tool of skeletonization to count the number of skeleton's endpoints for fingers. The second technique uses a radial distance method to enumerate the number of fingers in order to obtain a one dimensional hand representation. For both discussed methods, the different steps of the algorithms are explained. Then, a comparative study analyzes the accuracy and speed of both techniques. Through experimental testing in different background conditions, it was observed that the radial distance method was more accurate and responsive to a real-time video input compared to the skeletonization method. All test results were generated in Matlab and were based on displaying a human hand for three different orientations on top of a plain color background. Finally, the limitations surrounding the enumeration techniques are presented.

Keywords : comparative study, hand recognition, fingertip detection, skeletonization, radial distance, Matlab
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