Research Article

Commercial Video Evaluation via Low-Level Feature Extraction and Selection

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To discover the influence of the commercial videos' low-level features on the popularity of the videos, the feature selection method should be used to get the video features influencing the videos' evaluation mostly after analyzing the source data and the audiences' evaluations of the videos. After extracting the low-level features of the videos, this paper improved the Correlation-Based Feature Selection (CFS) method which is widely used and proposed an algorithm named CFS-Spearmen which combined the Spearmen correlation coefficient and the classical CFS to select features. The 4 datasets in UCI machine learning database were employed as the experiment data. The experiment results were compared with the results using traditional CFS, Minimum Redundancy and Maximum Relevance (mRMR). The SVM was used to test the method in this paper. Finally, the proposed method was used in commercial videos' feature selection and the most influential feature set was obtained.

1. Introduction

As a major kind of commercial multimedia, commercial videos' popularity is concerned by related companies and producers. There are many factors which influenced the audiences' evaluation to the commercial videos, such as the actor/actress, director, and story. But it is too subjective if these factors are employed to evaluate the videos. It is because that these factors are not quantitative in the evaluation procedure. So, the importance of design a model to analysis the videos and calculate the evaluation of them should be realized by the researchers [1]. The article [2] proposed an objective video quality evaluation method based on motion and disparity information. The article [3] presented a video quality evaluation method based on Quaternion Singular Value Decomposition. But only a few video features were used in [2, 3]. The video features should include many features such as color features, motion features, and shot features which might be very likely to influence the audiences' evaluation of the videos. However, the most influential feature set and the relationships between them and the video popularity are still not clear yet. For all the features extracted, we can select the most influential feature set through the feature selection

methods according the commercial videos' evaluation data. Of cause, the feature dimension reduction methods could also be used here.

Different feature set might be selected by different feature selection or dimension reduction methods. The feature dimension reduction algorithms, such as PCA [4, 5], FDA [6], and KPCA [7, 8], would reduce the feature number, while feature selection algorithms would select the optimal feature set from all the original features. Compared with the dimension reduction algorithms, the feature selection maintains the physical meanings of the original features and this is more convenient for data and relationship between features and videos' popularity analysis [9].

The main idea of feature selection is selecting a few valuable features and removing the useless ones from all the features extracted. The methods, such as embedded methods, Relief [10], mRMR [11], and CFS [12, 13], are widely used now.

For the embedded methods, sparsity regularized feature selection methods were also widely used in some research area such as appearance modeling in visual tracking [14–16]. In these methods, ℓ_1 -norm [17] (being called Lasso, presented by Tibshirani in 1996) and $\ell_{1,2}$ -norm based regularization models have been researched for selecting features with

joint sparsity across different tasks [18]. These methods select features by adding a penalty term with weight to the objective function of the machine learning model, which restricts the weight of each feature of the model. Feature selection is done in the process of model training, and those features whose coefficients are trained to zero are considered as redundant features. Recently, ℓ_p -norm and $\ell_{2,p}$ -norm model based regularization methods have attracted more and more attention because they can obtain sparser solutions than the methods based on ℓ_1 -norm and $\ell_{2,1}$ -norm [19]. The algorithms typically take a trade-off between a data-fitting loss function term and a sparsity term; therefore there inevitably exists residual in the loss function. However, little is known about such a residual's impact on the feature selection [20].

For other methods, only the correlation between feature and class was concerned in Relief algorithm but not the correlation between features. So, the selected feature set was not the optimal one [21]. For mRMR algorithm, both the correlation between features and feature-class were concerned to get the best feature set [22]. For the classifier, all the contributions of the features selected by mRMR were same, and the feature set was selected from the original features. The main idea of CFS is selecting the feature set with lower correlation between features and higher correlation between feature and class. After this procedure, the redundant features and the features which were not closely related to the class would be removed. The Pearson linear correlation coefficient was used in [21, 22] by Huanjing Wang and Ningqing Sun to calculate the correlation between features and feature-class. But only linear correlation coefficient could be measured in Pearson formula. For continuous data, discretization methods or kernel density estimation methods should be employed to solve the problem. This procedure would lead to probability estimation error.

So, the effectiveness of the correlation calculation is the key of successfulness of CFS. Currently, some correlation calculation methods were concerned by many researchers, and we should select the best one according to experiment results. Except Pearson Coefficient, some other correlation calculation methods are being used now. Spearman Rank Correlation Coefficient was used in the article of Marie Therese Puth [23] to describe the correlation of two vectors. The experiment result showed that the Spearman Rank Correlation Coefficient is better than Pearson Coefficient. In the research of Xiaoyuan Xu [24], the Spearman Rank Correlation Coefficient was employed to describe the correlation between features of wind speed. In the article of Jing Feng [25], a nonparametric method based on Spearman Rank Correlation Coefficient was proposed to measure the principle of storage degradation failure.

Spearman Rank Correlation Coefficient was not widely used in feature selection yet. In this paper, after extracting the commercial videos low-level features including color features, motion features, and shot features, a CFS-Spearman algorithm is presented and used to process the four datasets, including 'Cancer', 'Glass', 'Bank', and 'Credit', in the UCI machine learning database. The experiment results are

compared with CFS and mRMR. The LibSVM classifier is utilized to test the effectiveness of CFS-Spearman. Then, the method in this paper is employed to select the low-level features of the commercial videos to predict the popularity of them. The results showed that the proposed method was better than CFS, mRMR, and ℓ_p -norm based sparsity regularized feature selection.

2. Video Low-Level Features Extraction

2.1. Color Features. Color is an important feature of vision. The color feature set is combined with 10 features including means and variances of Brightness, Contrast, Saturation, Colorfulness, and Simplicity. Brightness is calculated by average the brightness of every pixel in every frame in HSV space. It is similar as Saturation calculation procedure. The Contrast could be expressed by the following formula:

$$cont = \text{var}_{\text{frame } i} \left(\frac{(\max(r, b, g) + \min(r, b, g))}{2} \right) \quad (1)$$

in which, r, g, and b represent red, green, and blue value of a pixel. Var is the variance calculation function [26].

Colorfulness is a parameter reflecting the combination of image's color. It is defined as

$$Cf = A + 0.3B \quad (2)$$

in which

$$A = \sqrt{\text{var}(r - g) + \text{var}\left(\frac{(r + g)}{2} - b\right)} \quad (3)$$

$$B = \sqrt{[\text{Mean}(r - g)]^2 + \left\{ \text{Mean}\left[\frac{(r + g)}{2} - b\right] \right\}^2} \quad (4)$$

Mean is the function to get the average the input value [27].

To attract the audiences' attention in the progress of movie making, the director and the cameraman always make the scenes simpler than the objects. The Simplicity is used to measure this character in some article. It is defined in [28] and the final Simplicity is the mean value of every frame.

2.2. Motion Features. Motion features reflect the changing rate of the scene or objects in the videos. It could be regarded as the moving speed between camera and the objects while shooting. In this article, the motion features are calculated as follows. Firstly, every frame is separated into 16×16 blocks. The pixel barycenter of every block is get, and then, the frame n and the frame n+1 are compared to obtain the barycenter changing rate of the corresponding blocks in the two neighbor frames. The motion feature mean is the mean value of pixel barycenter coordinate changing and the motion feature variance is the variance of it [29].

2.3. Shot Features. Shot features are also important for video evaluation. To get every shot in a video, the key frames, which are located at the edge of the shots, of the video should be selected firstly [30]. We compare the color histogram of every

FIGURE 1: Video features extraction procedure.

two neighbor frames to calculate the similarity of them. After key frame selection, the four features, “Shot length mean”, “Shot number”, “Shot length variance”, and “Video length”, are calculated.

Then, the 16 features, including “Brightness mean”, “Contrast mean”, “Saturation mean”, “Colorfulness mean”, “Simplicity mean”, “Brightness variance”, “Contrast variance”, “Saturation variance”, “Colorfulness variance”, “Simplicity variance”, “Motion mean”, “Motion variance”, “Trailer length”, “Shot number”, “Shot length mean”, and “Shot length variance”, are get as shown in Figure 1.

3. Feature Selection Suing CFS

When the features are extracted, the relationship between features and video evaluation is still not so clear. It is because that some features influence video viewers’ evaluation but others do not. We should select the most influential feature

set of the videos’ evaluation. Some feature selection methods might be introduced here.

3.1. mRMR. mRMR is a typical feature dimension reduction method which use mutual information to measure the correlation between two features and feature-class. The formulas are listed as follows:

$$\max D(S, c), \quad D = \frac{1}{|S|} \sum_{x_i \in S} I(x_i; c) \quad (5)$$

$$\min R(S), \quad R = \frac{1}{|S|} \sum_{x_i, x_j \in S} I(x_i, x_j) \quad (6)$$

in which S is the feature set, $|S|$ is the feature number, c is the class index, $I(x_i, c)$ is the mutual information between the i^{th} feature and class c , and $I(x_i, x_j)$ is the mutual information between the i^{th} feature and the j^{th} feature.

The mutual information between x and y here is defined as

$$I(x, y) = \iint p(x, y) \log \frac{p(x, y)}{p(x)p(y)} dx dy \quad (7)$$

Then, we get the criterion of feature selection as follows:

$$\max(D - R) \quad (8)$$

3.2. CFS Algorithm. CFS is a simple feature selection method. It calculates the correlation value between every two features and feature-class to select the features related to classes most closely. As shown in (9) and (10), this method tries to maximize the M_s .

$$M_s = \frac{k\bar{r}_{cf}}{\sqrt{k + k(k-1)\bar{r}_{cf}}} \quad (9)$$

$$r_{xy} = \frac{\sum xy - (\sum x \sum y) / N}{\sqrt{[\sum x^2 - (\sum x)^2 / N][\sum y^2 - (\sum y)^2 / N]}} \quad (10)$$

In the formulas above, M_s is a measure of feature set S with k features. $\bar{r}_{xy}$ is the average correlation calculation method of x and y which are all features or feature and class. N is the number of samples. According to formula (10), in the feature set S , the value of M_s will be bigger if the average correlation between features is minor and the average correlation between features and class is bigger. Then, the feature set is an optimized one. This algorithm is called Pearson Correlation Coefficient.

3.3. Spearman Rank Correlation Coefficient. Pearson Correlation Coefficient was employed in traditional CFS. But there are some other correlation calculation methods which could be tested. Spearman Rank Correlation Coefficient is one of them. It could be defined as follows:

$$r_{xy} = \frac{\sum_{i=1}^N [(R_i - \bar{R})(S_i - \bar{S})]}{\sqrt{\sum_{i=1}^N (R_i - \bar{R})^2} \sqrt{\sum_{i=1}^N (S_i - \bar{S})^2}} \quad (11)$$

In the formula above, we firstly define the random variable X and Y with N samples as (x_i, y_i) . Then, let R_i and S_i be the ranks of x_i and y_i in the corresponding sample. $\bar{R}$ and $\bar{S}$ are the average ranks of the sample. The Spearman Rank Correlation Coefficient described the monotonic dependence of variables X and Y . The monotonic direction could be recognized by the sign of r_{xy} . When Y creases with X creasing, the sign of r_{xy} is positive, and it is negative conversely. Y will not change with X while the sign of r_{xy} is 0.

The linear correlation coefficient is a widely used correlation measurement and it is easy to be calculated. When the random variables are elliptical distribution, the linear correlation coefficient could express the correlation between the variables. But the short points of it is that it is nonexistent when the variables' first- and second-order moments could not be get, its value should change when the variables

distribution function changed, and after nonlinear strictly increasing, the linear relationships between variables would change [24]. It is most important that the relationship could not be expressed accurately while the variables do not distribute as elliptical distribution.

The Spearman Rank Correlation Coefficient is a nonparametric statistic method. Let the rank correlation coefficient of the two variables X and Y be $r(X, Y)$, then

$$r(X, Y) = \rho(F_X(X), F_Y(Y)) \quad (12)$$

in which $F_{(X)}$ and $F_{(Y)}$ are the cumulative probability of X and Y , respectively.

The two random variables' rank correlation coefficient is the linear correlation coefficient of the cumulative probability distribution function expressed as $F_X(x) = P(X \leq x)$. If the inverse function of it exists, the variable $F_X(X)$ distributed as uniform distribution in $[0, 1]$ because of the following formula:

$$P(F_X(x) \leq r) = P(X \leq F_X^{-1}(r)) = F_X(F_X^{-1}(r)) = r \quad (13)$$

$r \in [0, 1]$

So the rank correlation coefficient is just an expression of relationship after transformation from the original variables to the variables in uniform distribution. Compared with linear correlation coefficient, the rank correlation coefficient's advantages are as follows: (1) always exist; (2) does not change with edge distribution; (3) does not change after strict nonlinear transform. So, it is chosen in this paper to measure the relationships between feature and feature or feature and class.

4. Experiment Analyzing for Feature Selection

To prove the effectiveness of CFS-Spearman feature selection method in this paper, the 4 datasets, including "Breast-cancer", "Glass", "Bank", and "Credit" in the UCI machine learning database, are used as the experiment data. The detailed information of the 4 datasets is listed in the Table 1. In the experiment procedure, CFS-Spearman feature selection method was employed to select the most important features and the SVM classification was used to test the selected feature sets. In the experiment, 1/10 of all the samples were selected randomly as the testing data and the others were used as the training data. This classification procedure was repeated for 10 times for every dataset. The mean values of the correctly classification rates were showed in the tables and figures to prove the effectiveness of the method in this paper.

The experiment results were got by Matlab and LibSVM tool box. The results of CFS-Spearman feature selection were also compared with the original CFS, mRMR, and ℓ_p -norm based sparsity regularized feature selection method as shown in the tables. In Tables 3 and 8, the weighted fonts are the correctly classification rate of CFS-Spearman higher than or equal to CFS, mRMR, and ℓ_p -norm. For ℓ_p -norm based sparsity regularized feature selection, we obtained the different settings of $p \in [0.1, 0.3, 0.5, 0.7, 0.9]$ in every

TABLE 1: The 4 datasets in UCI database.

Data set	Sample Number	Feature number	Class number
Breast-cancer	206	8	2
Glass	144	9	2
bank	30	9	2
Credit	998	14	2

TABLE 2: The 8 features and classes of dataset “Breast-cancer”.

Features								Class
1	2	3	4	5	6	7	8	
Age	Menopause	Tumour size	Tumour node	Canceration degree	Tumour position	Tumour quadrant	Radiotherapy or not	Benign or malignant

experiment. This parameter was selected by the classification results using SVM.

Table 2 showed the 8 features and classes of dataset “Breast-cancer”. As shown in Table 3, the CFS-Spearman feature selection method, original CFS, mRMR, and ℓp -norm ($p=0.9$) were used to select the features in this dataset. From the results, it is obvious that the selected features were different in most feature sets. But if using features selected by CFS-Spearman, the correct classification rates were higher than or equal to other methods in all cases.

In the second experiment, the dataset is “Glass”. We can estimate whether a piece of glass is “float glass” or not according to the chemical elements in it. These elements were listed in Table 4. Same as the second experiment, the third one is about one person might be a member of bank or not. The 9 features, like “Age”, “Living area”, “Income”, and so on, were listed in Table 5. The last experiment was about “Credit degree”. There were 14 features in this dataset as shown in Table 6.

The correct classification rates were shown in Figure 2. In the figure, (a) showed the classification results of dataset “Breast-cancer”. The red curve is the correct classification rate of CFS in the cases of 1-feature, 2-features, to 7-features. The green curve was for mRMR and the blue one was for CFS-Spearman. The pink curve was for ℓp -norm ($p=0.9$). The results in this subfigure are same as the data in Table 3.

Figure 2(b) showed the classification results of dataset “Glass” using different feature selection methods. Correct classification rates of CFS-Spearman algorithm in cases of 1-feature, 2-features, to 7-features were better than original CFS, mRMR, and ℓp -norm ($p=0.7$). But if we select 8 features, the correct classification rate of CFS-Spearman algorithm was lower. When 4 features were selected, the correct classification rate was highest and the feature set included features 1, 3, 4, and 5 corresponding to Table 4.

As shown in Figure 2(c), for dataset “Bank”, the correct classification rates of CFS-Spearman algorithm in cases of 1-feature, 2-features, to 8-features were better than or equal to original CFS, mRMR, and ℓp -norm ($p=0.7$). The correct classification rates were all 81.25%. Corresponding to Table 5, when we selected 2 features, the set is constructed by feature 1 and feature 6. When 4 features were selected, the set is combined with feature 1, feature 6, feature 7, and feature 8.

Figure 2(d) showed the classification results of dataset “Credit” using different feature selection methods. Correct classification rates of CFS-Spearman algorithm in cases of 1-feature, 2-features, to 13-features were better than or equal to original CFS, mRMR, and ℓp -norm ($p=0.9$). When more than 9 features were selected, the correct classification rate reached the highest value 84.2%, and the 9-features set included features 3, 5, 6, 7, 9, 11, 12, 13, and 14 corresponding to Table 4.

From Figure 2, in most cases, the correct classification rates increased with the increasing of feature number until one feature number and then decreased. So, if we want to make a classification with some features like those shown in Table 8, not all features are necessary. Some more important features should be selected by the appropriate feature selection method.

5. Videos Popularity Prediction

In this paper, the CFS-Spearman feature selection method was used in video low-level feature selecting for videos’ popularity prediction. The low-level feature set included 16 features as expressed in the second part of this paper. There are 300 videos, which were downloaded from “Youtube”, used in experiments. The 16 features were extracted for each video and the serial numbers of them were showed in Table 7.

To evaluate the popularity of them, the audiences’ “Like/Dislike” votes numbers were employed to calculate the popularity degree as shown in

$$Score = \frac{LN}{LN + DN} \times 5 \quad (14)$$

in which LN is the vote number of “like” and DN is the vote number of “dislike” for a video. We set 4.7 as the threshold of classification for “good” videos and “bad” videos. It means that if the score of a video is higher than or equal to 4.7, it is a good video. Otherwise, it is regarded as bad one. All the extracted features were listed in Table 7. We used the four methods to select the features, and the selecting results were shown in Table 8. If the selected features were employed to classify the videos in to two classes, good and bad, the correct classification rates were listed in Table 8.

TABLE 3: Classification results using features selected by different methods.

Feature number	CFS-Spearman		CFS		mRMR		ℓp -norm (p=0.9)	
	Features	Correct Classification rate (%)	Features	Correct Classification Rate (%)	Features	Correct Classification rate (%)	Features	Correct Classification rate (%)
k=1	(5)	70.1389	(5)	70.1389	(5)	70.1389	(5)	70.1389
k=2	(4-5)	75	(4,8)	71.5278	(2,5)	74.3056	(2,5)	74.3056
k=3	(1,4-5)	79.1667	(4-5,7)	76.3889	(2,4-5)	75	(2,4-5)	75
k=4	(1,3-5)	75	(4-5,7-8)	74.3056	(2,4-6)	73.6111	(2,4-5,7)	74.3056
k=5	(1,3-6)	75	(1,3-5,8)	74.3056	(2,4-6,8)	74.3056	(2,4-5,7-8)	74.3056
k=6	(1-5,8)	75.6944	(1,3-5,7-8)	75.6944	(2,4-8)	71.5278	(1-2,4-5,7-8)	72.9167
k=7	(1-5,7-8)	73.6111	(1-5,7-8)	73.6111	(1-2,4-8)	75.6944	(1-5,7-8)	71.5278

TABLE 4: The 9 features and classes of dataset “Glass”.

Features									Class
1	2	3	4	5	6	7	8	9	
Iridium	Sodium	Magnesium	Aluminium	Silicon	Potassium	Calcium	Barium	Iron	Float glass or not

TABLE 5: The 9 features and classes of dataset “Bank”.

Features									Class
1	2	3	4	5	6	7	8	9	
Age	Living area	Income	Marital status	Children umber	Have a Car or not	Deposit	Account exchange	Mortgage	Bank member or not

TABLE 6: The 14 features and classes of dataset “Credit”.

Features													Class
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Keeping Time	Credit record	Purpose	Limit	Instalment promise	Personal information	Residence	Credit degree						
Property rights	Age	Housing	Job	Family number	Cell phone	Foreign worker or not	Credit degree						

TABLE 7: Extracted video features and classes.

1	2	3	4	5	6	7	8	Class
Mean of motion	Variance of motion	Mean of brightness	Mean of contrast	Mean of saturation	Mean of colorfulness	Mean of simplicity	Variance of brightness	Good(1) Bad(0)
9	10	11	12	13	14	15	16	
Variance of contrast	Variance of saturation	Variance of colorfulness	Variance of simplicity	Mean of shot length	Variance of shot length	Shot number	Video length	Good(1) Bad(0)

The SVM classification results showed that most correct classification rates of CFS-Spearman method were higher than that of the other two ones. And when the feature number is 3, the correct classification rates are the highest one which is 78%. And in this case, the features “Mean of contrast”, “Variance of Simplicity”, and “Variance of shot length” were selected as the most influential features. So, they could be used as the feature set to predict the popularity of commercial videos.

The correct classification rates curves were drawn in Figure 3.

The results in Table 8 were obtained by SVM using the selected feature set. Recently, some classification methods associated with deep learning received wide attention. CNN (convolution neural network) is a popular one within them. To compare the classification effectiveness, CNN was designed to test the prediction of the videos’ popularity in this part using the selected 3 features. The design of CNN used in this paper was shown in Figure 4. Firstly, the selected feature set, including features 1, 3, 4, 5, 6, and 7, were employed as the original input data of CNN. It is because that other features, such as “Variance of motion” and “Variance of shot length”, were just one scalar but not a vector or matrix.

In contrast with using SVM, the 6 features (features 1, 3, 4, 5, 6, and 7) were not the mean values of every frame in the whole video, but just uniformly selected 500 frames from a video and calculated the 6 features in every selected frame.

Then, we get the input data whose size is 500×6 of CNN. The parameters in this framework were set as follows. The convolution and pooling procedure was repeated for 3 times. For the 6 features, there was no any relationship between each other. So, the convolution kernels’ size was set as $[m, 1]$. The parameters were designed as follows.

For the first time, $m_1=51$, $k_1=500$, and there were 4 convolution layers in the procedure. Then, the size of feature map C_1 was $4@(450 \times 6)$. After the first pooling processing with $p=2$, the size of feature map S_1 was $4@(225 \times 6)$. For the second time, $m_2=76$, $k_2=225$, and there were 10 convolution layers. The size of feature map C_2 was $10@(150 \times 6)$. The size of feature map S_1 was $10@(75 \times 6)$. For the third time, $m_3=75$, $k_3=75$, and the size of feature map S_3 was $10@(1 \times 6)$. We convert S_3 to a column shoes size which was (60×1) . Then, the video’s 3 features were transformed to a new feature set with 60 numbers. After Softmax classification, the results were obtained. The experiments were repeated for 10 times, as shown in Table 9, just like the experiments using SVM. The testing result showed that the mean correct classification rate was 61.6667, which was much lower than SVM using the 3 selected features. It is because that the 16 features were most scalars which were not suitable for CNN classification.

If we use the whole videos or some frames in them as the input data for CNN, according to the characteristic of CNN, it only pays attention to the differences between the input data in the convolution procedures or tries to get the edges

FIGURE 2: Correct classification rates of different datasets using the 3 methods. (a) Correct classification rates for dataset "Breast-cancer". (b) Correct classification rates for dataset "Glass". (c) Correct classification rates for dataset "Bank". (d) Correct classification rates for dataset "Credit".

in the images or videos. So, the features such as the 3 selected one, which were proved to be the influential features to the popularity of the videos, would not be calculated in the CNN framework.

6. Conclusions

This paper researched the low-level feature selection methods in commercial videos' popularity prediction. To select the more influential features in the feature set, the paper

proposed a CFS-based method in which the Spearman Correlation Coefficient was employed to take place of original Pearson Correlation Coefficient. To test the method, the data in UCI machine learning database were used as the experiments data source. The widely used algorithm, mRMR, original CFS, ℓ_p -norm based sparsity regularized feature selection, and the method called CFS-Spearman algorithm presented in this paper were compared using the data. Four results showed that the method in this paper was better than the other ones.

TABLE 8: Experiment results for video popularity prediction using different methods.

Feature number	CFS-Spearman			CFS			mRMR			ℓp -norm ($p=0.9$)		
	Feature set	Correct classificat-ion rate (%)	Correct classificat-ion rate (%)	Feature set	Correct classificat-ion rate (%)	Correct classificat-ion rate (%)	Feature set	Correct classificat-ion rate (%)	Correct classificat-ion rate (%)	Feature set	Correct classificat-ion rate (%)	Correct classificat-ion rate (%)
k=1	(1,4)	56.6667	56.6667	(5)	56.6667	56.6667	(12)	50.6667	50.6667	(14)	56.6667	56.6667
k=2	(4,14)	69.3333	59.3333	(5,14)	59.3333	63.3333	(4,12)	63.3333	63.3333	(5,14)	59.3333	59.3333
k=3	(4,12,14)	78	56.6667	(5,13-14)	56.6667	76	(4,12,16)	76	76	(4,12,14)	64.6667	64.6667
k=4	(4,7,12,14)	75.3333	68.6667	(5,13-15)	68.6667	73.3333	(4,9,12,16)	73.3333	73.3333	(4,9,12,14)	72	72
k=5	(2-5,7)	77.3333	69.3333	(5,12-15)	69.3333	74.6667	(4,6,9,12,16)	74.6667	74.6667	(4,5,9,12,14)	74.3333	74.3333
k=6	(2-5,7,14)	76	75.3333	(5,12-16)	75.3333	74.6667	(2,4,6,9,12,16)	74.6667	74.6667	(2,4,5,9,12,14)	74.6667	74.6667
k=7	(1-5,7,14)	76	74.6667	(5-6,12-16)	74.6667	76	(2,4,6,9,12,15-16)	76	76	(1,2,4,5,9,12,14)	76	76
k=8	(1-5,7-8,14)	74.6667	74.6667	(5-6,10,12-14)	74.6667	76	(2,4-6,9,12,15-16)	76	76	(1,2,4-6,9,12,14)	74.6667	74.6667
k=9	(1-8,14)	74.6667	74.6667	(5-6,10-16)	74.6667	74.6667	(2-6,9,12,15-16)	74.6667	74.6667	(1,2,4-6,9,12,14-15)	74.6667	74.6667
k=10	(1-8,13-14)	74.6667	74.6667	(5-6,9-16)	74.6667	74.6667	(2-6,9-10,12,15-16)	74.6667	74.6667	(1-6,9,12,14-15)	74.6667	74.6667
k=11	(1-8,13-15)	74.6667	74.6667	(4-6,9-16)	74.6667	74.6667	(2-7,9-10,12,15-16)	74.6667	74.6667	(1-6,9,12,14-16)	72	72
k=12	(1-8,12-15)	74.6667	74.6667	(1,4-6,9-16)	74.6667	74.6667	(2-7,9-12,15-16)	74.6667	74.6667	(1-6,8,9,12,14-16)	72	72
k=13	(1-8,12-16)	76	74.6667	(1,4-7,9-16)	74.6667	74.6667	(1-7,9-12,15-16)	74.6667	74.6667	(1-9,12,14-16)	72	72
k=14	(1-8,10-14,16)	72	76	(1,4-16)	76	74	(1-12,15-16)	74	74	(1-9,11-12,14-16)	71.6667	71.6667
k=15	(1-8,10-16)	75.3333	75.3333	(1,3-16)	75.3333	75.3333	(1-12,14-16)	75.3333	75.3333	(1-12,14-16)	75.3333	75.3333

FIGURE 3: Correct classification rate using video features by different methods.

FIGURE 4: The designed CNN for video popularity prediction.

TABLE 9: The classification results using CNN.

Correct classification rate (%)										Mean
1	2	3	4	5	6	7	8	9	10	
70	63.3333	60	66.6667	56.6667	63.3333	53.3333	56.6667	60	66.6667	61.6667

TABLE 10

No.	NAME	LINK
1	Chairman of the Board Trailer	http://www.youtube.com/watch?v=Q6muVAmQ0S0
2	"Daniel der Zauberer" (official trailer) HQ	http://www.youtube.com/watch?v=W2vKfxXE7_4
3	Dinoshark (2011) - Official Trailer	http://www.youtube.com/watch?v=9LnsIY8kOU
4	From Justin To Kelly Trailer	http://www.youtube.com/watch?v=o6kbtstfZjhk
5	Gigli (2003) Trailer	https://www.youtube.com/watch?v=4-7iv6-8BRw
6	Growth - Official Trailer [HD]	http://www.youtube.com/watch?v=GeiPMIC8D-o
7	House of The Dead - Official HD Movie Trailer	http://www.youtube.com/watch?v=JgfvYJGB2kl
8	House Of The Dead Trailer (2003)	https://www.youtube.com/watch?v=htx3igr0ksk
9	A Fox's Tale (Kis Vuk) English Trailer	http://www.youtube.com/watch?v=mubtxYoxmXY
10	Jack and Jill Trailer 2011	http://www.youtube.com/watch?v=WZZEmzQh5Q
11	Kaboom Movie Trailer 2011 Official Trailer	http://www.youtube.com/watch?v=DzmQUQdgGi8
12	Manborg (2012) - Official Trailer - Horror Movies HD	https://www.youtube.com/watch?v=mBHau4HeTZY
13	Mars Needs Moms Movie Trailer (HD)	http://www.youtube.com/watch?v=_a5SW__Ezk
14	Mega Python VS Gatoroid (2011) - Official Trailer	https://www.youtube.com/watch?v=R4yBv4sSKTw
15	Melissa Molinaro - The Hiltz (2004) Trailer	http://www.youtube.com/watch?v=f4SNoskjs-8
16	Outpost 31 - 2013 OFFICIAL Trailer	http://www.youtube.com/watch?v=WMXdE6sclxQ
17	Back to the Future 4 Official Trailer HD 720p	http://www.youtube.com/watch?v=GZbylqIDduw
18	piranhaconda trailer	http://www.youtube.com/watch?v=fcDaxyLfrNk
19	Quantum Apocalypse 2010 Trailer	http://www.youtube.com/watch?v=tNVV5n0N_LhU
20	Rise of the Animals (2012) - Official Trailer - Horror Movies HD	http://www.youtube.com/watch?v=U87zVklXXN10
21	RoboCop 2013 Trailer (official)	http://www.youtube.com/watch?v=U87zVklXXN10
22	Sand Sharks Trailer	http://www.youtube.com/watch?v=U87zVklXXN10
23	Sharktopus (2010) - Official Trailer [HD]	http://www.youtube.com/watch?v=U87zVklXXN10
24	Son of the Mask 2005 High Quality	http://www.youtube.com/watch?v=U87zVklXXN10
25	Son of the Mask Movie Trailer	http://www.youtube.com/watch?v=U87zVklXXN10
26	Superbabies: Baby Geniuses 2 (2004) Trailer [Official]	http://www.youtube.com/watch?v=U87zVklXXN10
27	SURF SCHOOL Trailer	http://www.youtube.com/watch?v=U87zVklXXN10
28	Bad ass (2012) Official Trailer HD	http://www.youtube.com/watch?v=U87zVklXXN10
29	The Double (2011) Movie Trailer HD	http://www.youtube.com/watch?v=U87zVklXXN10
30	The Fifth Element (1997) Trailer	http://www.youtube.com/watch?v=U87zVklXXN10
31	The Final Sacrifice Trailer	http://www.youtube.com/watch?v=U87zVklXXN10
32	The Hotie and The Nottie Movie Trailer	http://www.youtube.com/watch?v=U87zVklXXN10
33	The Human Centipede - Official Movie Trailer 2010 [HD]	http://www.youtube.com/watch?v=U87zVklXXN10
34	The Legend of the Psychotic Forest Ranger (2012) - Official Trailer	http://www.youtube.com/watch?v=U87zVklXXN10
35	Bad Kids Go to Hell Official Trailer 2 (2012)	http://www.youtube.com/watch?v=U87zVklXXN10
36	Titanic: The Legend Goes On Trailer	http://www.youtube.com/watch?v=U87zVklXXN10
37	Tony Blair Witch Project - Trailer	http://www.youtube.com/watch?v=U87zVklXXN10
38	Trailer - NOOBZ - Official Movie Trailer HD (2012)	http://www.youtube.com/watch?v=U87zVklXXN10
39	Transformers 4: The Return of Megatron Trailer HD	http://www.youtube.com/watch?v=U87zVklXXN10
40	Yes Sir! Trailer (Official Version)	http://www.youtube.com/watch?v=U87zVklXXN10

TABLE 10: Continued.

No.	NAME	LINK
41	YOUNG ADULT Trailer 2011 Official [HD]	http://www.youtube.com/watch?v=Ar-v7dEEoo
42	Zombie Nation Trailer	http://www.youtube.com/watch?v=jg-OHwll07Y
43	Battlefield America - Official Exclusive Trailer [HD]	http://www.youtube.com/watch?v=eEKIqrVaNk
44	Ben - Arthur - Trailer	http://www.youtube.com/watch?v=9XVPOjXmCQ0
45	Book of Shadows Blair Witch 2 [a steFANedit] TRAILER	http://www.youtube.com/watch?v=GbBQ0rwFd20
46	All Superheroes Must Die Official Trailer #1 (2013) - Jason Trost Mo	http://www.youtube.com/watch?v=QCcb5mAeb38
47	New Year's Eve Movie CLIP #2 - This is Not a Training Bra! (2011) H	http://www.youtube.com/watch?v=2LPwJrrlJDk
48	World Of Heroes - Exclusive Superbowl XLIV TV Spot - TRUE 720 HD	http://www.youtube.com/watch?v=vpHpfSKlpYE
49	Re-Kill Official Trailer (2011 Movie)	http://www.youtube.com/watch?v=WQkmEOK5Dik
50	"Snow Doesn't Melt Forever..." (official trailer)	http://www.youtube.com/watch?v=54Cl6llo7a4
51	District 13: Ultimatum' Trailer HD	http://www.youtube.com/watch?v=0Nd8qEpskCY
52	Cosmopolis (2012) - Official Trailer [HD]	http://www.youtube.com/watch?v=q3ZmIwteUAY
53	Four (2012) - Official Trailer [HD]	http://www.youtube.com/watch?v=LeXFfP6Zcv8
54	Dark Tide (2012) - Official Trailer [HD]	http://www.youtube.com/watch?v=ZxjYmpRlStE
55	Griff the Invisible (2010) Movie Trailer - HD	http://www.youtube.com/watch?v=_Z_AdqeDeo
56	Zone Of The Dead - Official Trailer	http://www.youtube.com/watch?v=xl6oeLPwyOk
57	The Wicked Official Teaser Trailer (2012) Horror Movie HD	http://www.youtube.com/watch?v=tbQ9_NBbIps
58	The Troll Hunter - Official Trailer	http://www.youtube.com/watch?v=TLFo7H9tqSM
59	American Hustle Trailer	http://www.youtube.com/watch?v=QhB6o3Dtwsj
60	Hammer of the Gods Official Trailer #1 (2013) - Viking Movie HD	http://www.youtube.com/watch?v=MURl7GcgHO0
61	Tiptoes (2003)	http://www.youtube.com/watch?v=ukRdEVhmWM
62	Superbabies: Baby Geniuses 2 (2004)	http://www.youtube.com/watch?v=qv7pRNfahis
63	Sharktopus (2010)	http://www.youtube.com/watch?v=U87zvKIXNI0
64	Disaster Movie (2008)	http://www.youtube.com/watch?v=tiH_G_2BSUqg
65	Vampire Dog (2012)	http://www.youtube.com/watch?v=_kbsJ2fC4c
66	Super Mario Bros (1993)	http://www.youtube.com/watch?v=wtMZKYnLg5c
67	Empire Of The Apes (2013)	http://www.youtube.com/watch?v=SGBYTcMPPnM
68	C Me Dance (2009)	http://www.youtube.com/watch?v=n-7TM3Udip4
69	Santa With Muscles (1996)	http://www.youtube.com/watch?v=nmPgWz85Uso
70	Quigley (2003)	http://www.youtube.com/watch?v=e6lRvQO8JB0
71	Dinocroc Vs Supergator (2010)	http://www.youtube.com/watch?v=xEV8Fz7xpYI
72	The Hottie & The Nottie (2008)	http://www.youtube.com/watch?v=NiDbKbo2DIE
73	Hobgoblins (1988)	http://www.youtube.com/watch?v=o0fhewrwrzBRM
74	Samurai Cop (1989)	http://www.youtube.com/watch?v=MTD2BZggats
75	Butterfinger The 13th (2011)	http://www.youtube.com/watch?feature=player_embedded&v=3k_reLLhOk
76	Transformers (2007)	http://www.youtube.com/watch?feature=player_embedded&v=4fp7PVK9l0U
77	LOL (2012)	http://www.youtube.com/watch?feature=player_embedded&v=d4XmycID4eE
78	Anaconda 4: Trail Of Blood (2009)	http://www.youtube.com/watch?feature=player_embedded&v=P0nKSINcIIs
79	Mega Python Vs Gatoroid (2011)	http://www.youtube.com/watch?feature=player_embedded&v=R4yBv4sSKTw
80	A Talking Cat (2013)	http://www.youtube.com/watch?feature=player_embedded&v=Y-h-KpG2tHM

TABLE 10: Continued.

No.	NAME	LINK
81	Battlefield America (2012)	http://www.youtube.com/watch?feature=player_embedded&v=wbgSad8w0Pw
82	Mega Shark Vs Giant Octopus (2009)	http://www.youtube.com/watch?feature=player_embedded&v=Fa7ck5mcdIo
83	Abraham Lincoln: Vampire Hunter (2012)	http://www.youtube.com/watch?feature=player_embedded&v=wZp7eBSiN1U
84	Old Dogs (2009)	http://www.youtube.com/watch?feature=player_embedded&v=RhY8AP806tU
85	Rottweiler (2004)	http://www.youtube.com/watch?feature=player_embedded&v=e3uluAacRD0
86	I Hate Valentine's Day (2009)	http://www.youtube.com/watch?feature=player_embedded&v=vYrlYGe_YT4
87	The Room (2003)	http://www.youtube.com/watch?feature=player_embedded&v=yCj8sPCWfUw
88	Age Of The Hobbits (2012)	http://www.youtube.com/watch?feature=player_embedded&v=tsulgyBdpM
89	Leprechaun (1993)	http://www.youtube.com/watch?feature=player_embedded&v=0x0D8AE8ZcpA
90	1 ROBOCOP - Official Trailer (2014) [HQ]	http://www.youtube.com/watch?v=INmtQXUXez8
91	White House Down - Official Trailer (2013) [HD] Channing Tatum, Jam	http://www.youtube.com/watch?v=4AXbiCdmXgw
92	Scary Movie 5 Official TRAILER #1 (2013) - Charlie Sheen, Ashley Tis	http://www.youtube.com/watch?v=RMDZ8M47j0I
93	Spiders 3D Official Trailer #1 (2013) - Science Fiction Movie HD	http://www.youtube.com/watch?v=M4bjDV1OC0I
94	Evil Dead Trailer 2013 Movie - Official [HD]	http://www.youtube.com/watch?v=FKFDkpHCQz4
95	SHARKNADO - Official Asylum Trailer - TOO VIOLENT FOR TV	http://www.youtube.com/watch?v=iwsqFR5bh6Q
96	Bad Milo Official Trailer #1 (2013) - Ken Marino Comedy HD	http://www.youtube.com/watch?v=aXJ-7oI9cqA
97	Hell Baby Official Trailer #1 (2013) - Horror Comedy Movie HD	http://www.youtube.com/watch?v=6AaoMfbx0o
98	DIANA OFFICIAL TRAILER 2013 (HD)	http://www.youtube.com/watch?v=axLcjp7xeU
99	Killing Season Official Trailer #1 (2013) - Robert De Niro, John Travolt	http://www.youtube.com/watch?v=_yseYEtQoIQ
100	Iron Sky Official Theatrical Trailer [HD]	http://www.youtube.com/watch?v=Py_IndUbcxc
101	Adore Official Trailer #1 (2013) - Robin Wright, Naomi Watts Movie H	http://www.youtube.com/watch?v=JjGaV0CEBR0
102	Lincoln Trailer	http://www.youtube.com/watch?v=qiSAbAuLhqs
103	Behind the Candelabra Trailer (Matt Damon - Michael Douglas)	http://www.youtube.com/watch?v=fp3wAyRf15c
104	Assault on Wall Street Official Trailer #1 (2013) - Dominic Purcell, Eri	http://www.youtube.com/watch?v=8Y-NqShTj5w
105	Chennai Express — Official Trailer 2013 — Shah Rukh Khan — Deepika P	http://www.youtube.com/watch?v=4O4mNdMoxDM
106	Rapture-Palooza Official Trailer #2 (2013) - Anna Kendrick Movie HD	http://www.youtube.com/watch?v=9oaS_NlzsQo
107	*The Smurfs 2* Official Trailer #1 Starring Neil Patrick Harris (2013) [HD]	http://www.youtube.com/watch?v=vQbSGLaVJ5c
108	Temptation Official Trailer #1 (2013) - Tyler Perry Movie HD	http://www.youtube.com/watch?v=SDfTwu2CgDY
109	The Tree of Life Movie Trailer Official (HD)	http://www.youtube.com/watch?v=WXYRA1dxP_0

TABLE 10: Continued.

No.	NAME	LINK
110	3 Geezers! Trailer	http://www.youtube.com/watch?v=ta3lt4BGLDU
111	The Stranger Within Exclusive Official Trailer #1 (2013) HD william bal	http://www.youtube.com/watch?v=exFchSag2QE
112	Jug Face Official Trailer 1 (2013) - Horror Movie HD	http://www.youtube.com/watch?v=WGSvhDcimJg
113	ATLANTIC RIM trailer	http://www.youtube.com/watch?v=TVpQmZmKNmo
114	Twilight Breaking Dawn Part 2 Official Trailer	http://www.youtube.com/watch?v=5xOSoONDpY4
115	Zero Dark Thirty - Official Trailer #2 (HD)	http://www.youtube.com/watch?v=YxC_JNz5Vbg
116	NTR Jr Ramayya Vasthavayya — Theatrical Trailer — Jr NTR, Samatha	http://www.youtube.com/watch?v=GYph_JLPGRY
117	Shuddh Desi Romance - Official Theatrical Trailer - Sushant — Parineet	http://www.youtube.com/watch?v=o2Hle83Plpo
118	The Demented Official Trailer 1 (2013) - Horror Movie HD	http://www.youtube.com/watch?v=OuyEfUDSUXg
119	Albatross Official Trailer #1 (2012) HD	http://www.youtube.com/watch?v=KQnXnbQCJD0
120	House of Pleasures Official Trailer #1 - L'Apollonide Movie (2011) HD	http://www.youtube.com/watch?v=sb_Dgbj_E5c
121	Official Call of Duty®: Ghosts Single Player Campaign Trailer	http://www.youtube.com/watch?v=SumLZb6qMjw
122	Magic Magic Official Trailer #1 (2013) - Michael Cera Movie HD	http://www.youtube.com/watch?v=elU_AlgW6Lw
123	Wadjda Official Trailer (2013) - Haifaa Al Mansour	http://www.youtube.com/watch?v=2pcCcbLzhcY
124	The Colony Official International Trailer #1 (2013) - Laurence Fishburn	http://www.youtube.com/watch?v=ZENI7UC3WQo
125	Eden Movie Trailer	http://www.youtube.com/watch?v=pb10Fn4COQ
126	Thanks For Sharing Official Trailer #1 (2013)	http://www.youtube.com/watch?v=CR_OkBBzdew
127	Trailer: RoboCop TRAILER 1 (2014)	http://www.youtube.com/watch?v=UuVphAuRo7Q
128	Need for Speed Official Trailer	http://www.youtube.com/watch?v=fsrjWUVoXeM
129	NEED FOR SPEED Movie Trailer	http://www.youtube.com/watch?v=zGVCdQ2ycmQ
130	Trailer: Her TRAILER 1 (2013) - Joaquin Phoenix, Scarlett Johan	http://www.youtube.com/watch?v=6QRvTv_tpw0
131	PARADISE Movie Trailer	http://www.youtube.com/watch?v=CeEpXPgptx34
132	Jobs Official Trailer #1 (2013) - Ashton Kutcher Movie HD	http://www.youtube.com/watch?v=FrvcS0ZGPU
133	The To Do List Trailer 2013 Movie - Official [HD]	http://www.youtube.com/watch?v=7UrOOoOXLV8
134	Ender's Game Official Trailer #2 (2013) - Asa Butterfield, Harrison	http://www.youtube.com/watch?v=2UNWLgY-wuo
135	Scary Movie 5 Official TRAILER #1 (2013) - Charlie Sheen, Ashle	http://www.youtube.com/watch?v=isE9TBaHkJQ
136	BOUNTY KILLER Movie Trailer	http://www.youtube.com/watch?v=QJPFAYpupuw
137	ANOTHER EARTH trailer 2011 official movie	http://www.youtube.com/watch?v=fp3wAyRf15c
138	Behind the Candelabra Trailer (Matt Damon - Michael Douglas)	http://www.youtube.com/watch?v=EaycdPGK8ek
139	Empire State Official Trailer #1 (2013) - Dwayne Johnson, Liam Hems	http://www.youtube.com/watch?v=sClADbHrZNg
140	Haunter Official Trailer #1 (2013) - Abigail Breslin Movie HD	http://www.youtube.com/watch?v=UJjCkZF8-R0
141	Baggage Claim Trailer 2013 Paula Patton Movie - Official [HD]	http://www.youtube.com/watch?v=UJjCkZF8-R0
142	Special Forces Movie Trailer (2012)	http://www.youtube.com/watch?v=AWZc-RtID84

TABLE 10: Continued.

No.	NAME	LINK
143	WINNIE MANDELA Movie Trailer	http://www.youtube.com/watch?v=d8bGqiZkgd0
144	7500 - Official Movie Trailer	http://www.youtube.com/watch?v=71vXzDCKqDw
145	Biryani official teaser — Karthi, Hansika, Venkat Prabhu, Yuwan, Pre	http://www.youtube.com/watch?v=84yomR2dsY
146	Date Movie - Trailer (2006)	http://www.youtube.com/watch?v=YvnT_Vb-Q3Q
147	Emperor Movie Trailer (2013)	http://www.youtube.com/watch?v=N7mTqpibZ5Q
148	Squirrels Teaser Trailer (2014) - Squirrel Horror Movie HD	http://www.youtube.com/watch?v=q7U2aVUAqPI
149	BA PASS Official Movie Trailer	http://www.youtube.com/watch?v=Oml0YzfANTY
150	Bangaru Kodi Petta - Telugu Movie Trailer - Swathi Reddy & Navdeep	http://www.youtube.com/watch?v=AzswH4UQVmE
151	Ainthu Ainthu Movie Trailer - Nikhils Channel	http://www.youtube.com/watch?v=eQap86TpTJw
152	Michael Bay's THE LAST SHIP Series Trailer	http://www.youtube.com/watch?v=4gZ6bpIjeLs
153	Monsters Movie Trailer Official (HD)	http://www.youtube.com/watch?v=QmR-l3y_coo
154	The Tree of Life Movie Trailer Official (HD)	http://www.youtube.com/watch?v=WXYRAIdxP_0
155	Fired Trailer — Bollywood Adult Horror Movie — Rahul Bose, Militza Rad	http://www.youtube.com/watch?v=JX0v_yeLPe4
156	Battle of the Year Trailer 2013 Movie - Official [HD]	http://www.youtube.com/watch?v=QibqRB9Gs9k
157	jOBS Movie CLIP (2013) - Ashton Kutcher Movie HD	http://www.youtube.com/watch?v=3rOiXeKaUUM
158	Vamps Movie Trailer	http://www.youtube.com/watch?v=eaT2FFZj4_8
159	Naked As We Came (2012) Movie Trailer (Gay Themed) Eshsizz.com	http://www.youtube.com/watch?v=RhD6G0KoaMU
160	Evil Dead Trailer 2013 Movie - Official [HD]	http://www.youtube.com/watch?v=FKFDkpHCQz4
161	NABAR - New Punjabi Movie — Official Theatrical Trailer — Latest Punj	http://www.youtube.com/watch?v=vjvMvvc6lVw
162	Raja Huli Promo Kannada — Yash, Meghana Raj — Latest Kannada Mo	http://www.youtube.com/watch?v=EsH6gQhTRw
163	Lucky (2011) - Movie Trailer - HD	http://www.youtube.com/watch?v=e2eo-95ZSp4
164	Samrajyam 2 Son Of Alexander Malayalam Movie Trailer — Unni Muk	http://www.youtube.com/watch?v=6lZX9Jlp3hs
165	Metro Official Trailer #2 (2013) - Russian Disaster Movie HD	http://www.youtube.com/watch?v=OKh17zFt8-E
166	Once Upon A Time In Shanghai Official Movie Trailer 2013 in HD	http://www.youtube.com/watch?v=lvkTvaXYvL8
167	Directors special Kannada movie Latest Trailer - Guru Prasad,Ara	http://www.youtube.com/watch?v=q6d6gSzsW8
168	Spring Breakers Trailer 2013 Selena Gomez Movie - Official [HD]	http://www.youtube.com/watch?v=0GnUAaeHbEw
169	The Assassins Movie Trailer (2013)	http://www.youtube.com/watch?v=cyI2ghkMngI
170	SHELL (film 2013) official UK trailer	http://www.youtube.com/watch?v=NpSCJA38ORY
171	New Moon Movie Trailer - Official (HD)	http://www.youtube.com/watch?v=KYBF3HKzrmE
172	Prom Movie Trailer Official (HD)	http://www.youtube.com/watch?v=VGCtgUNgZKs
173	Youth of Christ- The Movie Trailer	http://www.youtube.com/watch?v=E9xPODBdj-s
174	Universal Soldier 4 Red Band Trailer	http://www.youtube.com/watch?v=aJ0sIny4NTQ
175	Sahara - Movie Trailer	http://www.youtube.com/watch?v=oWJ6gXpI7Ok
176	Hardwired movie Trailer 2009	http://www.youtube.com/watch?v=bdlmGZA-2SM
177	Official Watchmen Trailer	http://www.youtube.com/watch?v=R3orQKBxiEg
178	Casino Royale teaser	http://www.youtube.com/watch?v=LozaiZBdji0
179	The official Cloverfield trailer	http://www.youtube.com/watch?v=IvNkGm8mxIM
180	Terminator 4 Salvation teaser trailer 2009 official	http://www.youtube.com/watch?v=VYc3vOmof_L8
181	Battle Los Angeles - Official Movie Trailer #1 (2011) US — HD	http://www.youtube.com/watch?v=0dI94ZO2SbM

TABLE 10: Continued.

No.	NAME	LINK
182	Mission: Impossible Trailer HQ (1996)	http://www.youtube.com/watch?v=qbg99ykA2bk
183	Marvel's The Avengers Super Bowl XLVI Commercial	http://www.youtube.com/watch?v=bGt-saFvkNk
184	Iron Man 3 Trailer UK - Official Marvel — HD	http://www.youtube.com/watch?v=5EjG-1U3wqA
185	Sleepless In Seattle: Recut as a horror movie	http://www.youtube.com/watch?v=frUPnZMxr08
186	X-Men: First Class Movie Trailer Official (HD)	http://www.youtube.com/watch?v=o8cSIH4olo
187	Harry Potter and The Deathly Hallows Part 2 Trailer Official (HD)	http://www.youtube.com/watch?v=LkDb-pRCds
188	Bubble Trailer	http://www.youtube.com/watch?v=HN9tYb7QlJA
189	House of The Dead - Official HD Movie Trailer	http://www.youtube.com/watch?v=ek5AZVonwv4
190	Paranormal Activity 2' Trailer	http://www.youtube.com/watch?v=07XbSk7Rjt4
191	Pirates of the Caribbean 3 - At World's End Trailer	http://www.youtube.com/watch?v=PetrAmq9fcw
192	District 9 - Official Trailer 2 [HD]	http://www.youtube.com/watch?v=d6PIDIMggROA
193	The Departed - Trailer - (2006) - HQ	http://www.youtube.com/watch?v=SGWw-wjZ0eDc
194	Iron Man 2 Trailer	http://www.youtube.com/watch?v=siQgD9qOhRs
195	THE CRAZIES - Trailer	http://www.youtube.com/watch?v=I7w9uWFIMBs
196	The Dark Knight HD 1080p Trailer	http://www.youtube.com/watch?v=yQ5U8suTUw0
197	'Inception' Trailer 2 HD	http://www.youtube.com/watch?v=66TuSJo4dZM
198	The Dark Knight Rises - Official Trailer #3 [HD]	http://www.youtube.com/watch?v=g8evyE9TuYk
199	The Hobbit: An Unexpected Journey	http://www.youtube.com/watch?v=SDnYMBYB-nU
200	World War Z Official Trailer #1 (2013) - Brad Pitt Movie HD	http://www.youtube.com/watch?v=Md6DvxdR0AQ
201	Independence Day - Official® Trailer [HD]	http://www.youtube.com/watch?v=UqNRKA0Zq3Q
202	Prometheus - Official Full HD Trailer	http://www.youtube.com/watch?v=HHCHYisZFfLU
203	Transformers 3 Dark of the Moon Teaser Trailer - Official (HD)	http://www.youtube.com/watch?v=3H8bnKdf654
204	Rise of the Planet of the Apes - HD Trailer 2 - (2011)	http://www.youtube.com/watch?v=I3tidwWlgGM
205	Harry Potter and the Sorcerer's Stone Trailer	http://www.youtube.com/watch?v=geNlXmmIp7w
206	RESIDENT EVIL 5 Retribution Trailer 2 - 2012 Movie - Official [HD]	http://www.youtube.com/watch?v=HYuxE3YctQo
207	TOTAL RECALL Trailer 2012 Movie - Official [HD]	http://www.youtube.com/watch?v=4SerZm7DheA
208	Trailer: GREAT GATSBY Trailer (2012) Movie HD	http://www.youtube.com/watch?v=rARN6agiW7o
209	THE LUCKY ONE Trailer 2012 Movie - Official [HD]	http://www.youtube.com/watch?v=9w8IE83oYem
210	TED Movie Trailer 2012 - Official [HD]	http://www.youtube.com/watch?v=3Vl5q06UEIM
211	FLIGHT Trailer 2012 Denzel Washington Movie - Official [HD]	http://www.youtube.com/watch?v=xnVNNR6CEOE
212	Killing Them Softly Trailer 2012 Brad Pitt Movie - Official [HD]	http://www.youtube.com/watch?v=6S8sGrqgwaA
213	Jarhead Trailer HD	http://www.youtube.com/watch?v=JEihaz6FcW's
214	Stand Up Guys Official Trailer #1 (2012)	http://www.youtube.com/watch?v=8h6voLvn8JA
215	Trailer: Pitch Perfect Trailer (2012)	http://www.youtube.com/watch?v=QCekEuGEbEI
216	Seven Psychopaths Official Trailer #1 (2012)	http://www.youtube.com/watch?v=jsHR77oQKEY
217	RUBY SPARKS Trailer 2012 Movie - Official [HD]	http://www.youtube.com/watch?v=W4RjYISgDKM
218	Wreck-It Ralph Official Trailer #1 (2012)	http://www.youtube.com/watch?v=vf45q8-aWo
219	Trailer: Hit And Run Official Trailer #1 (2012)	http://www.youtube.com/watch?v=CnlgYTFfUJA
220	The Amazing Spider-Man New Trailer 2 Official 2012 [1080 HD]	http://www.youtube.com/watch?v=atCfTRMjyGU

TABLE 10: Continued.

No.	NAME	LINK
221	The Lone Ranger Official Trailer #2 (2012) - Johnny Depp Movie HD	http://www.youtube.com/watch?v=JfFsNSoDZk8
222	THE CAMPAIGN Trailer 2012 - Will Ferrell movie - Official [HD]	http://www.youtube.com/watch?v=5JkHxf4c3I
223	Pitch Perfect Trailer Clip - 2012 Movie - Official [HD]	http://www.youtube.com/watch?v=tNfDYmuY-
224	Hitchcock Trailer 2012	http://www.youtube.com/watch?v=Q7vYhtFNm9U
225	Forrest Gump Trailer (Movie release: July 6, 1994)	http://www.youtube.com/watch?v=JdsMqRaz2WY
226	Trailer: The Butterfly Room TRAILER 1 (2012)	http://www.youtube.com/watch?v=rtFQZfah5FQ
227	Best New Movie Trailers - February 2012 HD	http://www.youtube.com/watch?v=sP5r7jmN7so
228	The Imposter - Official Trailer HD (2012)	http://www.youtube.com/watch?v=2LuFOX0Sy_o
229	Iron Man 2 Trailer 2 (OFFICIAL)	http://www.youtube.com/watch?v=FNQowwwwYao0
230	500 Days of Summer	http://www.youtube.com/watch?v=PsD0NpFSADM
231	Pirates of the Caribbean: On Strange Tides - Trailer 1	http://www.youtube.com/watch?v=KR_9A-cUEJc
232	SOURCE CODE - Trailer	http://www.youtube.com/watch?v=mnEgNvAbIw
233	Official SALT Trailer - In Theaters 7/23/2010	http://www.youtube.com/watch?v=QZ40WlshNwU
234	FANTASTIC MR. FOX	http://www.youtube.com/watch?v=n2igjYFojUo
235	John Carter Trailer	http://www.youtube.com/watch?v=nlvYKlIfBI
236	JUST WRIGHT - Official trailer	http://www.youtube.com/watch?v=ZHYSeSAXQf4
237	Bad Teacher- Trailer	http://www.youtube.com/watch?v=GahC5cVsU6A
238	Supernatural Comedy Trailer HD	http://www.youtube.com/watch?v=vDYBrWPIIwg
239	Supernatural Comedy Trailer	http://www.youtube.com/watch?v=9u8vZwvP57Y
240	GASLAND Trailer 2010	http://www.youtube.com/watch?v=dZelAeH0Qz8
241	I Spit On Your Grave (2010) - Official Trailer [HD]	http://www.youtube.com/watch?v=HC9p7SkJPwE
242	The Social Network Official Trailer	http://www.youtube.com/watch?v=LB95KLmpLR4
243	New Beastly Movie Trailer - Official	http://www.youtube.com/watch?v=Neo6W1f7hyY
244	"Shutter Island" - Official Trailer [HD]	http://www.youtube.com/watch?v=5iaYLCiq5RM
245	Carriers Trailer(HD)	http://www.youtube.com/watch?v=IwH4bxNK8Os
246	The Crazies - Official Trailer [HD]	http://www.youtube.com/watch?v=mepo50RuhdM
247	"Brothers" - Official Trailer [HQ HD]	http://www.youtube.com/watch?v=7xYyCCjLpZs
248	SURROGATES - Bruce Willis	http://www.youtube.com/watch?v=0T7IsP62pdU
249	Julie & Julia - Official Trailer	http://www.youtube.com/watch?v=0zRK7VXQl-k
250	LITERAL Tron Legacy Trailer Parody	http://www.youtube.com/watch?v=UCmeQaXuFig
251	The Hurt Locker - Official Trailer [HD]	http://www.youtube.com/watch?v=2GxSDZc8tg
252	8 Mile Official Trailer #1 - (2002) HD	http://www.youtube.com/watch?v=axGVrfwm9L4
253	Road To Perdition Trailer (2002) [HD]	http://www.youtube.com/watch?v=klCd_dNY
254	A Walk To Remember Official Trailer (HD)	http://www.youtube.com/watch?v=R3bI9svqbls
255	Spider Man - Trailer [2002]	http://www.youtube.com/watch?v=9p3PIUVzLgE
256	Immortals - Official Trailer [HD]	http://www.youtube.com/watch?v=7VdONYkKFmQ
257	The Tree of Life Movie Trailer Official (HD)	http://www.youtube.com/watch?v=WXRYA1dxP_0
258	What's Your Number? Official Movie Trailer 2011 HD	http://www.youtube.com/watch?v=TKL-yt4F0B0
259	The Darkest Hour Trailer 2011 Movie Official HD	http://www.youtube.com/watch?v=JZ42p40qDEc
260	The Bucket List Official Trailer #1 - (2007) HD	http://www.youtube.com/watch?v=vc3mkG2lob4
261	Halloween 2007 Trailer (HD)	http://www.youtube.com/watch?v=MhyZmUeq6do
262	ANOTHER EARTH trailer 2011	http://www.youtube.com/watch?v=QIPfAYpnpuw
263	John Carter Fan Trailer 2 "Heritage"	http://www.youtube.com/watch?v=OzPVYy7LHIo
264	REC 2 - Official Trailer [HD]	http://www.youtube.com/watch?v=G18Y-S8YrQ0
265	GONE Trailer 2012 - Amanda Seyfried Movie - Official [HD]	http://www.youtube.com/watch?v=xQYztnrUlwK
266	The Human Experience - Official Trailer [HD]	http://www.youtube.com/watch?v=ctyX5ItSQEI
267	Paranormal Activity 4 Trailer # Extended	http://www.youtube.com/watch?v=g4yp2t7Doac

TABLE 10: Continued.

No.	NAME	LINK
268	Casino Royale - Official® Trailer [HD]	http://www.youtube.com/watch?v=xK7PbujRUOk
269	Serenity (2005) Trailer 1080p HD	http://www.youtube.com/watch?v=JY3u7bB7dZk
270	Harry Potter and the Goblet of Fire - Official Trailer [2005][720p HD]	http://www.youtube.com/watch?v=aFhCLiGvb08
271	Motorstorm E3 2005 trailer	http://www.youtube.com/watch?v=wig-XT8Rbiw
272	The Bourne Supremacy - Official HD Trailer [2004]	http://www.youtube.com/watch?v=WrWTJv0yEyI
273	Being Flynn Official Trailer #1	http://www.youtube.com/watch?v=NHZfQDgkqIM
274	Puss in Boots (2011)	http://www.youtube.com/watch?v=55gmAtakj4
275	I'll Be Seeing You (2004) HD	http://www.youtube.com/watch?v=ielkiD8w-M8
276	Iron Man 3 Official Trailer (2013) Marvel Movie HD	http://www.youtube.com/watch?v=aV8H7ksXqo
277	A Haunted House Official Trailer #1 (2013)	http://www.youtube.com/watch?v=J50vA5VLR6k
278	Now You See Me Official Trailer #1 (2013)	http://www.youtube.com/watch?v=2h7OymLEH8s
279	Pacific Rim Official Trailer #1 (2013)	http://www.youtube.com/watch?v=K-ZcqvwQbas
280	The Place Beyond the Pines Official Trailer #1 (2013)	http://www.youtube.com/watch?v=G07pSbHLXgg
281	The Tower Official Trailer #1 (2013)	http://www.youtube.com/watch?v=jjBRTKc0Wc
282	Star Trek Into Darkness (NEW) Official Trailer (2013)	http://www.youtube.com/watch?v=4g2gRpp4poU
283	Die Hard 5 Official Trailer (2013)	http://www.youtube.com/watch?v=FRLwoMXaZHQ
284	Identity Thief Trailer 2012 Official [HD]	http://www.youtube.com/watch?v=mgJj7Y0I3A
285	Red 2 Official Trailer #1 (2013)	http://www.youtube.com/watch?v=sCM3HhGUjsM
286	Safe Haven Trailer 2013 Movie Nicholas Sparks - Official [HD]	http://www.youtube.com/watch?v=ejQEdUwv0ew
287	The Heat Official Trailer #1 (2013)	http://www.youtube.com/watch?v=c-KKx0lcn2A
288	Anchorman 2: The Legend Continues Official Teaser (2013)	http://www.youtube.com/watch?v=jZcJk-RlppI
289	The Host Trailer #2 - 2013 Movie - Official [HD]	http://www.youtube.com/watch?v=uiq198cWjCLQ
290	Jack the Giant Killer Trailer 2012 Official 2013 Movie [HD]	http://www.youtube.com/watch?v=bg0ibhX_84U
291	[720p] Official Rurouni Kenshin Action Movie Promo Trailer 2012	http://www.youtube.com/watch?v=4WNi8z5EWuE
292	TRON: LEGACY Official Trailer	http://www.youtube.com/watch?v=L9sznlQQfas
293	Trailer: Man of Steel Teaser	http://www.youtube.com/watch?v=y-gTIRJdk
294	Trailer: Oz the Great and Powerful TRAILER (2013)	http://www.youtube.com/watch?v=Bl88a5xUvls
295	End Of Watch Official Trailer #1 (2012) Jake Gyllenhaal Movie HD	http://www.youtube.com/watch?v=waclztJlL8
296	Dark Shadows Trailer (Tim Burton)	http://www.youtube.com/watch?v=6Eo766iZZ0c
297	The Man With The Iron Fists Trailer 2012 Movie - Official [HD]	http://www.youtube.com/watch?v=0A57zjclmoI
298	The Dark Knight Rises trailer 2012	http://www.youtube.com/watch?v=M-mf5IyVIac
299	SKYFALL - Official Teaser Trailer	http://www.youtube.com/watch?v=24mTIE4D9JM
300	MEN IN BLACK 3 - Official Trailer	http://www.youtube.com/watch?v=IyaFEBL1L24

Then, to select the influential low-level features for commercial videos, 300 videos were downloaded from Youtube. For each video, 16 features were extracted, and the videos were separated into two classes, “good” and “bad” according to their scores which were calculated through the “like/dislike” number voted by audiences. When the selected feature number is 3 by CFS-Spearman, the correct classification rates is the highest one which is 78%. The features called “Mean of contrast”, “Variance of Simplicity”, and “Variance of shot length” were selected as the most influential ones.

Finally, the SVM classification was compared with the popular classification method CNN. The results showed that because the 16 features were most scalars, the SVM was more suitable for this target.

Appendix

See Table 10.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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