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The Application of Imaging Processing Technologies in Evaluation of Stroke Recovery Stages

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Upper-extremity movement has been used to indicate the degree of recovery success from the stroke by therapists. More and more researchers study human motion analysis from computer version. The purpose of this study then is to develop a motion image analysis system similar to VICON but with low cost image processing method and simplified 3D setting to study stroke patients' motion analysis. With the development of classification algorithm, stroke patients can be categorized according to their degree of affection.

There are 20 stroke patients participating in this study. The average age of the subject is 58.8; the average duration of stroke affection is 15.4 weeks. In addition, there are nine normal participants in the study, too. The age range is from 21 to 25. All participants understand the experiment procedures and agree to the study.

The proposed system utilizes a camera to obtain a stroke patient's arm motion data as the patient is asked to perform a designed action. The stroke patient's hand location is detected and tracked. The hand moving information is computed in 2-D and 3-D global coordinates to calculate five parameters including the normalized total of displacement (NTD), the percent of peak velocity (PPV) and the movement units (MU) in addition to 2 combination parameters that combine NTD, PPV and MU. Stroke patients' group and the normal group are significant of the significance level of $p < 0.05$. Therefore, it is efficient to detect stage 4 and 5 stroke patients with the proposed motion analysis system in the study.

The proposed system in this study is a good tool for assessing and tracing cerebral vascular accident patient's recovery progress. By applying low-cost imaging processing and simple set-up, we have developed a motion analysis system which is similar to the VICON system in stroke motion analysis and classification. The combination parameters indicate a patient's movement degrees and are able to distinguish a normal person from a stroke patient, and the occupational therapists confirm the experimental results. The data can be used as reference in the future clinical stroke patient classification as well as occupational therapy program planning.