Feature selection analysis for multimedia event detection

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Abstract. Selection of attributes has been the current emerging research area for a long while and much work has been finished on. With the making of tremendous dataset and the resulting necessities for good machine learning systems, new issues emerge and ways to deal with feature selection are the area of research and in need. Preprocessed and generated datasets of multimedia event detection with numerical values is the input for our research. This paper recognizes the contribution of each attribute and combinational attributes towards the accuracy of the classifier model. The analysis is done using LIBSVM tool and different kernel modes using Support Vector Machine (SVM) classifier. After the analysis is done, we will get to know that which attribute yields the maximum accuracy in classifying the instances.

1. Introduction

Feature selection makes new components from elements of the first datasets, though include choice returns a subset of the elements. Feature Selection systems are frequently utilized as a part of spaces where there are numerous components and relatively few examples (or data points). This paper consists of multiple theories and concepts which have been applied in process to work out the proposed work. The concepts to be named a few are: 1. Detection theory, 2. Multimedia Event Detection, 3. Concept drift. We have also used few tools for visualization and working out the theory. Some of the tools are 1. LIBSVM, 2. Mat Lab. In order to process all the data sets, we have trained them, which consists of artificial intelligence, integrated in LibSVM, which is then used to predict the outcome of any random data points entered which gives outcome as per desired demand. We will see the theories and proposed concepts below in details.

2. Literature Review

The paper titled ‘Video Event Detection using Motion Relativity and Feature Selection’ just emphasized on the approach in light of movement relativity and selection of features for video events. They proposed a new motion feature called as ERMH-BoW to utilize movement relativity for detection of event [1].
The paper titled ‘Multimedia Event Detection with ℓ2- regularized Logistic Gaussian Mixture Regression’ focused on the utilization of model named as Gaussian Mixture or GMM for visualization of video events and proposed a new approach which is likewise called as LLGMM classifier [2].

The paper titled 'Feature Selection for acoustic Event Detection' emphasized the recognition of strange circumstances caught through sound handling. They also used feature selection algorithms like joint mutual information and minimum redundancy maximum relevance and proposed the system for identification of perilous actions like weapon shots [3, 9].
The paper titled 'Learning a Rare Event Detection by Direct Feature Selection' introduced an algorithm based on forward selection of features which is quite faster than the Jones technique and yields quite good quality classifiers [4].

3. Concepts And Theories

Let us summarize the theories.

3.1 Detection Theory

Detection theory is a way to evaluate the capacity to perceive between data bearing examples (called boosting stimulus in living beings, motion in machines) and arbitrary examples that divert from the data (called commotion/noise, comprising of foundation jolts and irregular movement of the recognition machine and of the sensory system of the administrator). In the field of hardware, the partition of such examples from a camouflaging foundation is denoted as signal recovery or recovery of signals. [5]

3.2 Multimedia Event Detection

It is a way to characterize the events in a possible way so that it can be segregated based on the type of media we are dealing with. Some of the media may be pictures, videos, movies, songs and random other medias. They are characterized by unstructured data, structured data and semi-structured data. The data discussed above comes under unstructured data. Now, the data is configured as data with high level and low level features. The low-level features consist of edge detection, corner detection concepts to name a few. The high-level consists of certain innate body pose classification, facial detection, classification of living thing actions, object and variation detection and recognition and so on. [6]

3.3 Concept Drift

Concept Drift in predictive analytics and machine learning implies that the factual properties of the objective variable, which the model is attempting to be foreseen, change after some time in unpredictable ways. Thus, it causes issues in light of the fact that the expectations turn out to be less exact over the long haul. The word "concept" denotes to the amount to be anticipated or estimated. All the more for the most part, it can likewise direct to other wonders of intrigue other than the objective idea, for example, an information, be that as it may, with regards to idea float, the term regularly alludes to the objective or the target variables. [7, 10]

4. **SVM**

A support vector machine builds a hyper plane or a set of hyper planes in a high-or endless dimensional space [11]. The hyper plane constructed can be utilized for data mining functionalities like prediction etc. A great partition is accomplished by the hyper plane that has the biggest separation to the closest preparing information purpose of any class, since when all is said in done the bigger the edge the lower the speculation mistake of the classifier. The hyperplanes in the higher-dimensional space are defined as the set of points whose dot product with a vector in that space is constant. Relation is given as- $\Sigma \mathrm{i}\ \alpha \mathrm{k}(\mathrm{xi}, \mathrm{x}) = \mathrm{constant}.$

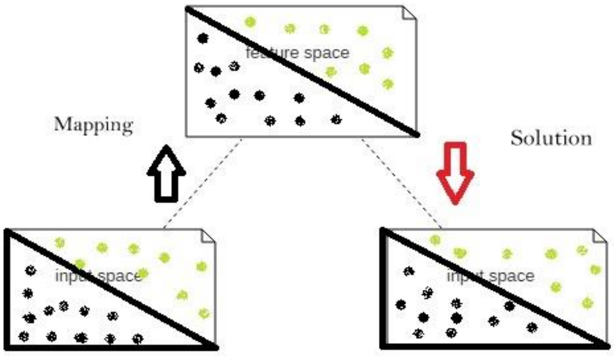

Fig 1: SVM Working Technique [8]

5. Proposed Work

Our work is done based on the previously discovered and traditional way of classifying i.e. the training set is used to generate the model and then the test set means the dataset for which the class labels are unknown and have to be predicted will be passed to this generated model and the outcome will be the classification result. The model will classify the instances and also give the accuracy which will tell that how many instances of the test dataset have been correctly classified by the model out of the total instances present in the test dataset. The basic working of the already well known classification technique is shown below in the diagram.

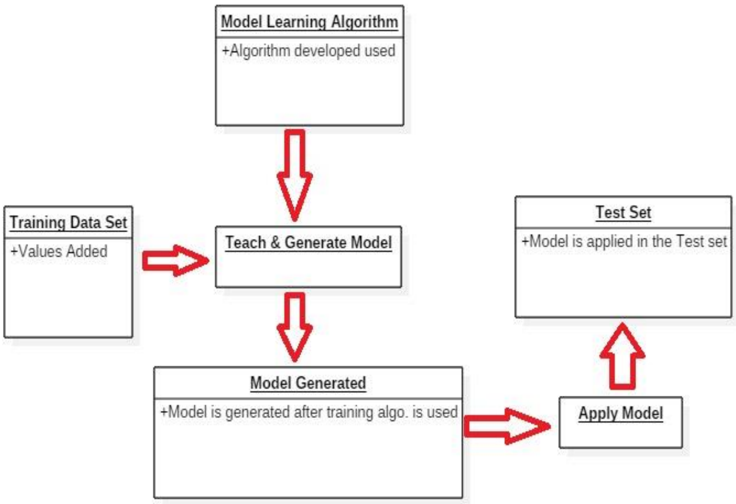

Fig 2: Illustration of Classification Process

This paper contains the analysis of the multimedia event detection dataset. So, the training and test data set are the most important files. The training data set has 193 instances and 3 attributes or features and has 19 different class labels. So, the process is a Multi-class classification. Thus, Support Vector Machine (SVM) classifier is used. The analysis is carried out with the help of LIBSVM tool and the training set is manipulated every time before generating the model. Manipulation mainly here means attribute selection. Like for the first run, out of 3 attributes only 1 attribute is selected and used in training set. The process is repeated using single attribute as well as combinational attribute. The svm-train library of LIBSVM has various parameters like kernel mode, svm type etc., we have carried out our analysis by changing the kernel modes as well.

The modes of kernel supported are: Linear mode, Radial Basis Function and Sigmoid mode.

6. Experiment & Results

For carrying out the analysis, the training file should be saved with .train extension and the test dataset file be saved with .test extension.

The command used to train the model –

svm-train.exe [options] training dataset file

Example: svm-train.exe –t 0 a.train

In the above example, -t denotes kernel mode,a.train is the name of training dataset file. The value 0 indicates the 'linear kernel mode'

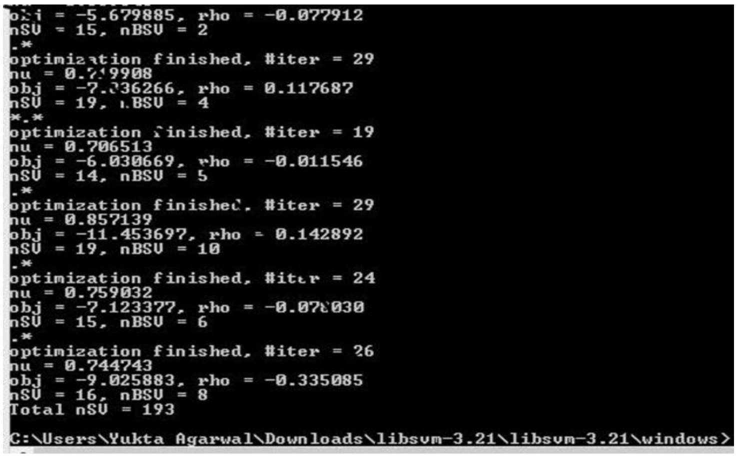

Fig 3: Output of svm-train.exe a. train

The command used to predict the class –

-svm-predict.exe test-data-file.test training -model- name result–file.out

Example: svm-predict.exe ddw.testa.train.modelaresult.out

In the above written example, ddw.test -> test dataset file name ;a.train.model -> training model name ; aresult.out -> output file name

Fig 4: Output of svm-predict.exe

The following tables shows the results of analysis using different attributes for the different modes of kernel-

1. Using Linear Mode(0)

Attribute in TDS	Accuracy of classifier	Instance Classification class label
A	0/18 (0%)	4,16,17,4,17,9,4,0,9,1,7,18,3,17,17,8,4,3,4
B	2/18 (11.11%)	10,10,10,10,3,10,3, 3,14,3,14,3,3,10,3,7,3,7
C	2/18 (11.11%)	10,10,10,10,3,10,3, 3,14,3,18,3,3,10,3,7,3,10
Ab	0/18 (0%)	4,16,17,4,17,9,4,0,9,1,18,3,17,17,8,4,3,4
Bc	2/18 (11.11%)	10,10,10,10,3,10,3, 3,14,3,18,3,3,10,3, 7,3,10
Ac	0/18 (0%)	4,16,17,4,17,9,4,0,9,17,18,3,17,17,8,4,3,4

Abc	0/18 (0%)	4,1,6,17,4,17,9,4,0,9,17,18,3,17,17,8,4,3,4

Table 1: Classification done Using Linear Model

2. Using Radial Basis Function Mode(2)		
Attribute in TDS	**Accuracy of classifier**	**Instance Classification class label**
A	2/18 (11.11%)	7,16,5,4,7,6,16,3,5, 5,13,13,7,7,1,13,6,4
B	1/18 (5.55%)	10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10
C	1/18 (5.55%)	10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10
Ab	2/18 (11.11%)	7,16,17,4,7,9,4,3,5, 5,13,13,7,7,1,13,6,4
Bc	1/18 (5.55%)	10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10,10
Ac	1/18 (5.55%)	7,16,17,4,7,9,4,8,5,5,17,13,7,7,1,13, 16,4
Abc	1/18 (5.55%)	7,16,17,4,7,9,4,8,5,5,17,13,7,7,1,13, 16,4

Table 2: Classification done Using Radial Basis Function Mode

3. Using Sigmoid Mode(3)		
Attribute in TDS	**Accuracy of classifier**	**Instance Classification class label**
A	1/18 (5.55%)	18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18
B	2/18 (11.11%)	10,10,10,10,3,10,3, 3,14,3,14,3,3,10,3,7,3,7
C	2/18 (11.11%)	10,10,10,10,3,10,3, 3,14,3,18,3,3,10,3,7,3,10
Ab	1/18 (5.55%)	18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18
Bc	2/18 (11.11%)	10,10,10,10,3,10,3, 3,14,3,18,3,3,10,3, 7,3,10
Ac	1/18 (5.55%)	18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18
Abc	1/18 (5.55%)	18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18,18

Table 3: Classification done Using Sigmoid Mode

7. Conclusion

Based on the analysis carried out we can conclude that test data set plays an important role and also the kernel mode is equally contributing towards the variation in the results. Although different attributes may give same accuracy but the class instance label may differ. Like if we consider the Radial Function Mode of the analysis and take the attributes ‘c’ and ‘ac’. Both yields 5% accuracy but the class labels are different. The results thus conclude so far that they may vary vastly depending on the datasets provided. Pruning may be done if the datasets has more number of attributes, whereas here we had few attributes in the dataset provided, thereby avoided pruning. We also analyzed that the test datasets if changed will have impact on the results.

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