COMPARISON OF DYNAMIC BAYESIAN MODEL AND UNIFIED FACE IMAGE APPROACH USING SURVEILLANCE VIDEOS

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ABSTRACT:

The economical growth of our society is forcing our lives to be frightened one with increased robbery and theft. The objective of our project is to identify a face from the surveillance video which would help in identifying the person's face. The camera apps in smartphones and digital cameras using image processing to enhance the image quality, video stabilization and noise removal. A Face can be even recognized when they are partially obstructed from view. Image processing allows the use of much more complex algorithms, and hence, can offer both more sophisticated performance at simple tasks, and the implementation of methods which would be impossible by analog means. Face recognition is still a challenging problem in the field of computer vision. It has received a great deal of attention over the past years because of its several applications in various domains. Although there is strong research effort in this area, face recognition systems are far from ideal to perform adequately in all situations from the real world.The software is implemented to recognise human faces using Dynamic Bayesian Network and Unified Face Image approach and obtaining the optimal result. The use of Dynamic Bayesian Model approach models interdependent entities that changes over time. The Unified Face Image is an approach which is generated from the data of surveillance cameras, the different lighting condition in the original frames will introduce non-uniform lighting in UFI's. It may happen that in some cases latter may work better than former approach and vice versa.

INDEX TERMS (KEYWORDS):

Surveillance video, face recognition, Dynamic Bayesian Model, Unified Face Image, Interdependent entities, video stabilization, enhance image quality.

INTRODUCTION:

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a single dispensation in which input is the image, like video frame and output may be image or characteristics associated with that image.

Usually image processing system includes treating images as two dimensional signals while applying already set signal processing to them. It involves three major steps such as importing the image, analysing and manipulating the image and output is the last stage which yields the result. To detect an image from a video we use certain algorithms. In our paper we have used Dynamic Bayesian Model and Unified Face Image to detect a face from the surveillance video and to compare both the approaches and obtain the optimal result from the comparison. The Dynamic Bayesian Model is used since it is a Bayesian Network in which the variables are related to each other over adjacent time steps and they are trainable and provide means for providing over fitting. The Unified Face Approach is used since it is the Novel Image Representation which synthesized from multiple camera feeds. UFI is the frontal view of the subject that incorporates information from different cameras. Using UFI, the appearance of data and gallery data is reduced. This paper provides a comparison of both the algorithms and providing the optimal result.

EXISTING SYSTEM:

Image processing allows the use of much more complex algorithms, and hence, can offer both more sophisticated performance at simple tasks, and the implementation of methods which would be impossible by analog means. The basic techniques are Classification which is the problem of identifying to which of the set of categories a new observation belongs, on the basis of a training set of data containing observations whose category membership is known which is followed pattern recognition and feature extraction. The challenges to unconstrained face recognition in surveillance cameras are mainly due to the following reasons such as low resolution, arbitrary poses, varying lighting conditions, noise and blurriness, image quality, image size, face angle and processing and storage. To overcome all these problems we have proposed a comparative study using two algorithms inorder to identify the efficient one.

PROPOSED SYSTEM:

Face recognition using DYNAMIC BAYESIAN NETWORK and UNIFIED FACE IMAGE. The framework will compare these approaches and better recognition rate is analyzed. Face recognition uses biometric identification verification based on facial characteristics. The system may look at specific algorithms of the distances between features, consult 2D images, or use 3D facial recognition to identify specific facial features.

The main function of the system is to determine

- Whether human faces appear in a given image.
- Where the faces are located at.

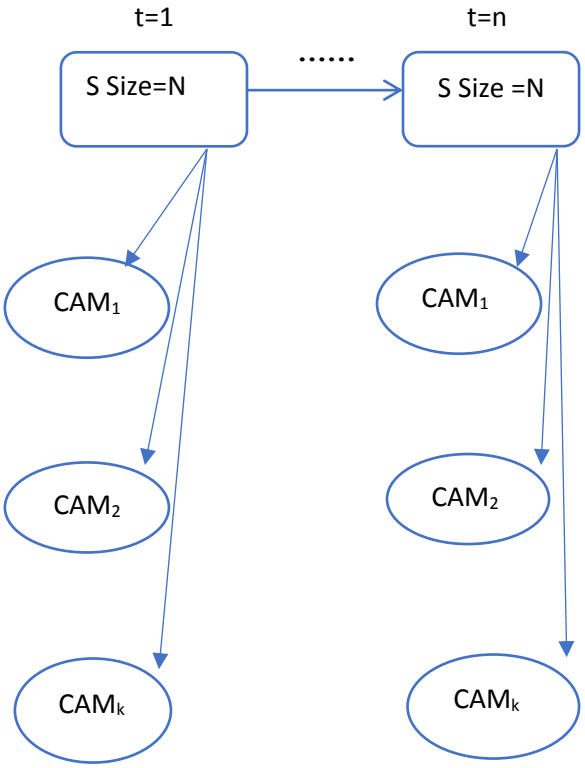
The first step in implementing the system is to convert the video into multiple frames. The video frame should be either in .mp4 or .avi format. The image capturing process contains the Video library which plays the video and captures the frame from the camera. Video is captured from CCTV footage.

The obtained frames are then sliced into equal number of parts or nodes with rows and columns. The sliced images will be packed into one jpg image file. Face alignment is performed to justify the scales and orientations of the patches. Besides serving as the pre-processing for face recognition, face detection could be used for region of interest. After the face detection step, human face patches are extracted from images. The last step is to recognize the identities of faces and generate the result in the form of report.

Dynamic Bayesian Network

Compared to the traditional face recognition methods which are typically image based, the video based face recognition is advantageous since the dynamics in different frames for the specific person can be learned to help the recognition of the subject. Dynamic Bayesian Network is a Bayesian Network which relates variables to each other over adjacent time steps. It used to capture facial interactions at different level. It represents the problem utilizing a set of random variables whereas Hidden Markov Model uses a single discrete random variable. In a standard first-order Hidden Markov Model which is modeled as a Dynamic Bayesian Network, the random variables at time slice t depend only on the variables in time slices t and t−1 for all t > 1.

Operating a graphic model requires three main steps: defining structure, learning the parameters, and inference. The structure of the DBN consists of the inter-slice topology and the intra-slice topology. The inter-slice topology is defined as follows. Each time slice t = 1...T has K+1 nodes; one root node S, and K camera nodes CAM_k=1...K. This structure is represented in the diagram given below. The number of possible structures is super-exponential in the total number of nodes; therefore, it is best to avoid performing exhaustive search for structure learning.



DBN Structure for T time slices

The intra-slice topology is illustrated in the above diagram with T time slices. After defining the structure, it is required to learn the parameters of the DBN before recognition is performed. Therefore, the probability distribution for each node given its parents should be determined.

For the first time slice this includes

p (CAM1|S), p(CAM2|S),….,p(CAMK|S), p(S)

For time slices t = 2 … T it includes

$p(CAMt^1|S^t)$, $p(CAMt^2|S^t)$,…., $p(CAMt^K|S^t)$

$p(S^t|S^{t-1})$

The reasons for using DBN are stated as follows:

- DBNs present several advantages to the problem of user modelling from multi-sensory information
- They can handle incomplete data as well as uncertainty.
- They are trainable and provide means for avoiding over fitting.
- They encode causality in a natural way.
- They offer a framework for combining prior knowledge and data.
- They are modular and parallelizable.

Unified Face Image

Unified Face Image is the Novel Image Representation which synthesized from multiple camera feeds. UFI is the frontal view of the subject that incorporates information from different cameras. Using UFI, the appearance of data and gallery data is reduced. UFI is generated using several consecutive frames from each camera. These frames are first warped towards a frontal face template and the warped images are then averaged to obtain the UFI.

In a temporal window centered at time t, the UFI is generated as

$$UFI(t) = \frac{1}{(2K+1)C} \sum_{i=-k}^{k} * \sum_{j=1}^{C} * \langle Ij(t+i)|I0\rangle$$

where Ij(t + i) is the frame at time t + i from camera j. C is the total number of cameras and 2k + 1 is the length of the temporal window.

The UFIs have less deviation from the gallery data in appearance. During this warping-averaging process, the noise and blurriness are suppressed and the facial details are enhanced.

The UFI in the next non-overlapping temporal window is generated in the same manner. For a given set of video sequences from multiple cameras, the number of UFIs generated is the total number of the frames in each sequence divided by the length of the temporal window, given that the sequences from different cameras have the same length. UFIs generated from the original set of sequences and the lowest summed score across all the gallery images provides the identity of the subject. Each UFI is considered equally important yet any frame weighting scheme can be applied to the UFIs to further improve the recognition performance.In general the recognition rates at different ranks are higher by using UFIs. Moreover, no training or complex modelling is required. The advantages are

- Efficient feature extraction
- Automated time tracking
- Labor cost savings
- Security
- Saves time and reduces contagion
- Ease of integration

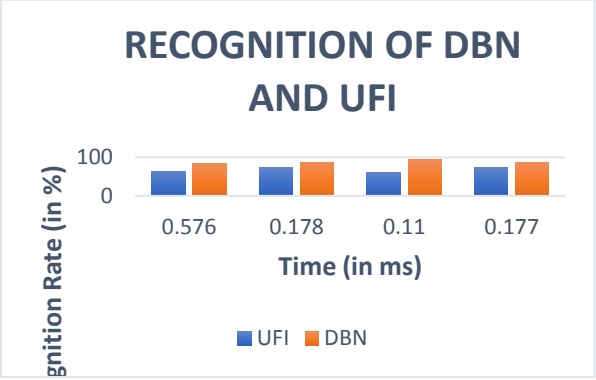
THE FRAMEWORK OF THE PROPOSED SYSTEM:

Initially, the video which is the collection of frames should be imported and it should be in either .mp4 or .avi format. Inorder to convert the frames, the frames are sliced into equal parts of nodes and represented in the form of grid. Spliced frames are grouped into single image file.It should be able to handle jpg or jpeg images. To evaluate the proposed system the following things are required such as Fetch the execution time. Compare the execution time and recognition rate of both the approaches. Depict the result in report.

RECOGNITION RATE COMPARISON:

The recognition rates of both the methods can be depicted as follows:

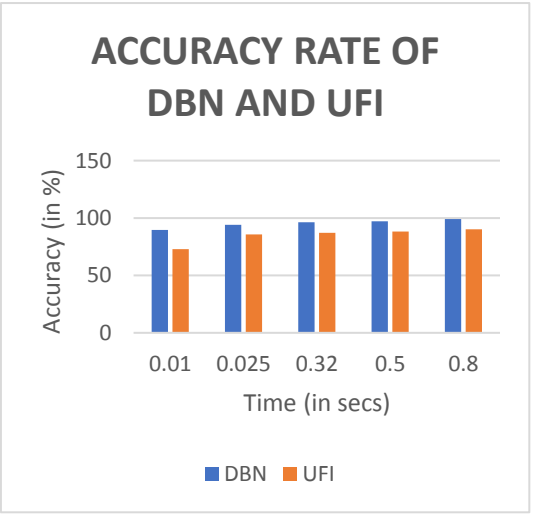
	Recognition Rate (in %)	
Load Time(in sec)	**DBN**	**UFI**
0.576	83	63
0.178	87	73
0.11	94	61
0.177	86	74



ACCURACY COMPARISON:

The table shows the comparison of accuracy between two different approaches Dynamic Bayesian Network and Unified Face Image with their corresponding time.

	Accuracy rate (in %)	
Time (in secs)	**DBN**	**UFI**
0.01	89.65	73
0.025	94	85.66
0.32	96.3	87
0.50	97	88.2
0.80	99	90.25



CONCLUSION:

The main contribution of present research is summarized as follows

A customized approach has been presented for face recognition using **DYNAMIC BAYESIAN NETWORK** and **UNIFIED FACE IMAGE.** It is inferred from the result that Dynamic Bayesian Network has higher recognition rate and accuracy than Unified Face Image. These applications usually work in controlled environments and recognition algorithm can take advantage of the environmental constraints to obtain high recognition accuracy.

The proposed system has improved the face recognition system under illumination variation and non-frontal view. The system improves the speed in terms of recognition. On the basis of investigation carried out in the present research, the following suggestions are presented for further research in future

- The geometric properties of the image can be included in the feature vector for recognition.
- Face recognition system uses grey-scale image and discards the color information. The color information in the frame can be used for recognition of the face.
- The system can use a database which contains the personal information of the person, so whenever the face is recognized it will display the details about the person.

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