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Classifying Energy Feature for Video Segmentation

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Abstract

Video segmentation is a major role in digital image processing. This paper provides methodology for detecting moving object presented in the given input video. First step is converting input video into frames. Second step is feature calculation by using edge histogram descriptor method. Third step is classification using online support vector machine classifier. Finally, convex hull algorithm is used to grouping the moving pixel.

Keywords: Classification, feature extraction, Edge histogram descriptor, convex hull

Introduction

Image processing is any form of signal processing for which the input is an image, such as photography or a video frame. The output of image processing may be either an image or a set of characteristics or parameters related to the image. Image is a two dimensional function that represents a measure of some characteristics such as brightness or color of the viewed scene. Image is composed of a finite number of elements called pixel. Different types of images available are intensity images, binary images, indexed images and RGB images.

At a glance human can easily determine the subject of interest in a video, even though that subject is presented in an unknown or cluttered background or even has never been seen before. With the complex cognitive capabilities exhibited by human brains, this process can be interpreted as simultaneous extraction of both foreground and background information from a video. Many researchers have been working toward closing the gap between human and computer vision. However, without any prior knowledge on the subject of interest or training data, it is still very challenging for computer vision algorithms to automatically extract the foreground object of interest in a video. As a result, if one needs to design an algorithm to automatically extract the foreground objects from a video. In practice, it is infeasible to manipulate all possible foreground object or background models beforehand. However, if one can extract representative information from either foreground or background regions from a video, the extracted information can be utilized to distinguish between foreground and background regions, and thus the task of foreground object extraction can be addressed.

Methodology

First feature calculation is done by using edge histogram descriptor method for each frame. Then classification is performed by using online support vector machine classifier. Finally, convex hull algorithm is used to grouping the moving pixel.

Feature extraction using Edge Histogram Descriptor method

In pattern recognition and in image processing, feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (e.g. the same measurement in both feet and meters) then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input. In this enhancement system, input video is converted into frames. Then each frame, feature extraction can be performed. Edge histogram descriptor method is used for the feature extraction process.

Classification using Online Support Vector Machine

After the extraction of feature for each frame, classification operation is performed by the use of Online Support Vector Machine Classifier based on convex hull vertices selection. Online Support Vector Machine Classifier classifying the

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features by the use of training dataset. It classifies the input feature into positive and negative points.

Convex hull algorithm

In computational geometry, numerous algorithms are proposed for computing the convex hull of a finite set of points, with various computational complexities. Computing the convex hull means that a non-ambiguous and efficient representation of the required convex shape is constructed. The algorithmic problem of finding the convex hull of a finite set of points in the plane or other low-dimensional Euclidean spaces is one of the fundamental problems of computational geometry. Shape of the object is performed by the convex hull.

Enhancement work is implemented by online support vector machine classifier based on convex hull vertices selection. The main objective of the enhancement work is detecting or tracking the pedestrian from the given input video. For this detection, Online SVM trained in all the classes. There are two classes are presented in the work, pedestrian and other irrelevant things. Pedestrian is only the important thing which we want tack. In the testing phase, the given input video is converted into frames. From each frame, Online SVM predicting the pedestrian, then by using convex hull vertices selection, the pedestrian are marked.

The following figure represents the architecture of proposed system. The first step is input video converted into frames. For each frames, feature extraction operation is performed. By using Online Support Vector Machine Classifier, the extracted features are classified and if any pedestrian is presented in the frames, labeling is performed by using convex hull vertices selection.

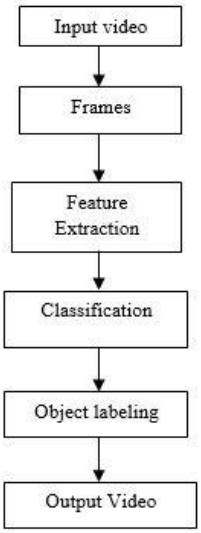

Fig 1 Flow chart of extracting moving object

Experimental Work

The first step is input video converted into frames. For each frames, feature extraction operation can be performed by using edge histogram. An image histogram is a type of histogram that acts as a graphical representation of the tonal distribution in a digital image. It plots the number of pixels for each tonal value. By looking at the histogram for a specific image a viewer will be able to judge the entire tonal distribution at a glance. The histogram is a graphical representation of the distribution of data. It is an estimate of the probability distribution of a continuous variable. A histogram is a representation of tabulated frequencies, shown as adjacent rectangles, erected over discrete intervals (bins), with an area equal to the frequency of the observations in the interval. By using Online Support Vector Machine Classifier, the extracted features are classified and if any pedestrian is presented in the frames, labeling is performed by using convex hull vertices selection.

Feature Extraction

In pattern recognition and in image processing, feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (e.g. the same measurement in both feet and meters) then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input. In this enhancement system, input video is converted into frames. Then each frame, feature extraction can be performed. Edge histogram descriptor method is used for the feature extraction process.

Classification

The extracted features are classified by using Online Support Vector Machine classifier which classifies the moving pixel. Already classifier trained in all the classes. Based on the training dataset, the testing dataset classified correctly. In this step moving pixels are correctly classified.

Convex hull algorithm

Convex sets are enclosed together to form a convex hull. Convex hull algorithm is used to construct convex hull of various object. Set of positive points are called convex. Vertices of the convex hull are selected and linearly separate the object from the background. This algorithm is proposed for computing the convex hull of a finite set

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of points, with various computational complexities. Computing the convex hull means that a non-ambiguous and efficient representation of the required convex shape is constructed. The algorithmic problem of finding the convex hull of a finite set of points in the plane or other low-dimensional Euclidean spaces is one of the fundamental problems of computational geometry. Shape of the object is performed by the convex hull.

Pedestrian detection

Pedestrian detection process is performed by Online Support Vector Machine Classifier. Enhancement work is implemented by online support vector machine classifier based on convex hull vertices selection. The main objective of the enhancement work is detecting or tracking the pedestrian from the given input video. For this detection, Online SVM trained in all the classes. There are two classes are presented in the work, pedestrian and other irrelevant things. Pedestrian is only the important thing which we want tack. In the testing phase, the given input video is converted into frames. From each frame, Online SVM predicting the pedestrian, then by using convex hull vertices selection, the pedestrian are marked.

Performance Metrics

The following performance metrics are calculated.

True positive means actual output is predicted correctly. True positive is calculated by using the following formula

$$TP=\frac{Number\ of\ correctly\ segmented\ pixel}{Total\ NO\ of\ pixel}\times 100 \quad (1)$$

True negative means the actual output is predicted correctly. True negative is calculated by using the following formula

$$TN=\frac{Number\ of\ Falsely\ segmented\ pixel}{Total\ no\ of\ segmented\ pixel}\times 100 \quad (2)$$

False negative means the actual output is predicted incorrectly. False negative is calculated by using the following formula

$$FN=\frac{Number\ of\ correctly\ false\ segmented\ pixel}{Total\ no\ of\ pixel}\times 100 \quad (3)$$

False positive means the actual output is predicted correctly. False positive is calculated by using the following formula,

$$FN=\frac{Number\ of\ falsely\ segmented\ pixel}{Total\ no\ of\ pixel}\times 100 \quad (4)$$

Table 1 Performance metrics of classification

Performance Metrics	Values
True Positive	95.05
True negative	5.03
False Positive	89.03
False negative	10.8058

As seen in Table 1, the system performance using Online Support Vector machine classifier gives 95% correct classification.

Conclusion

The enhanced method delivers reasonable result for detecting the pedestrian presented in the input video, which has high accuracy when compare to Support Vector Machine Classifier. This real time application is mainly used for automatic car driving system.

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