International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017),e-ISSN:2455-2585
International Conference on
Recent Explorations in Science, Engineering And Technology (ICRESET'19)
Volume-5, Special Issue-March, 2019.

A SURVEY ON HUMAN POSTURE RECOGNITION

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ABSTRACT

Human posture recognition is gaining increasing attention in the field of computer vision due to its promising applications in the areas of personal health care, environmental awareness, human-computer-interaction and surveillance systems. With the development of image processing and computer vision techniques, it is possible to analysis human behaviour automatically by recognition the posture of human body, which has become one of most significant research topic in both computer-based intelligent video surveillance system and pattern recognition area. Paper surveys the use of human body posture mechanism for interaction with the computers, describing various techniques for performing accurate recognition. In this paper different phase of human body posture discuss. Also include the different techniques for each phase of the system.

KEYWORDS: Artificial Intelligent, Human Body Posture Recognition, Feature Extraction, Classification

I. INTRODUCTION

Image processing is a method to translate an image into digital form and execute some operations on it to get an enhanced image or to extract some useful information from it. It includes basically three steps: Importing the image, analyze and manipulate and output. This is to extract valuable information from image quickly which is the primary goal of image processing. Image Processing systems are becoming popular due to easy availability of powerful human resources computers, large size memory devices, graphics software's etc.

Human body posture plays important role in nonverbal communication. Researches studies have shown the result of body posture on emotions. Physical posture has been study using two methods: static and dynamic. In static, human can sit in certain position and in dynamic the human perform certain actions. The following are some of the human body postures standing, sitting, squatting, lying, kneeling, and crouching.

The goal of Posture recognition is to interpret human posture via mathematical algorithms. It is an essential part in the field of computer vision with the wide range of applications. With image processing, computer vision techniques, is possible to analysis human behaviour automatically by recognition the posture of the body, which has become one of most significant research topic in computer-based intelligent video surveillance system.

II. RELATED WORK

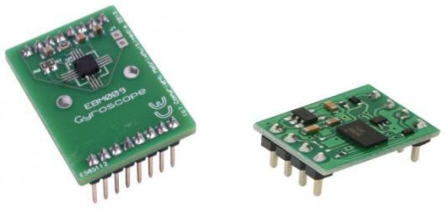
A recognition system can be divided into different units: data acquisition, preprocessing, segmentation, feature extraction and classification. In this paper we discuss each unit and its methods to recognize the human body posture.

A. DATA ACQUISITION

The human body posture recognition system begins with the capturing the image. In the literature survey there are two type of recognition system: intrusive and non-intrusive.

1) Intrusive Method

Sensor like accelerometer and gyroscope are generally used in today's handheld machine (mobile phones, portable gaming device, tablets etc). These sensors can provide 3-axis acceleration. These sensors are adopted by researchers to perform physical activity monitoring. Sensor mote, which is an embedded platform that consists of 3-axis accelerometer, microprocessor, and wireless transceiver, which is required to be attached to the targeted person. Fig 2 shows several sensor mote .these type of wearable sensor are attached to the chest, waist or several body parts.



(a) Acceleometer **(b) Gyroscope**

Fig. 1: types of intrusive sensors

2) Non-intrusive Method

These methods provide image and video in a non- intrusive way, without requiring the attachment to the target. Various type of computer vision and pattern recognition algorithms have proposed and applied to the human body posture recognition, based on static images or video captured by different type of vision sensor. There are different type of vision-based sensor like conventional gray level or color camera, thermal infrared sensor, depth sensor and smart vision sensor.

B. PREPROCESSING

Captured image includes the noise, which causes the reduce the accuracy of recognition system. So keep up the accuracy of system noises is to be removed using different types of filtering methods.

1) Median Filter

An alternative to linear smoothing is median filtering. The idea of median filtering is to process an image pixel by pixel. Each pixel is calculated by the median of the value of a set of neighbouring pixels. The method can therefore also be considered as a filtering technique, though the filter is non-linear (and non separable in general).

2) Mean Filter

A mean filter is the best linear filter for Gaussian noise in the sense of mean square error. Linear filters too tend to blur sharp edges, wipe out lines and other fine image details, and execute poorly in the existence of signal-dependent noise.

3) Winner Filter

The wiener filtering method requires the information about the spectra of the noise and the original signal and it works well only if the essential signal is smooth. Wiener method implements spatial smoothing and its model complexity control match to choosing the window size.

4) Gaussian Filter

The Gaussian Smoothing Operator executes a weighted average of surrounding pixels based on the Gaussian distribution. It is used to eliminate Gaussian noise and is a realistic model of defocused lens. Sigma defines the amount of blurring. The radius slider is used to manage how large the template is. Large values for sigma will only provide large blurring for larger template sizes. Noise can be added using the sliders.

Table 1: Different Types of Filtering Method

Filtering Method	Advantages	Disadvantages
Median filter [1]	Very effective for removing noise while preserving	It is only used for salt and pepper noise. computation time is longer.
Mean filter [2]	Easy to implement	Blur the sharp edges
Winner filter [3]	Remove the additive noise and inverts the blurring.	Commonly used to de-noise audio signals, specially for speech recognition
Gaussian filter [4]	Smooth the whole image	It will take too much time.Not smooth the edge

C. SEGMENTATION

Image segmentation is a method to split ROI image from background. ROI is a region that we want to study for the recognition system. Output of this step is human body posture shape region. There are different types of segmentation methods are used for segmentation.

Presentation of background model, stimulating methods can be divided in to three groups like basic (such as frame difference, running average and temporal median filtering), parametric (e.g. mixture o Gaussian), and non-parametric (e.g. kernel density estimation)

In the basic group, along with all techniques, frame difference is possibly the simplest approach of background subtraction. This method is very responsive to the threshold; however, it does adapt fast to the quick illumination changes.

In the parametric group, Gaussian of mixture is a typically one. It represents each pixel's distribution with a mixture of Gaussian and several parameters have to be dynamically updated. **Table 2: Different Types of Segmentation Methods**

D. FEATURE EXTRACTION

Feature extraction is a essential step in the frame work of object recognition. It extracts distinct feature from the original rich content of images. Feature extraction reduces the amount of information that is requiring representing the original pattern. It also increases the accuracy of the classification. Different kinds of feature and a large number of representations have been proposed and demoralized by researchers.

Segmentation methods	Advantages	Disadvantages
Frame differences [3,4,5,9]	Fast and Easy to implement. Background models are not stable, they change over time.	Accuracy depends on object speed and frame rate.
Approximati- on median[11]	It p erform better than Gaussian distribution	Computation required buffer with recent pixel value.
Gaussian distribution[2]	Low memory requirement	It does not deal with multimodal background.

Human body posture can recognize and discrimination objects by their color, texture and shape. Researcher said that the object's class identity is more related with its volumetric description (shape) rather than surface characteristics such as color and texture. However, color and texture are useless. There are many examples in nature and also artificial environment where color (or texture) correlates well with class identity.

Colour and texture feature are interesting in terms of their low complexity and high efficiency in circumstances where images contains noticeable unique colour or texture. However, in general, there are many cases where colours or texture are not available or not clearly discriminative for different objects. Therefore, shapes such as edges or lines, corners, contours or silhouettes have been generally adopted in object tracking, pattern recognition, and human activity analysis.

Table 3: Different Types of Feature Extraction

Feature extraction methods	Advantages	Disadvantages
Fourier descriptor	Easy to implement No matter where the shape is located in image. If the shape is scaled doesn't effected on result	Not localized in the frequency domain.
Wavelet descriptor	Well localized in both time and frequency domain.	Loss of generality Difficulty in designing.
Curvature scale space	High robustness to noise.	Computationa l complexity is average.

(k-NN), support vector machine (SVM), artificial neural network (ANN) and so on will be examined.

1) K-Nearest Neighbours

The k-nearest neighbour algorithm [4,6] is a simple classification an unknown example based on the neighbouring samples. The feature vector of training samples are stored and labelled in the training phase. In the classification phase, a testing example is classified by assigning the label that most frequently appears in the k- nearest training samples (summarize as "majority voting"). K- NN is example-based classification method which need search along with the training samples. The user defines constant "k" is generally odd number for binary classification to avoid tie votes. When k=1, it become the nearest neighbour algorithm, in which the unknown example is classified by directly handover to it the label of its nearest neighbour.

2) Artificial Neural Network

The field of artificial neural network[1, 2, 5, 7] is a computational model of nervous system. It contains organized group of nodes; mimic the huge network of neurons in the human brain. ANN can be seperated into feedforword neural network (FNN) and recurrent neural network (RNN) which has feedback connections. The feedforword neural network is typically used in data classification and pattern recognition. In general FNNs include multilayer perception (MLP) and radial basis function (RFB) neural network. MLP consist of several layers of artificial neurons with fully feed forward relations. It has an input layer, one or more hidden layer, and output layer. The output of each neuron is obtained by applying an activation function on the weighted summation of previous-layer neurons. The another type of feed forward neural network , the RBF network, is composed of input layer (which receive the feature vector), a hidden layer and linear output layer ,anywhere each node is weighted summation of hidden layer neurons and corresponds to one class.

3) Support Vector Machine

SVM [3,7] is a familiar supervised learning technique, which separates the classes, more accurately particularly for linearly non-separable dataset. It is based on learning, testing, and performance evaluation. Learning engages optimization of a convex cost function. Testing is based on model evaluation using the support vectors to classify a test dataset. Performance evaluation is depends on error rate determination as the test dataset size be likely to infinity. In that situation; the input space of colour pixels is Changed into a feature space using nonlinear function "Φ," called kernel function. The feature space is a high dimensional space in which the classes can be seperated by a linear classifier.

Table 4: Different Types of Classification Methods

Classification Method	Advantages	Disadvantages
K-Nearest Neighbor [4,6]	High performance with large dataset Gives accuracy about distance, weighted average about pixel Very simple model	Computation cost is high. Degraded by existence of noise.
Artificial neural network [1,2,5,7]	Quite simple to apply. Effectiveness and accuracy of performance	Time consuming for large dataset. Semantically poor.
Support vector machine[3,7]	Minimize the number of misclassification. High performance rate. Good generalized ability.	Lack of transparency in results. Requirement of memory

III. CONCLUSION

The aim of this paper is to examine all the phase of human body posture recognition with variety of feature extraction and classification methods. This paper mainly focused on human body posture recognition based on non-intrusive methods. Here also discuss a range of techniques of each phase of recognition.

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