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RESEARCH ON CHINESE SIGN LANGUAGE RECOGNITION BASED ON SKELETON FEATURES

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Abstract. The hearing-impaired people in China account for about 20% of the world 's hearing-impaired people, and increase year by year. Chinese sign language is an important auxiliary tool for communication between the hearing impaired and the outside world. Finger language is a part of sign language, the number of it is not large and it is easy to learn and remember. Therefore, this thesis takes Chinese letter sign language as the research object, studies Chinese letter sign language in different backgrounds, and researches the skeleton extraction of gesture images, the presentation and recognition of skeleton descriptors based on computer vision.

The main research content of this thesis is Chinese letter sign language recognition based on skeleton features. Firstly, gestures are extracted. Secondly, on the basis of the extracted binary image of gestures, an improved gesture skeleton extraction method based on distance change is proposed to make the extracted skeletons have connectivity.

Keywords*:* sign language recognition; skeleton; probabilistic neural network.

Introduction

The main research content of this thesis is Chinese letter sign language recognition based on skeleton features. Firstly, gestures are extracted. Secondly, on the basis of the extracted binary image of gestures, an improved gesture skeleton extraction method based on distance change is proposed to make the extracted skeletons have connectivity; then, an improved invariant moment is proposed to describe the skeleton; finally, probabilistic neural network is used to classify the value of the obtained invariant moment to achieve the purpose of recognizing gestures. To sum up, this thesis mainly conducts research work from the following two aspects:

(1) A gesture skeleton extraction method combining distance transformation and morphological watershed algorithm is proposed. This method uses the distance field and watershed algorithm to obtain the skeleton potential map containing the gesture skeleton, uses the active contour model to determine the skeleton endpoint, and trims the redundant skeleton through the A * algorithm to obtain the final skeleton. Experimental results prove that the skeleton obtained by this method not only solves the problem of disconnection of the skeleton extracted by the skeleton extraction method based on distance transformation, but also ensures the single pixel of the skeleton and conforms to the target topology.

(2) An improved invariant moment is proposed to describe the gesture skeleton and apply it to the field of gesture recognition. First, it proves that Hu invariant moments are not fully scale invariant in digital images. Then, on the basis of Hu invariant moments, circumvent the limited invariant moments, eliminate their regional factors, and derive Iimproved invariants moment describing the skeleton of the gesture, and finally combined with probabilistic neural network for sign language recognition. The experiment proves that the improved invariant moment proposed in this thesis changes the eigenvalue of the gesture skeleton when it rotates and scales. The accuracy is improved by 5% when it is combined with probabilistic neural network for sign language recognition.

Sign Language Recognition Research

Sign language is a "language" spoken by people who are hard of hearing or otherwise unable to communicate verbally. In sign language recognition research, researchers usually use different kinds of algorithms to recognize sign language. Sign language can not only be expressed through hand movements alone, but also can be expressed with the help of external things, such as directions. Generally, sign language recognition can be divided into static sign language

recognition and dynamic sign language recognition. Static sign language recognition refers to the recognition of the information expressed by individual sign language gestures at a certain point in time; compared with static sign language recognition, the recognition of dynamic sign language is more complicated, and dynamic sign language recognition needs to recognize the information expressed by gestures within a certain period of time , for dynamic sign language recognition, the information to be expressed must be recognized under the premise of correctly capturing dynamic gestures.

Gesture Segmentation

Compared with the computational complexity of converting an RGB image to the HSV color space, the computational complexity of converting an RGB image to the YCbCr color space is lower.[1] The conversion method of YCbCr is more direct and convenient, and there is no need to consider the calculation method according to the situation. Also, in the YCbCr color space, the distribution of skin tones is tighter and less sensitive to light. Therefore, in this article, the RGB image is converted to the YCbCr color space.[2]

Basic Idea Of Skeleton

Regarding the skeleton, it can be approximately regarded as the central axis of the object. After the skeleton theory was proposed, because the skeleton of the object is not only concise and clear, but also can represent the topological structure of the object very well, especially when there is a cavity inside the object (such as a water cup with a handle), the contour information cannot represent the water cup and the handle. There are holes between them, and in the case that the topological structure of the object can also be represented, the number of pixels required by the skeleton is much less than the number of pixels required by the outline, so the skeleton is often applied to life Not only the image field, but also other fields, such as: archaeology [3], literature [4], sorting of materials [5] and information storage and retrieval [6], etc.

Skeleton Recognition

Skeleton recognition is the last step of object recognition.Comparing the processed skeleton with the skeleton in the library,it can retrieve the graphics corresponding to the graphics library by the matching degree of object skeleton. Therefore, the key step of shape retrieval is to perform effective bone matching[7].At present, there are several common skeleton matching methods,such as skeleton graph matching based on path similarity,skeleton matching based on clustering and affine invariant of image feature matching algorithm.

Conclusion

The research in this paper adopts sign language recognition based on computer vision: the image of sign language gestures is captured by the camera, the image is preprocessed to extract the binary image of the gesture, and then the skeleton features of the gesture are extracted, and the skeleton features of the gesture image are extracted using the improved invariant moments. It is represented by feature quantity, and finally, the calculated feature quantity information is classified (that is, recognized) by using a probabilistic neural network.

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