T.V. COMMERCIAL DETECTION IN SERIAL VIDEOS

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ABSTRACT

In recent years Commercial detection has become a widely research area of digital video processing because of its huge importance. The task of detection of commercial in TV videos is extremely difficult because of diversities involved. Diversities are involved as exact timings of start and end of commercial break is not fixed. The number of commercials appearing in a break is not fixed. The length of each individual commercial is different. The number of commercial breaks and their duration are normally dependent on the duration of program to be aired, the time at which program is aired and genre of program. Here we have discussed some existing commercial detection works and proposed a new scheme for detection of commercial break in TV serial videos. The proposed work is based on the concept of frequency of number of cuts and appearance of caption text.

Keywords: Histogram based cut detection, Scene change rate, Template matching.

I. INTRODUCTION

Advertise is a way to publicize a product, it’s features and it’s working to people. Analysis of advertisement helps the marketing personnel and sponsor’s to decide their strategy to publicize product as compared to their competitors. T.V. commercials are a big source of revenue for broadcasters. They must keep track of the statistics of this source. Automatic detection of T.V. commercials minimize the human involvement, error occurred due to human involvement and also reduces the cost of tracking of commercials. The work presented here is carried out with intention of fulfilling above discussed objectives.

A Albiol et al. detect T.V. commercial based on assumption that T.V. or network logo disappear during advertisements [1]. J H Yeh et al deal with the problem of commercial detection by two-level hard cut based commercial detection scheme for TV news programs [2]. Pinar Duygulu et al in his study proposed a method that combines two scheme of
commercial detection one of which is based on repeated sequence detection where author assumes that commercial repeats itself and uses this fact for commercial detection and another method is based on FLD classifier that uses distinctive color and audio features for commercial detection [3]. Z Cao proposed commercial boundary detection method based on reference commercial database which is made of commercial samples [4]. M Mizutani suggested a method that differentiate between commercial and program segment using discriminative classifier that is based on audio/visual features of video segment [5].

The proposed approach for commercial break detection is based on frequency of cuts or scene change rate in a group of frames and appearance of caption text. We have concentrated our work on SONY TV serial videos. SONY TV is India’s leading entertainment channel. The same work can be extended to serials of other channels as well with little modification.

The general analysis of SONY TV serial video generates some interesting observation that length of each commercial normally ranges from 15sec -2 minutes, normally 2 commercial blocks appears in a serial of 30 and 60 minutes duration and Length of each commercial block is in the range of 3 – 5 minutes in a serial of 30 minutes duration.

The paper is further organized as follows. Section II gives the overview of proposed commercial detection algorithms. Section III discusses how the proposed scheme identifies the commercial segment or commercial break and section IV and V discuss the technique used to refines the boundary of identified commercial segment. Section VI gives the experimental results and Section VII concludes the paper with related future work.

II. PROPOSED SCHEME : AT A GLANCE

Below is the block diagram that explains the proposed commercial detection scheme. The proposed scheme identifies commercial break detection as two-step process.

Figure 1. The block diagram of the proposed commercial detection system

In step-1 approximate commercial break, commercial group of frames who’s exact starting and ending frame is not known, is identified and fed as input in Step-2. Step-2 helps in refining the boundary of commercial break. That is in step-2 exact starting and ending commercial frames are identified.

Step-1 uses the concept of frequency of cuts that is scene change rate in each block for finding approximate commercial break. The frequency of cuts present in commercial is high as compared to serials as commercial ad producer has to show more information in short span of time. Ad producer has to attract the viewers as viewers are normally not as much interested in ads as they are in TV serials and tend to change the channels during ad duration or take break to do some work. Therefore ad producer uses more number of cuts and use only specific colors for ad to emphasize product and attract the viewer’s [2]. Hence the area where frequency of cut identified by putting high threshold is more, can be identified as commercial break.
Step-2 identifies exact start of commercial segment by the appearance of caption text “AAGE DEKHIYE” which gives brief story upcoming for the serial after break. Step-2 identifies exact end of commercial segment as the last cut identified in commercial segment.

III. IDENTIFING THE COMMERCIAL BREAK

Cut or shot change is transitions between successive shots. A “cut” can also be defined as is the editing between two individual continuous camera shots [9]. The proposed scheme process the video in a bunch of 1000 frames each. Each bunch of 1000 frames is termed as block. The scheme identifies number of cuts in each block. Equation (1) given below can be used to compute the cut which is based on histogram based shot boundary detection technique in RGB space. If number of cuts in a block is greater than thresh-value then this group is identified as candidate commercial block. If 6 or more consecutive blocks contains candidate commercial block then these consecutive blocks are identified as commercial segment or commercial break. This fact is based on fact that commercial break in SONY TV serials normally ranges in 3-5 minutes duration.

\[
\text{Diff}(i, i+1) = \sum_{R} |h(i) - h(i+1)| + \sum_{G} |h(i) - h(i+1)| + \sum_{B} |h(i) - h(i+1)| \quad \text{………………. (1)}
\]

Here \(h(i)\) is the histogram of \(i\)th frame and \(h(i+1)\) is the histogram of \((i+1)\)th frame. The absolute sum of histogram difference between all the three red, green and blue component gives the \(\text{Diff}(i, i+1)\) that is the difference between frame \(i\) and \((i+1)\). Likewise find out the histogram difference between all the frames of a video and all the frames between which this difference \(\text{Diff}(i, i+1)\) exceed some threshold value is identified as location of shot change.

IV. REFINING THE BOUNDARIES OF IDENTIFIED COMMERCIAL SEGMENT

Each identified commercial segment has 2 boundaries, start and end boundary. For identifying exact starting commercial frame, identify the presence of “AAGE DEKHIYE” caption text in each frame of the identified first candidate commercial block and in each frame of the surrounding blocks. The observation of SONY TV serials leads us to conclusion that “AAGE DEKHEYE” caption text is appearing in bottom-left corner of screen and the font and style of appearance of this text always follow same pattern. Hence the presence of caption text is identified using template detection technique discussed in [8].

A) Algorithm for detecting exact start frame of commercial break
   1. Let 1st candidate commercial block of identified commercial break be known as \(F_1\).
   2. Detect the presence of the “AAGE DEKHIYE” caption in each frame of the \(F_1\) block, and blocks surrounded by \(F_1\) block, using template detection algorithm. The template detection algorithm will return the correlation coefficient.
   3. Put the flag = true if correlation coefficient is greater than 0.8. This indicates presence of caption text “AAGE DEKHEYE” in frame.
   4. If flag = true and difference between correlation coefficient of consecutive frames is greater than thresh-value then the frame where difference is greater than thresh-value is declared as first frame of commercial break.
5. If flag = false then first frame of the FIRST block is declared as first frame of commercial break. As it gives the first position where maximum color difference is appearing as might be the case in serial and commercial. Therefore it is the highest probability where first commercial is starting.

Below is the graph that shows the calculation of correlation coefficient in one of the sample video. Horizontal axis represents frame number and vertical axis is correlation coefficient. The frame for which correlation coefficient raises above 0.8 value indicates that recap of serial which will be coming ahead has been started and sudden drop in correlation value indicates that recap has finished and commercial has started.

![Correlation Graph](image)

**Figure 2**: Corelation graph for identifying caption text “Aage dekhiye” in F1 block

![Frames](image)

**Figure 3**: Frames identified as before and after start of commercial break

**B) Algorithm for detecting exact end of commercial break.**

1. Let the last block in identified candidate commercial break be known as L1 and the block following L1 block as N1.
2. Check the number of cuts in $N_1$ block. If numbers of cuts in $N_1$ block are equal to (thresh_value-1) or more then the first cut frame in the $N_1$ block is identified as exact end of commercial block.
3. Else last cut frame in $L_1$ block is considered as the exact end of commercial break.

![Figure 4: Cut detector result for L1 block](image4)

![Figure 5: Frames identified as after and before end of commercial break](image5)

Frames 328-339 are blank frames in above block. Frame 339 is identified as last frame of commercial break by proposed algorithm.

V. OUTLIER REMOVAL

Some Serials may have many shot changes or high motion. In such serials some program frames may be falsely identified as commercial break. For any such serial videos more than 2 commercial breaks are identified and some extra processing is needed to identify true commercial breaks and reject false breaks. The fact that SONY TV serials contain exactly 2 commercial breaks is utilized over here. To identify true commercial break search for SONY TV logo is carried in bottom area of each frame of identified commercial breaks. The break which contains at least one SONY TV logo is considered as true commercial break and the breaks in which no logo is detected is identified as false break.
VI. EXPERIMENTAL RESULTS

Experiments are carried in Matlab R2010b on the intel core 2 duo 2.40 GHz processor with 3 GB RAM. Our experiments are carried out on almost all SONY TV serial videos, where all videos are captured with the help of tv tuner card. Almost 22 serial videos are checked where 13 of them are of almost 30 minutes serials 3 are almost 60 minutes serials and one is 40 minutes serial shoot. Out of 22 videos we have to carry out outlier removal for 2 videos. Precision and Recall for 8 videos are displayed in Table 1 below.

The metrics used to evaluate the proposed algorithm are recall and precision [12]. The formulae for the two are:
1) \[ \text{Recall Rate} = \frac{TP}{TP+FN} \]
2) \[ \text{Precision} = \frac{TP}{TP+FP} \]

Where,
- The number of frames of commercials correctly identified (true: positive TP)
- The number of frames of commercials missed (false negative: FN)
- The number of frames of programs recognized as commercials (false positive: FP)

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>serial name</th>
<th>Approx duration in minutes</th>
<th>Recall</th>
<th>Precision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>comedy circus ke ajube</td>
<td>9 min 16 sec</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>parvarish kuch khati kuch mithi</td>
<td>30 min 28 sec</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>Bade aache lagte he</td>
<td>30 min 38 sec</td>
<td>99.99%</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>dil ki nazar se khubsurat</td>
<td>27 min 59 sec</td>
<td>100%</td>
<td>99.85%</td>
</tr>
<tr>
<td>5</td>
<td>kya hua tera vada</td>
<td>30 min 19 sec</td>
<td>100%</td>
<td>89.96%</td>
</tr>
<tr>
<td>6</td>
<td>kuch tooh log kahenge</td>
<td>29 min 15 sec</td>
<td>85.68%</td>
<td>96.70%</td>
</tr>
<tr>
<td>7</td>
<td>anamika</td>
<td>30 min 46 sec</td>
<td>100%</td>
<td>95.73%</td>
</tr>
<tr>
<td>8</td>
<td>comedy circus ke ajube</td>
<td>55 min 30 sec</td>
<td>95.05%</td>
<td>100%</td>
</tr>
</tbody>
</table>

VII. CONCLUSION AND FUTURE ENHANCEMENT

By video scene change rate and caption detection, an effective commercial break detection scheme is proposed for SONY TV serial videos. This work can be easily extended to serials of other broadcast networks. However as the technology changes, the TV commercial broadcasting strategies also changes. Hence this work may need to be enhanced ahead to suit changing requirements. The result can be fastened by implementing the proposed scheme in some other simulating software such as open CV.
REFERENCES


