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IMAGE SEGMENTATION FOR HUMAN MOTION ANALYSIS: METHODS AND APPLICATIONS

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ABSTRACT

Human motion analysis is closely connected with the development of computational techniques capable of automatically identify objects represented in image sequences, track and analyse its movement.

Feature extraction is generally the first step in the study of human motion in image sequences which is strictly related to human motion modelling [1]. Next step is feature correspondence, where the problem of matching features between two consecutives image frames is addressed. Finally high level processing can be used in several applications of Computer Vision like, for instance, in the recognition of human movements, activities or poses. This work will focus in the study of image segmentation methods and applications for human motion analysis.

Image segmentation methods related to human motion need to deal with several challenges such as: dynamic backgrounds, for instance when the camera is in motion; lighting conditions that can change along the image sequences; occlusion problems, when the subject does not remain inside the workspace; or image sequences with more than one subject in the workspace at the same time. It is not easy to develop methods which can deal with all these problems at once, so it is common to make some assumptions, however each day more robust and accurate methods are being developed.

A typical method of image segmentation is background subtraction, which involves the calculi of a reference image followed by the subtraction of each frame of the image sequence from the reference and further threshold of the result [2]. The simplest form is using a time-averaged background image as reference but it requires a training period absent of foreground objects. Other possibility is describing each pixel in the scene by a mixture of Gaussian distributions, where the weight parameters of the mixture represent the time proportions that those colours stay in the scene, so background components will be the ones with the highest

probable colours. However, this last method usually fails in busy environments where a clean background is rare. In [3] is presented an improvement for the background mixture models that also describes a method to detect moving shadows.

In [4] is proposed a method based on Bayes decision theory to detect foreground objects from complex image sequences which contain both stationary and moving backgrounds. It starts to establish a Bayes decision rule for background and foreground classification from a general feature vector and then applies to both stationary and moving background with suitable feature vectors. This method showed to work well in complex backgrounds including sequences with variable light conditions and shadows of moving objects however has a problem of absorbing foreground objects when they are motionless for a long time.

In this work we will present some experimental results using these image segmentation methods for human motion analysis, discuss their advantages and disadvantages and address possible practical applications related with human motion.

The analysis of human motion is motivated by the advantage to improve men/machine interaction in several applications, such as: surveillance systems, virtual reality animations, clinical study and diagnosis and analysis of athletic performances.

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