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Linear Discriminant Analysis with Genetic Based Support Vector Machines for Image Retrieval in Videos

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Abstract

Retrieval of a Specific image sequence from continuous video databases is one of the most challenging issues in Computer Vision community. As video Databases are growing rapidly in the World Wide Web there are huge numbers of video archives in recent years. To search for an exact image in the large number of video repositories an efficient search and retrieval mechanism is needed. In this paper we use a conventional approach where Feature Extraction the basic is done to extract the features from image and L1-norm based Linear Discriminant Analysis (LDA) is used to classify the features in videos and Genetic based Multiclass Support Vector Machines(SVM) used for learning and retrieval of an image, so that accurate retrieval is ensured. Various Experimental results prove that our retrieval system is effective

Keywords: Feature Extraction, L1 based Linear Discriminant Analysis (LDA), Genetic based Support Vector Machines (SVM)

1. INTRODUCTION

Content Based Image retrieval has become one of the most challenging task in research. Images present in the video contain many useful information for Investigation purpose. To access a particular scene immediately on a continuous video sequences an efficient and effective retrieval for that particular scene is needed. Nowadays there are numerous Surveillance cameras in operation recording millions of frames per hour. So instead of browsing hours and minutes of videos for a particular scene, it can be retrieved quickly by giving a single frame present in the continuous video. Images that occur naturally on the Scene like human activity, objects, Nameboards, Commercial centers, moving vehicle's, Entertainment videos in an ordinary lighting conditions. Recognition of an image and its object categories is the most challenging problems in computer Vision Extraction, classification and detection.

Raw Video sets are taken and segmented into basic element called frame where each frame is treated as a static image against the Input image to retrieve it exactly. Edge based Feature Extraction is done for each frame and L1-based Linear Discriminant Analysis is used to classify and learn the features in videos. Then Genetic Based Support Vector Machines is used for feature selection and label them accordingly for classification and prediction , so that accurate image is retrieved from the set of videos.

2. RELATED WORK

There are different approaches used in retrieval of images from video,some ofthe related works are mentioned here Ja-HwungSu Yu-Ting Huang S.Tseng[1] proposes an innovative method to achieve effective content based video retrieval by mining the temporal patterns in the video contents, an efficient Indexing technique is proposed to reduce the computation cost in searching videos. Here Preprocessing of video is done with shot clustering and shot encoding. This is a foundational stage for indexing the videos in the database and processing the query clip, Finally whether for the query clip or videos in the database, each of them is assigns a symbol by its belonging cluster number in a FPI (Fast-PatternIndextree)-tree, by the symbolized patterns of the videos in the database.

S.Padmakala[2] proposed an "An Effective Content Based Video Retrieval Utilizing Texture, color and Optimal Key frame Features" with the intention of retrieving video for a given query, the raw video data is represented by two different representations schemes, Video Segment Representations (VCR) and Optimal key frame representation (OFR) based on the visual contents. At first, the input raw video is segmented using video object segmentation algorithm so that the objects presented in this raw video can be obtained. Then, feature vectors are computed from VSR using the texture analysis and color moments. Furthermore, the optical frame (OFR) is extracted by considering the probability of occurrence of the pixel intensity values with respect to the pixel location among every frame presented in a raw video. Finally, all these features of a video, texture, color and optical frame are combined as a feature set and stored in the feature library. For the query video clip, the aforesaid features are extracted and compared with the feature in the feature library. The comparison is achieved via the feature weighted distance erasure and the similar videos are retrieved from the collection of videos.

B. V. Patel et al[3] proposed "Content Based Video Retrieval". Proposed approach consists of various modules for key frame extraction, indexing, features extraction, similarity search etc. They use a dynamic programming approach to compute the similarity between the feature vectors for the query and feature vectors in the feature database. Proposed Video Storage and Retrieval System, stores and manages a large number of video data and allows users to retrieve videos from the database efficiently. It is interactive web based application which takes video frame from users and retrieve the information from the database. Database consists of various video data like still video frames, audio and video. The retrieval is based on the content of the video object. This System provides different functionality for two main clients-which are Administrator and user. Administrator is responsible for controlling the entire database including security and adding, updating and deleting videos to and from database. User can only retrieve videos based on submitted query based on content on metadata.

Thanh DUC NGO et al[4] proposed "Scalable Approaches for Content Based Video Retrieval". In general, a video itself contains multiple types of information including embedded video metadata, audio content, and visual content. In this paper, they address video retrieval systems based on information derived from visual content only. First, they address video retrieval based on human face. They presented robust and efficient approaches for face-track extraction and face-track matching. Second, they target video retrieval based on object categories appearing in videos. The main goal of this paper is to develop approaches which require lowest annotation cost or computational cost while achieving competitive accuracy. They introduce approach based on Multiple Instance Learning. Spatial information is taken into account to achieve significant accuracy improvement.

Mr. Siddhant Kulkarni et a [5] proposed "A Novel Model for Content Based Video Classification of Distributed Datasets". The paper describes proposed model along with the implementation details. It presents three steps in which the proposed model for distributed data was developed: Simple standalone, multi-threaded standalone and finally the model for distributed data sets. This paper presents a novel model for Distributed Multithreaded Video Classification. This model classifies video data distributed over a set of nodes with optimum resource utilization. The model uses number of threads equal to the available number of processors in order to utilize the full processing power supported by the latest processors. In addition to this, the number of slave nodes contributing to DMVCM can be increased and decreased as per availability. The method of implementation as well as the platform independence of Java allows heterogeneous systems to implement in the model.

Pengyi HAO proposes an algorithm [6]for two direction Linear Discriminative Analysis with Maximum correntropy criterion(2DLDA-MCC) results in two kinds of signatures used in the query and the other is compared with the database.

C.Femandez Lozano and team Proposes [7] neural networks for classification and uses Hybrid Genetic algorithms with SVM as a fitness function used to select and represent variables for a specific classification problem.

Vapnik[8] proposed statistical learning theory, the support vector machines which becomes fast and one of the most used methods of prediction classification. Although their use is fairly recent, a considerable number of researchers have already reported states of the art of their performance in a variety of applications in pattern recognition, regression estimation, and prediction of time series.

Gómez-Carracedo MP, Gestal M, Dorado J, Andrade JM.[9] proposes a hybrid approach combines GAs and SVM for protein identification in two-dimensional gel electrophoresis images and Yimeng Zhang ZhaoyinJia Tsuhan Chen [10] proposes retrieval based on Big of visual word (BoV).Here spatial information is used to retrieve image using Geometry preserving Visual Phrases(GVP) through RANSAC(RANdom SAmple Consensus)

Dr. Sanjay Kumar ,Er. AnkurChauhan[12] proposes different feature extraction algorithm for feature extraction to find the most optimum methods. among ICA,PCA and LDA statistical methods is analysed and it is found that LDA is most optimum technique for object recognition purpose because of the proposed model includes more than one class definitions for a single object

3. PROPOSED WORK

The main objective of this research method is to implement a multimodal search retrieval system in which similar image of videos can be retrieved from the large volume of video pool. The proposed method can support multi modal search retrieval resulting in retrieval of the most matching frame in the video. The main goal of this research work is to increase the search retrieval accuracy even in case of more irrelevant videos present in the database.

A plain set of videos are taken as input query and it is subjected to the following process to find out the exact match in videos.

1) Videos are sequenced to continuous frame division
2) Shape features are extracted using Edge based feature Extraction
3) Linear Discriminative analysis is used to find the linear Combination of features
4) Genetic based Support Vector Machines are used for Classification, labeling and prediction to find the exact image scene in videos

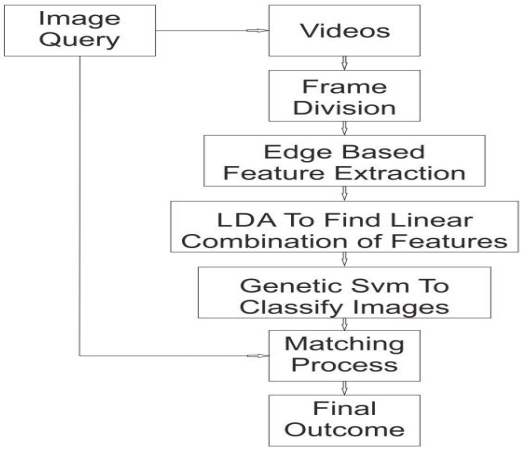

Figure1: Flow of the proposed system

3.1 Frame Division in videos

The Process of splitting a long video into smaller units is called video parsing. So the video is divided into basic elements like Key frame where each frame is treated as a static image, shot is defined as a set of contiguous frames taken in continuous camera recording. A set of contagious shots make a scene and the extraction process takes place. To facilitate fast and accurate content access to video data, we should segment a video document into frames, shots and scenes [11]

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3.2 Shape based Feature Extraction

Frame Extraction begins by extracting the contents of an image for preprocessing as it is the fundamental step. Frames are extracted as individual shot and spatial analysis is done. Shape based extraction is used to identify and locate discontinuities in the image. Compared to other types of feature extraction like color and texture, shape based feature is ahead. Identified shapes are selected as regions to compare further in edges. Shapes outline an object in a definite distinctive way, as it maps and converts shape space vector to close identical shape descriptors. The two-Dimensional (2D-feature) of an object O is defined as,

$$M_{ab} = \sum \sum_O x^a y^b \quad \text{f(x,y)}$$

Where f(x,y) is the function that describes intensity of O and a+b is the order of moment

Edge based technique is used for separation and labeling purpose. Sobel Edge detection is used to measure the difference in the neighboring pixels. It uses Gradient magnitude of an image using 3x3 filters, so for each pixel, value is greater for images that have change in its intensity in the direction and illumination effects

3.3 Linear Discriminant Analysis based Feature Extraction

Linear Discriminant Analysis is commonly used for classification in supervised learning. There are numerous techniques used for classification of data. Principal Component Analysis and Linear Discriminant Analysis are normally utilized systems for dimensionality reduction and data classification. Discriminant Analysis effortlessly handles the situation where the inside class frequencies are unequal and their exhibitions have been inspected on haphazardly produced test information. This method boosts the extent of between-class fluctuation to the inside class change in a particular informational collection in that way encouraging maximal distinctness. The key contrast among LDA and PCA is that PCA perform highlight grouping and LDA works for information arrangement

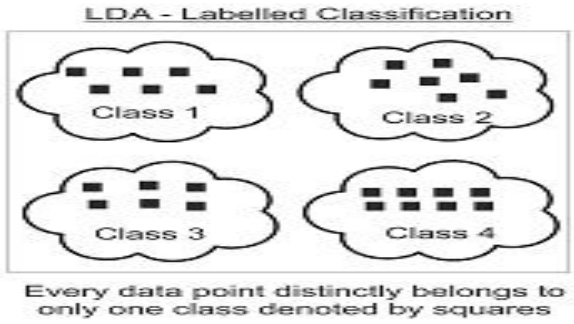

Figure2: LDA for Data Classification into Linear classes

Mathematically, this objective can be achieved by maximizing the Fisher criterion (the ratio of the between class scatter to the within class scatter). Given the sample set from the k-th class $X^k = \{X_1^k, X_2^k, \ldots, X_{N_k}^k\}$, where N_k is the number of samples in the *k*-th class, the between class scatter and the within class scatter are computed as

$$S_b = \frac{1}{N}\sum_{i=1}^{C} N_i (M^i - M)(M^i - M)^T$$

$$S_w = \frac{1}{N}\sum_{i=1}^{C}\sum_{j=1}^{N_i} (X_i^j - M^i)(X_j^i - M^i)^T$$

Where $N = \sum_{i=1}^{C} N_i$ is the total number of samples; C is the number of classes; $M^i = \frac{1}{N^i}\sum_i^{N^i} X_i$ is the mean vector of class i and $M = \frac{1}{N}\sum_i^C \sum_{j=1}^{N_i} X_i^j$ is the mean vector over the whole sample set. The key difference among LDA and PCA is that PCA perform feature classification and LDA works for data classification. The shape and location of the inventive data sets changes when transformed to a different space in PCA, on the other hand LDA doesn't change the location but only attempts to offer more class separability and induce a decision region among the given classes. This technique also supports to better recognize the distribution of the feature data [13].

3.4 Genetic Based Support Vector Machines

After learning of videos from LDA, its relevant features are selected and fitness function is taken based on its covariance selected as the Fitness function. Then Genetic algorithm is expected to perform classification based on

optimal features and predication is made with Multiclass SVM to find out the exact match of image in video accurately.

In each generation, evaluation of an individual datasets requires training the corresponding SVM and computing its accuracy. Let n be the total number of features available for representing the data to be classified. Hence, the chromosome is represented by binary vector of dimension n. If a bit is 1, it means that the corresponding feature is selected. A value of 0 indicates that the corresponding feature is not selected. The fitness function needs to choose different criteria such as the accuracy of the classification or the cost of performing classification or both of that as standard for the function. The GA is used to maximize the fitness value in order to find the optimal features subset which has been achieved the highest LOOCV accuracy. Finally, it produced the optimal subset of training and testing sets. The optimal subset from training set is used to construct SVM classifier. The choice of the optimal subset from testing set to test the performance of built Multiclass SVM classifier is based on the same type of features in the optimal subset from training set.The fittest function is selected based on difference .The distinct with high fitness value is taken as optimal feature and it is subjected to the process as it is given as single possible chromosomes under consideration and fitness function is set ,then cross over and mutation operations are performed to produce off spring, a better solution. These are assigns again for fitness, once the required best chromosome is fit, the process terminates and the best solution is obtained.

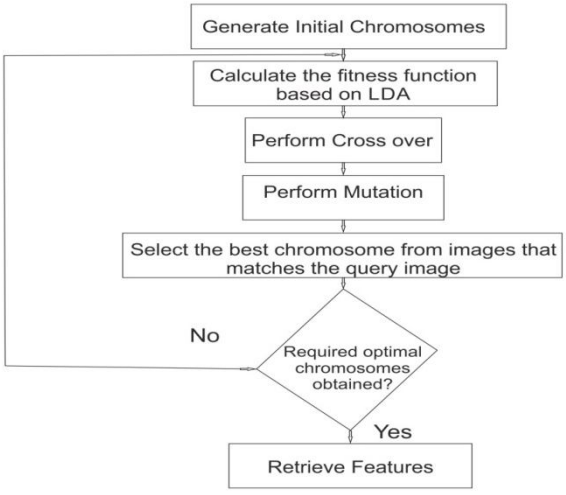

Figure3: Genetic Algorithm to find Similarity measure for the proposed system

4 Results and Discussion

The Evaluation of the proposed system is done by comparing its performance with various other metrics, So from the below mentioned figure 4,it is confirmed that the processed method gives an improved performance efficiency in retrieval of videos

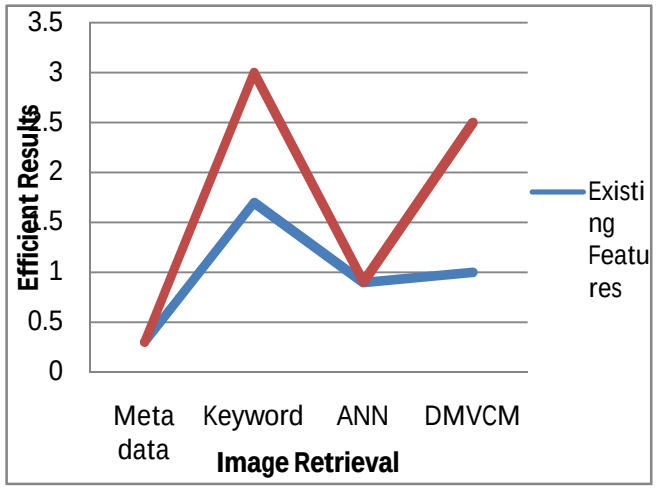

Figure 4 Performance of our proposed system with other systems

5.Conclusion

In this paper, as stated, we Proposed a conventional approach for image retrieval from video databases and our algorithm is used to reduce the dimensionality in classification and prediction of multidimensional space Testing the proposed system with the older systems improved precision and recall rate by about 20% and 18% respectively.LDA with Genetic Multiclass SVM has attained good accuracy with 1000 features. As an important extension of our work is on Hybrid Cuckoo Search based Transductive Support Vector Machine for optimal learning with other edge deduction methods to make the retrieval process still faster, so that speed and accuracy can be improved for matching video frame more accurately with very less computation speed.

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