PEDESTRIAN DETECTION USING MODIFIED INDEPENDENT COMPONENT ANALYSIS

Angel shalini.M,[1] Research Scholar, Email:shalum14@gmail.com*

Dr.S.VijayaLakshmi,[2] Associate Professor, Sri Ramakrishna Arts and Science College for women, Coimbatore, Email: vijics@srcw.org

Moorthi.V,[3] Research Associate, D-Tek technology, Coimbatore, Email: techmoorthi@gmail.com

Ramalingam.D,[4] Associate Professor, Nehru Institute of Technology, Coimbatore, Email: psdtjothiramalingam24@gmail.com

**corresponding author*

ABSTRACT: Wide range of applications and numerous other complexities involved in pedestrian detection makes it a continuous and open area of research. Recently pedestrian detection is getting much more interest and researchers are contributing a lot in this field. Selection of a feature extraction method is very important factor for high recognition performance in human detection systems. In this paper, we propose an efficient self-similarity based human identification using modified Independent Component Analysis (MICA). Initially the background modeling is done from a video sequence. Subsequently, the moving foreground objects in the individual image frames are segmented using the background subtraction algorithm. Then, the morphological skeleton operator is used to track the silhouettes. The MICA based on eigen space transformation is then trained using the sequence of silhouette images. Finally, the proposed system recognizes the human features based on multikernel SVM classification. The proposed system is evaluated using gait databases and the experimentation on outdoor video sequences demonstrates that the proposed algorithm achieves a pleasing recognition performance.

Keywords: pedestrian detection, muktikernel SVM, MICA

INTRODUCTION

Pedestrian detection is a canonical instance of object detection. It has various applications such as car safety, surveillance, robotics etc. which enabled it to acquire some much needed attention in the previous years. On the contrary pedestrian detection remains to be a challenging task in the field of object detection. The detection of pedestrian is becoming more significant as the number of pedestrians fatalities are increasing day after day (more than 30999 pedestrians are killed and 430000 injured in traffic around world every year). One of the main concerns of car manufacturers is to have an automated system that is able to detect pedestrians in the surroundings of a vehicle.

To be able to effectively detect pedestrians based on vision is challenging for number of reasons. Few such challenges are pedestrians appear in different backgrounds with a wide variety of appearances and also different body sizes, poses, clothing and outdoor lighting conditions.

Distance of the pedestrian from the camera also plays a vital role as standing relatively far away from the camera may make them appear small in the image. Most pedestrian detectors can achieve satisfactory performance on high resolution datasets; however they encounter difficulties in low resolution images.

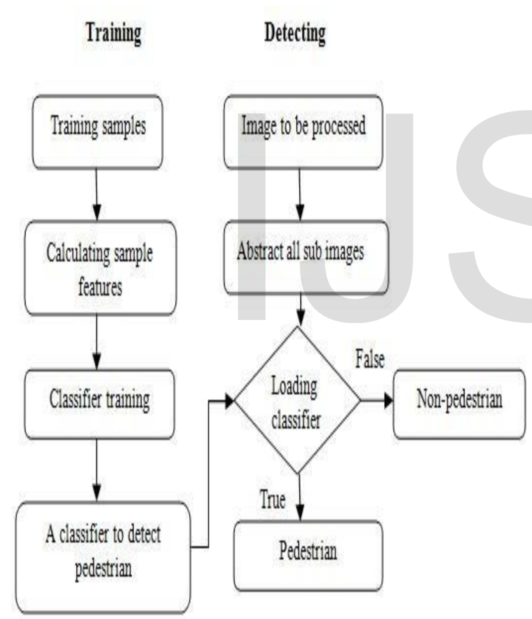

Fig.1. Block Diagram

Training: In machine learning one of the most important mechanisms is to train this algorithm on this training set. The training set must be different and distinct from the test set. If I use the same data set for both training and testing, the resulting model may not be able to detect unseen data. Hence it is important to separate data into training and test set. Once a model has been created using the training set, I can test the model with the help of the test set.

In the training part the main motive is to extract features of the object so that I can feed the extracted features to the classifier. After normalization the data in the training set I can extract features like Haar-like features or Histogram of oriented Gradient (HOG) features. Certain algorithms like AdaBoost uses a number of training samples to help select appropriate features from the dataset. AdaBoost is able to combine classifiers with poor performance into a bigger classifier with much higher performance.

Once training the system is done and I have a classifier, I can feed the test set to the classifier to check the efficiency of our algorithm. Once the image to be processed is loaded the system can abstract the subimages or the Region of Interest (ROI) from the image and load it onto the classifier. Based on the features extracted in the training phase the classifier will be able to classify whether in a particular image a pedestrian is present or not.

MODIFIED INDEPENDENT COMPONENT ANALYSIS

In this research, we propose an efficient human recognition system using modified Independent Component Analysis (MICA). The proposed pedestrian detection system characterizes in terms of a signature computed directly from the sequence of silhouettes. Initially, the human's are segmented and tracked in each image. Then, the pedestrian detected by training and testing using MICA on the extracted feature vectors. Fig.2. depicts the block diagram of the Proposed Pedestrian detection System

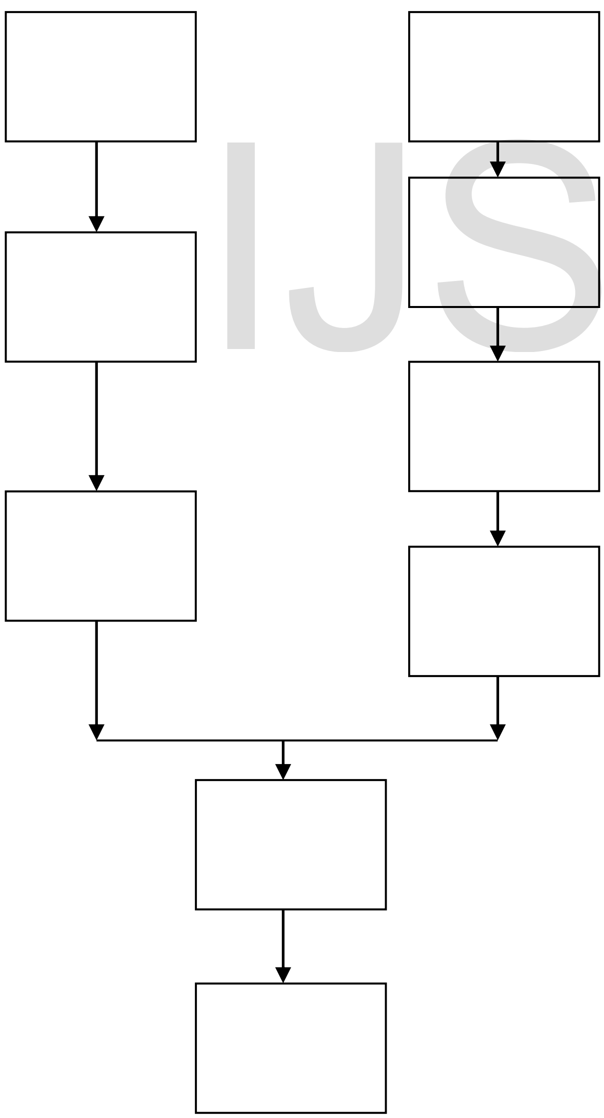

Fig.2. Proposed system

SEGMENTATION

Background subtraction has been extensively used in foreground detection, where a fixed camera is usually used to capture dynamic scenes. In the proposed system a simple motion detection method based on median value is adopted to model the background from the video sequence. Let P represent a video sequence having N image frames. The background $P(x, y)$ can be constructed using the formula:

$$P(x,y) = median[P_1(x,y), P_2(x,y), \ldots P_N(x,y)]$$

The value of $P(x, y)$ is the background brightness to be calculated in the pixel location (x, y) and *median* symbolizes its median value. In the proposed gait recognition system, we have computed the median value rather than mean value of pixel intensities over N frames, since,

1) Distortion of the mean value for a large change in pixel intensities while the person moves. The median is impervious to spurious values and

2) Median value Computation is comparatively faster than the least mean square value.

Both these statements hold with the assumption that a person continuously moves around over the frames. Subsequently, the extracted background and the original image frames are provided for the foreground modeling. The background subtraction algorithm subtracts the background from the original image frames to obtain the moving foreground objects i.e. human subject in binary.

MICA:

We implement the modified Independent Component Analysis (MICA) to extract and train the features. The purpose of training the silhouettes with the modified ICA is to attain a number of independent components to represent the original human features from a high dimensional measurement space to a low-dimensional Eigen space. ICA aims to identify the vectors that describe data to its best in terms of reproducibility; nevertheless these vectors may not comprise of any effective information for classification, and may eliminate discriminative information.

Algorithm of Modified Independent component analysis:

Step 1: *Data centering*. The mean of the observed mixed signal data $\boldsymbol{X}$ is computed and the mean is subtracted from the observed data set to make it zero mean.

$$Xc \leftarrow X - E\{X\}$$

Step 2: *Whitening*. The covariance matrix ***cov X*** of the centered data Xc is computed. The eigenvalue decomposition of **cov *X*** is performed.

Step 3: *Fixed-point iteration for one unit.* The fast ICA algorithm for one unit estimates one row of the demixing matrix $\boldsymbol{w}$ as a vector W^t that is an extremum of contrast functions. Estimation of $\boldsymbol{w}$ proceeds iteratively with following steps until a convergence as stated below is achieved.

Step 4: *Evaluation of second independent component.* To estimate the other ICs, Step 3 of the algorithm is repeated for getting weight vectors W_i, $i = 2,3, \dots, n$.

Multikernel SVM

SVM implementation was built on the Lib SVM library. Several parameters were set by taking into account the Lib SVM practical guide. The cost parameter was established to 1 according to a small margin, minimizing the trade-off between wrong classified samples.

On the other hand, the kernel, defined as a RBF and linear kernels composition was parameterized based on the resultant clusters from the optimal hierarchy level:where P = number of clusters in optimal level, RBF = RBF kernel function,$[t_{k1},\dots t_{kl}]$ = terms of the cluster , and k= terms nongrouped in any cluster.

$$\mathrm{MLRBF}\left(d_i, d_j\right) = \underbrace{\left\langle d_i\left[t_a \cdots t_b\right], d_j\left[t_a \cdots t_b\right]\right\rangle}_{\text{Linear kernel}} + \sum_{k=1}^{p} \mathrm{RBF}_k\left(d_i\left[t_{k1} \cdots t_{kl}\right], d_j\left[t_{k1} \cdots t_{kl}\right]\right),$$

Recalling the main idea about identifying cohesive slices to divide the matrix, each slice (cluster) is composed of normal distribution terms and defined as a common pattern (multivariate normal distribution). Clusters provide a simple way to parameterize RBF kernels in the proposed multikernel.

EXPERIMENTS

Dataset

We created a set of video sequences of street scenes with all pedestrians marked with a box in each frame. We have eight such sequences, each containing around 2000 frames. One frame of each sequence used for training along with the manually marked boxes

.

Fig.3. Training Samples

RESULTS

Tests were performed in an Intel Core i7 at 3.8 Ghz with 8 Gb of RAM. They were restricted to one execution thread because preconfigured classifiers on LibSVM are implemented under a single execution thread.

The performance metrics are calculated by using the confusion matrix. Based on the matrix, accuracy, Precision, and Recall are calculated and compared with the literature method ICA.

Precision:

Precision (*P*) is the proportion of the predicted positive cases that were correct, as calculated using the equation:

Precision = True positive /(True Positive + False Positive)

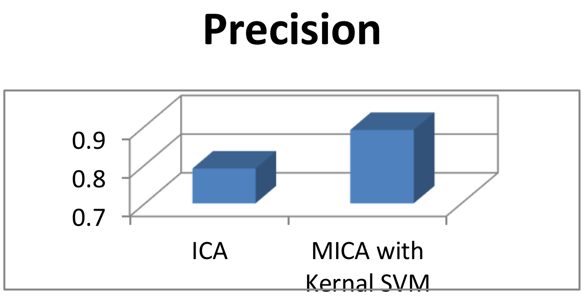

Fig. 4. Precision Comparison

Recall:

The *recall* is the proportion of positive cases that were correctly identified, as calculated using the equation:

Recall = True positive /(True Positive + False Negative)

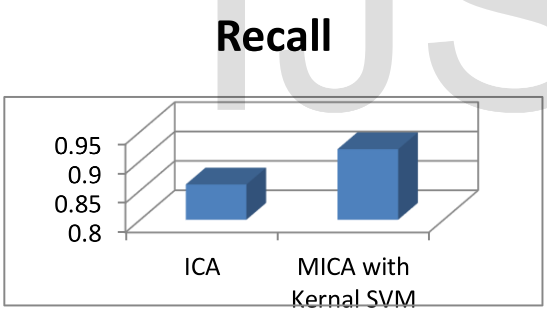

Fig.5. Recall Comparison

Accuracy:

The accuracy (*AC*) is the proportion of the total number of predictions that were correct. It is determined using the equation:

Accuracy = (TP + TN)/(TP + TN + FP + FN)

In figure, 4,5 and 6 shows that, the performance of the proposed MICA with multikernel SVM acquires best accuracy,

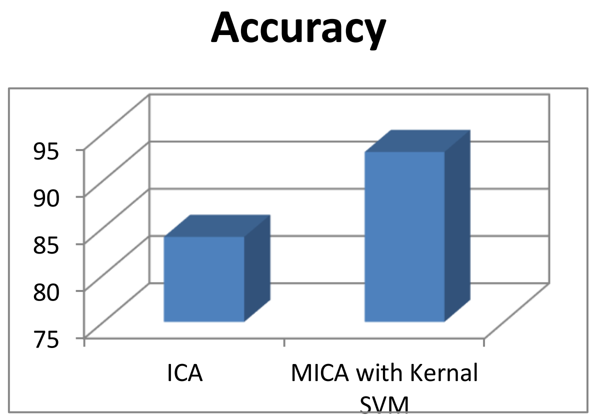

Fig.6. Accuracy Comparison

precision, recall values when compared to the literature menthod ICA.

CONCLUSION:

In this paper, we proposed an efficient pedestrian detection system using modified Independent Component Analysis (MICA). The MICA based on eigenspace transformation is then trained using the sequence of silhouette images. Then the proposed system recognizes the human features based on multikernel SVM classification. The proposed system is evaluated using gait databases and the experimentation on outdoor video sequences demonstrates that the proposed algorithm achieves 92% of accuracy.

In future, we can implement the fast feature extraction algorithms so that the execution time can get decreases also can improve the recognition accuracy.

References:

1. Vision based pedestrian detection using Histogram of Oriented Gradients, Adaboost & Linear Support Vector Machines aSamantha D. F. Hilado; aElmer P. Dadios; aLaurence A. Gan Lim; Edwin Sybingco; Isidro V. Marfori; Alvin Y. Chua TENCON 2012 IEEE Region 10 Conference.
2. A review on pedestrian detection techniques based on Histogram of Oriented gradient feature Chi Qin Lai; Soo Siang Teoh 2014 IEEE Student Conference on Research and Development Pedestrian detection for driver assistance systems P. Vasuki; S. Veluchamy 2016 International Conference on Recent Trends in Information Technology (ICRTIT).
3. HOG feature extractor circuit for real-time human and vehicle detection Seonyoung Lee; Haengseon Son; Jong Chan Choi; Kyoungwon Min TENCON 2012 IEEE Region 10 Conference.
4. Region-of-interest reduction using edge and depth images for pedestrian detection in urban areas Chen Zhang; Kwang-Hoon Chung; Joohee Kim 2015 International SoC Design Conference (ISOCC).
5. An region of interest based video compression for indoor surveillance Ganfeng Qiang; Lijun Yue; Fengqi Yu Proceedings of 2nd International Conference on Information Technology and Electronic Commerce.
6. Depth gradient based region of interest generation for pedestrian detection Maral Mesmakhosroshahi; Kwang-Hoon Chung; Yunsik Lee; Joohee Kim 2014 International SoC Design Conference (ISOCC).
7. Pedestrian detection using HOG, LUV and optical flow as features with AdaBoost as classifier Rabia Rauf; Ahmad R. Shahid; Sheikh Ziauddin; Asad Ali Safi 2016 Sixth International Conference on Image Processing Theory, Tools and Applications (IPTA).
8. Improving pedestrian detection Jamie Bowers; Richard Green 2016 International Conference on Image and Vision Computing New Zealand (IVCNZ)
9. A.Suresh (2014), “Privilege based Attribute Encryption System for Secure and Reliable Data Sharing”, International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE), ISSN(Online):2320-9801, ISSN(Print): 2320- 9798, *Vol. 2, No.5, May 2014*, pp. 4099 – 4102.