Video Classification using Thepade's Sorted Block Truncation Coding using Bayes, Function, Lazy, Rule and Tree Classifiers

Madhura M. Kalbhor, Sudeep D. Thepade, Sanjay R. Sange

Abstract— Video classification is a process of grouping the relevant videos under the predefined set of categories. With the advance technology there is significant growth of video data. To properly manage this data there is need of efficient system. To store the video data in an efficient manner, video classification plays a vital role. This paper proposes a video classification system that uses Thepade's sorted block truncation coding method to fetch the attributes from the videos. The fetched attributes are supplied to twelve different classifiers belonging to Bayes, Function, Lazy, Rule and Tree classifier families. With the proposed classification system Simple Logistic classifier have given the best classification accuracy of 89.83%.

Keyword- Content based video classification, Thepades sorted block truncation coding, data mining classifiers.

I. INTRODUCTION

Videos on various different topics are uploaded daily on internet. There is need to classify the videos based on their content to enable efficient storing and retrieving. Many online sources retrieve various relevant videos based on our query. Most of classification systems use label based classification in which each video is associated with labels that are matched with the query. A better approach would be to return the video whose actual content match the query [1]. In recent years, content based classification systems are proposed. Content based video classification is the process of classifying the videos into the set of predefined classes based on the attributes or features. These attributes can be the colours in video, shapes, textures, audios, music, transformed contents etc. A single feature vector can be formed by using these attributes to represent the video. These systems employ feature extracted from the key frames or shots from the videos. In the proposed classification system the features that are used to train the classifiers are the colour attributes. The colour attributes are extracted using Thepades sorted block truncation coding method (TSTBTC). The experimentation is carried out with level1 and level2 of TSTBTC. To predict the class of query video Navie Baye, BayesNet, RBFNetwork, Simplelogistic, IB1, Kstar, DecisionTable, Part, BFTree, J48, RandomForest and RandomTree classifiers [4][5] are used. Experimentation is done to evaluate various data mining classifiers belonging to different families using TSTBTC to get the best classification system.

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II. LITERATURE SURVEY

Multimedia data can be described using the colour features. There are various techniques to extract the colour features. To extract the colour components from the video first key frames are extracted. From these key frames, colours are extracted to form the feature vector to be used in classification system.

A. Block Truncation Coding(BTC)

Block Truncation Coding is an efficient image encoding algorithm. BTC was developed in 1979 [10]. IN BTC process image is divided into n x n non overlapping blocks [11]. A single binary bitmap of the same size as the block is formed for single bitmap BTC of color image and two colors are computed to approximate the pixels within the block. An Inter Band Average Image (IBAI) is first created to form a binary bitmap in the RGB space and the threshold value is found to be a single scalar value. The pixels in the IBAI are compared with the threshold value to create the bitmap [12].

B. Data Mining Classifiers

Classification is a data mining (machine learning) technique which has a set of predefined classes and determine which class a new object belongs to [9]. There are large numbers of classifiers available which are used to classify the data such as decision tree, bays, function, Rule lazy, Meta, etc. Bayes method is used for classification in data mining [8], [13]. Here Bayesian Net and Naive Byes classification methods belonging to Bayes family are used. The various methods of function classifier are Linear Regression, Logistic, Functions Logistic, RBNFNetwork [10] etc. For our experiment we have used RBFNetwork and Simple Logistic methods. PART and Decision table methods are used from the Rule family. Next family used is Lazy from which IB1 and Kstar methods are used. There are different methods for decision tree such as ADTree, BFTree, J48, J48graft, DecisionStump ,RandomForest, RandomTree etc. For our data set we have used BFTree, J48, RandomForest and RandomTree.

III. PROPOSED VIDEO CLASSIFICATION APPROACH

Video classification process has two main steps. First is training the classifiers using the features of the video and second is query execution phase that predicts the category of query video.Fig1. Shows overall video classification process in which first feature vector of videos in training data set are formed using TSTBTC. Feature vectors of training data set are given to twelve classifiers. For the query video feature vector is formed using TSTBTC. Feature vector of query video is given to the trained model that predict the class

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labels of query video.

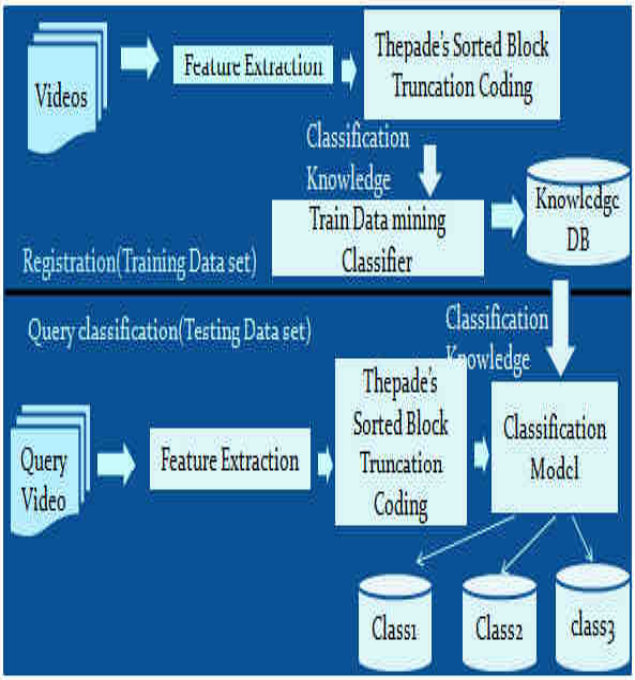

Fig. 1. Proposed Content Based Video Classification

A. Thepade's Sorted Ternary Block Truncation Coding (TSTBTC) Algorithm.

1. Extract the Red, Green, and Blue Planes of the image.
2. Intensity values of Red plane are in form of m x n are stored in column of size m x n. Similarly for Green and Blue planes.
3. Sort the intensity values of Columns formed in step two in ascending order. We get sorted red column vector, green column vector and blue column vector.
4. Sorted column vector is divided into three parts and average is computed of each part using equation 1, equation 2 and equation 3.

$$LR = \left(\frac{3}{r\times c}\right) \times \sum_{i=1}^{\frac{r\times c}{3}} sortedRED \quad (1)$$

$$MR = \left(\frac{3}{r \times c}\right) \times \sum_{i=(r\times c)/3+1}^{\frac{2\times r\times c}{3}} sortedRED \quad (2)$$

$$HR = \left(\frac{3}{r \times c}\right) \times \sum_{i=(2\times r\times c)/3+1}^{\frac{r\times c}{3}} sortedRED \quad (3)$$

Similarly the features of green (LG, MG, HG) and blue (LB, MB, HB) planes are obtained.

5. Feature vector formed as [LR, MR, HR, LG, MG, HG LB, MB, and HB] is used for classification.

From each video every 20th frame is extracted as a key frame. Thus from each video five frames are used to form the feature vector. For each frame TSTBTC algorithm is applied and finally the feature vectors of key frame concatenated to form the final feature vector. Using the TSTBTC algorithm, two feature vectors are computed as TSTBTC level1 and TCTBTC level2.

IV. Experimentation Enviornment

The proposed technique is implemented using Matlab on computer with Intel core i5 processor and 4 GB RAM. Video database used which contains 300 videos of 6 different classes. Fig. 2 shows dataset sample.

Fig. 2. Testing Dataset Sample video from each of the six classes.

Classification Accuracy is used for performance evaluation to compare the variations of proposed classification technique. The training is done using 180 videos. Total 120 queries are tested to get average accuracy. Accuracy is calculated for different feature vector sizes.

V. Results and Discussion

The experimentation is carried out to evaluate the impact of different data mining classifiers on content based video classification using accuracy as the measure. TSTBTC Level-1 and TSTBTC Level-2 are used to extract the features and supplied to Navie Baye, BayesNet, RBFNetwork, Simplelogistic, IB1, Kstar, DecisionTable, Part, BFTree, J48, RandomForest and RandomTree classifiers. Table 1 shows the experimental results. From the results it can be observed simple logistic classifier belonging to Function family is giving the higest classification accuracy of 89.16 % when TSTBTC- Level 2 is used as features.

Table I. Results TSTBTC for content based video classification for testing Accuracy.

Classifier		Classification Accuracy (%)	
		TSTBTC –Level 2	TSTBTC – Level 1
Bayes	Navie Bayes	88.33	85
	BayesNet	88.33	83.33
Function	RBFNEtwork	81.66	81.66
	Simple Logistic	89.16	87.5
Lazy	IB1	83.33	82.5
	KStar	73.33	80
Rule	DecisionTable	73.33	68.33
	Part	80.83	79.16
Tree	BFtree	88.83	79.16
	J48	81.66	80
	RandomForest	88.33	85.83
	RandomTree	79.16	84.166

Fig. 3. Shows the comparative analysis of accuracy given by Navie Bayes and Bayes Net classifier of Bayes family. Bayes Net and classifier is giving more accuracy 88.33 % using TSTBTC- Level 2.

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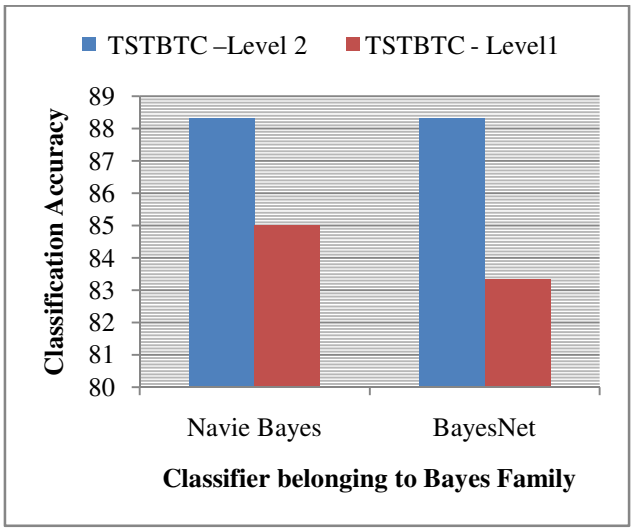

Fig. 3. Comparative analysis of Bayes family classifier

RBFNetwork and Simple Logistic Classifier are used from the function family. Fig4 shows the classification accuracy given by function family methods. Simple Logistic is giving highest accuracy using TSTBTC level2.

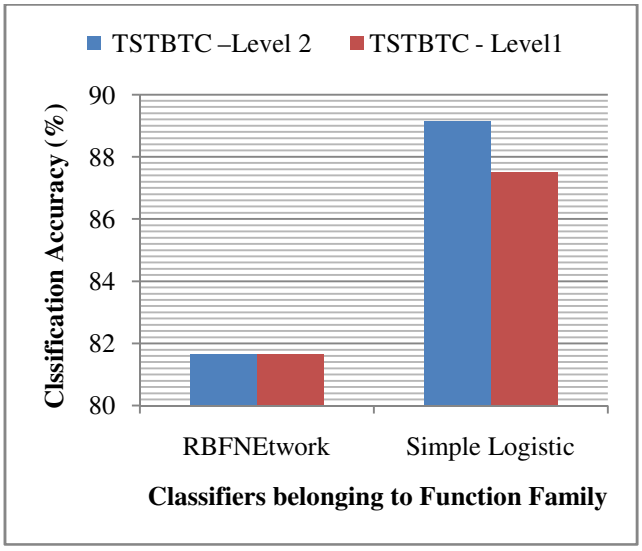

Fig. 4. Comparative analysis of Function family classifier.

Lazy Classifier methods, IB1 and Kstar are comprared and analyzed in Fig5. IB1 classifier is giving better performance than KStar classifier.

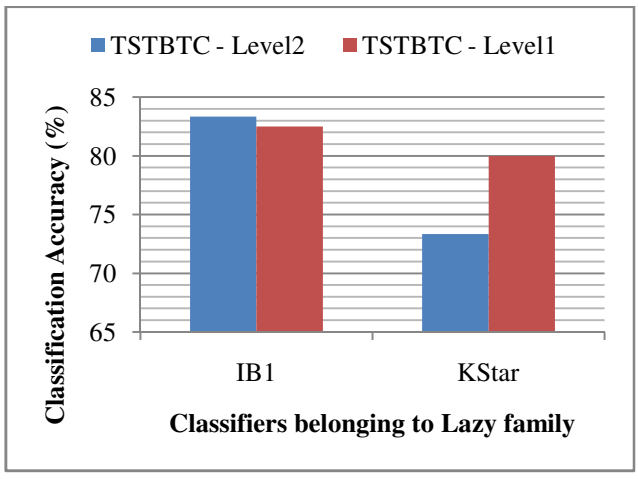

Fig. 5. Comparative analysis of Lazy family classifier.

Fig. 6. Show the Decision Table and Part classifiers performance. Part classifier has given 80.83% classification accuracy when compared with Decision Table method. Here again the TSTBTC level 2 has given the highest performance.

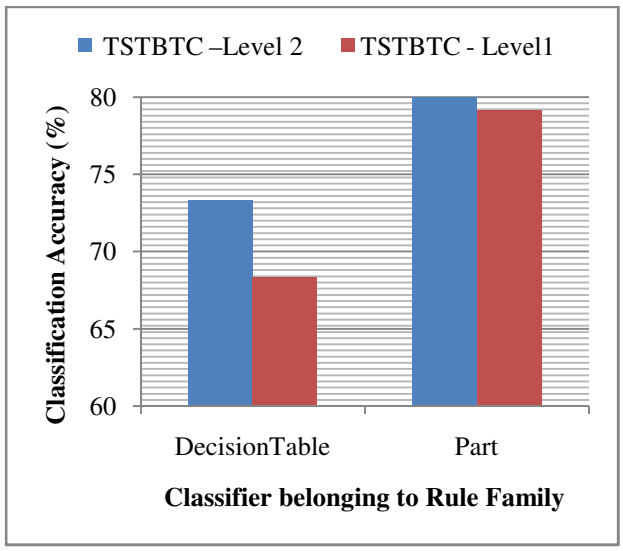

Fig. 6. Comparative analysis of Rule family classifier.

From the Tree family BFTree, J48,RandomTree and RandomForest classifiers are compared in Fig7.Among the Tree family methods BFTree has given the 88.83% of accuracy.

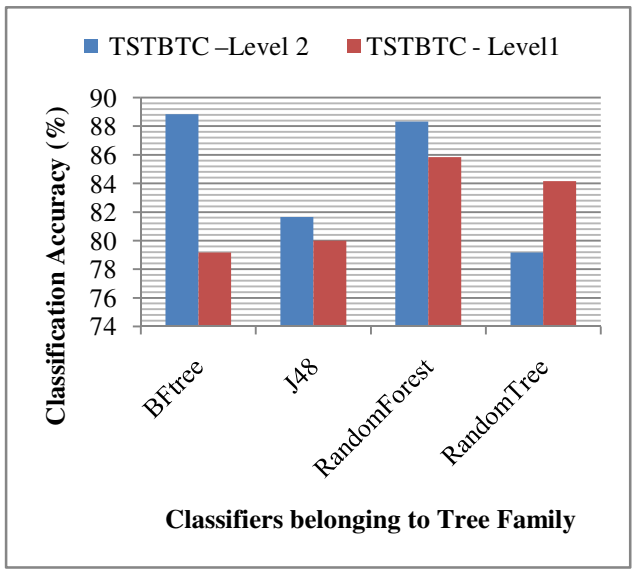

Fig. 7. Comparative analysis of Tree family classifier

VI. CONCLUSION

Content based video classification has become one of the most important research fields due to increasing digital video data. In this paper novel data mining based video classification system is proposed with good classification accuracy using Thepade's Sorted Ternary Block Truncation Coding (TSTBTC). The TSTBTC level 1 and level 2 are used for Color Content Based Video classification with 12 assorted classifiers spread across 5 families to check the performance of classifiers using accuracy measure on Content Base Video Classification. The proposed video

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classification system has given the best testing classification accuracy 89.83% with the Simple logistic classifier. With all the classifiers TSTBTC Level 2 has given better performance than Level 1.

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