



Algorithm development for commercial break detection: A Survey

Prof. Swati D. Bendale¹, Prof. Patel Falguni N², Prof. Sneha A. Gaywala³

^{1,2,3} Assistant Professor, IT Department, S.V.I.T, Vasad, Gujrat, India

ABSTRACT

Huge revenue is generated through TV commercials. This paper surveys different work done in area of television commercial detection. Television commercial detection aimed to identify any particular commercial or detect whole commercial block. Objective can be anything ranging from monitoring whether TV regulation rules are followed or not while airing the commercials, or removal of whole commercial break by non interested user, or to monitor commercialization strategy of competitor.

Keywords: Blank Frame, caption detection, commercial Detection, Logo Detection, Number of Cuts,

I. INTRODUCTION

As internet has become cheaper these days, people have started to use social networking with more intensity than earlier. Importance of Television advertising is still no less. TV commercial comprises great portion of Indian revenue. As per the report of Telecom Regulatory Authority of India (TRAI) there has been 33% growth in ad revenue generated through television in 2017, up to 267 billion Indian rupees. It has grown up to 304 billion Indian rupees by 2018 and expected to grow even more in upcoming years [1].

Automatic Commercial detection in real time Television broadcast comprises task such as detecting broadcast of known commercials or identifying whole commercial break. The commercial break recognized this way can be removed from recorded program, as most users who record television shows are unwilling to watch commercials. Every company does the marketing of their product and advertises how the product accommodates current market needs. Advertiser may want to monitor how many time their ad has been broadcasted, time of ad broadcast, duration of their commercials to identify whether their contract with broadcaster has been met or not. TV regulatory authority may want to monitor commercial to identify whether TV regulations have been followed or not.

Television programs have great variety ranging from entertainment program such comedy serials, drama to news, reality shows, music channels etc. Each type of genres is characterized by different sets of attributes. Also the broadcasting strategy keeps on changing. Due to all of above reason the task of commercial identification becomes extremely difficult task.

The work done until now is genre specific or depends upon the database of known commercials. The commercial detection technique which identifies commercial break from one genre normally unable to detect commercial break from other genres. For example commercial detection strategy applied on news program video may not work for sport or serial videos and vice-versa. Other types of techniques which are dependent upon known commercial are unable to identify unknown commercial.

Glasberg [6] have used separating area descriptor, static area descriptor and hard cut descriptor to identify commercial break. Gomes et al. [3] identify TV commercial block using digital onscreen graphics classification. Li et al.[4] used Inception – V3 which is a cnn (convolution neural network) for commercial detection. This technique consists of two modules. In first module shots are identified. And inception-V3 is applied on each shot to automatically extract features of shot. SVM is applied lastly to classify shot as commercial or non-commercial program. For detecting commercial break from news program video Yeh [5] have performed two step process. In first step author has divided video in one minute segment and in this segment identified number



of cuts and strong cuts . if number of cuts and strong cuts are greater than some particular threshold then this one minute video is labeled as candidate commercial block. Author then refined the commercial boundary by finding coherence between the shot. The local minimum of coherence identifies scene change. Zhen [6] have used SVM classifier to combine the three different commercial identification algorithm. First algorithm identifies commercial as duplicate sequence. Second algorithm identifies tv logo by variance analysis of pixel values in consecutive frames. Third algorithm uses color and audio characteristics.

II. PROPERTIES OF COMMERCIALS

In India TV, commercials are normally grouped and are broadcast in a form of commercial break. Duration of each commercial varies from 15 sec to 2 minutes. Different genres have different number of commercial break. Even the length of commercial breaks may be different for each genre.

III. STATE OF ART

Commercial detection method can be roughly classified as knowledge based method and retrieve based method. Below Fig.1 gives the details of each type of method. Authors have used different combination of features to detect commercials to improve accuracy of classifier. Where knowledge based methods provide more accuracy, they are heavily depend upon the use of specific features by TV broadcaster. They fail to handle outliers. Retrieve based methods are highly computational and provide less accuracy as compared to knowledge methods.

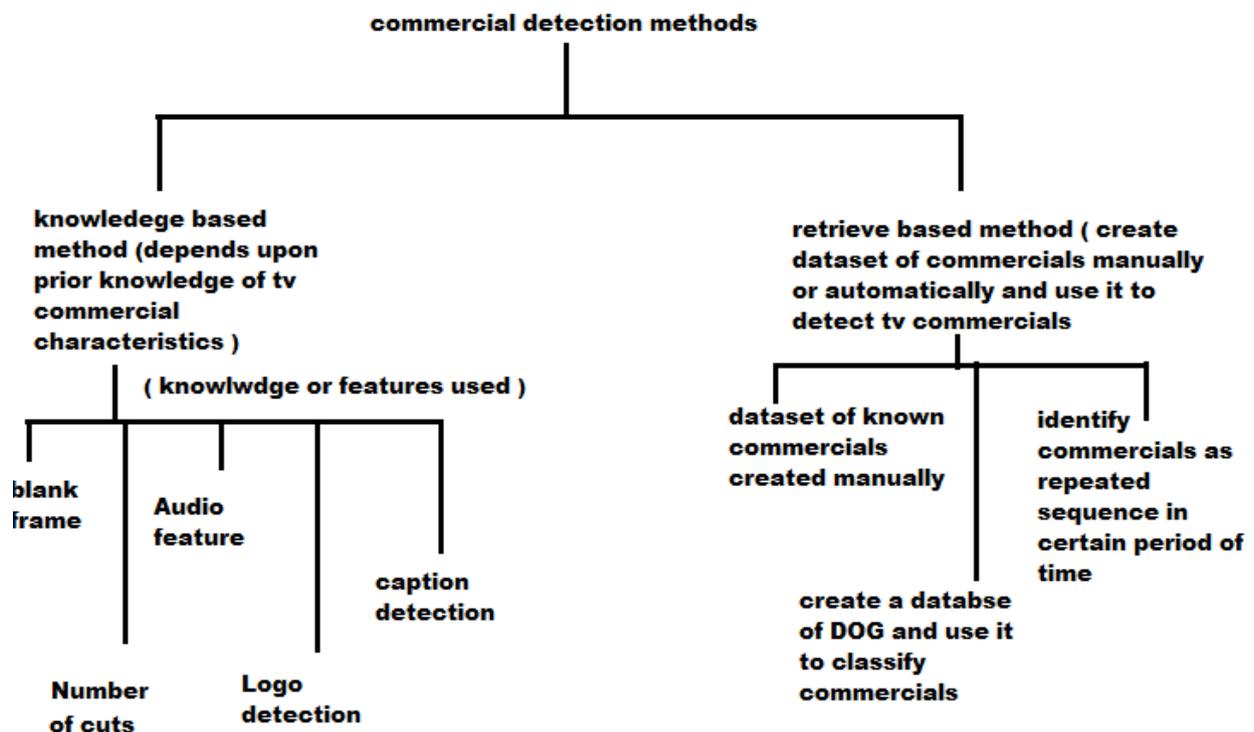


Fig 1: commercial detection method classification

3.1 BLACK FRAME DETECTION

Black frames were inserted between each commercial, also before and after each commercial break. Black frames are detected by identifying the change in average brightness level and average variance between consecutive frames[6]. Distance between black frames is another measure to identify the commercial break[6].



3.2 NUMBER OF CUTS

In order to catch audience attraction and represent lot many information in short span of time, commercial producer normally pack up commercial with lot many shots. Comparatively other programs do not have too many shots. This fact is exploited for commercial detection.

Cut is the location in video where two shots are joined. Cut can be hard cut or gradual cut. To detect the cuts present in a video [5,6,9,11] proposed methods such as pixel based shot boundary detection, block based shot boundary detection, histogram based shot boundary detection. In all these methods, we identify difference between consecutive frames pixel by pixel or block by block or based on histogram bins. And if this difference is greater than particular threshold then we identify it as cut.

Normally cut detection method process video of certain period of time say 1 min or say 1000 frames each. The method identifies number of cuts and strong cuts present in each group or portion of video. For strong cut selection, higher threshold is taken as compared to simple cut. If number of cuts and strong cut present in each group or portion of video is higher than some certain threshold then this group is labeled as a commercial block video [6,11].

3.3 ABSENCE OF CHANNEL LOGO DURING COMMERCIAL BROADCASTING

Every channel flashes their logo constantly in one of the screen corner during the program broadcasting. This logo was not flashed during commercials. Hence researcher has identified the trick to detect commercial break as just to identify the absence of this channel logo. Glasberg et al. uses static area descriptor method based on brightness value for logo detection. Bendale et al. [8] used template based matching technique for logo detection. Zhen et al [6] uses variance analysis of pixel value to detect and track opaque logo. -2 Below shows SONY- SAB logo broadcasted while airing the SONY-SAB TV show.



Fig 2: SAB TV logo broadcasted while airing TV program

3.4 USE OF COMMERCIAL DATABASE

Database of known commercial is constructed and can be used to identify individual commercial and commercial break. Known commercials are stored in form of key frames. Then program to be classified as commercial or non-commercial is first divided in shot. Key frame representing shot are extracted and compared with stored commercials. If matching number of key frames exceed threshold then commercials are identified [7]. [16] uses Reference commercial database for detection of commercials. Author [16] calculate the signature of first frame of known commercial and store it as commercial signature along with length of each commercial in Reference commercial database and uses this information for commercial detection.

3.5 COMMERCIAL IDENTIFICATION AS DUPLICATE SEQUENCE

Number of commercial repeats themselves after certain period of times. This property is exploited to identify the commercials. Zhen et al uses [6] candidate key frame based technique to identify commercial as duplicate sequence. Wu et al [10] used TRAH (two-stage hashing algorithm) for detecting commercials.

3.6 AUDIO FEATURES

Commercials have different pattern of audio (speech, music, silence) than regular program. Commercials normally have higher volume than regular program. There is short duration of silence between two commercials.



Commercial normally have music and less amount of speech. In contrast programs have more amounts of speech and lack in music. These properties are used to identify commercials. FMCC (mel-scale frequency cepstral coefficient) feature can be used to identify speech or speaker reorganization [12,13]. RMS (root mean square values) and ZCR (zero crossing rates) can be used to distinguish between music and speech[11,14]. Commercials normally have higher audio amplitude and hence have higher STE (short time energy). STE feature can used to distinguish between commercial and non-commercial. As Higher SC (spectral centroid) indicates higher frequency normally present in commercials as they packed with large variation of music. Higher SF (spectral flux) indicates rapid change in power spectrum and can be used to identify commercials[12,14].

3.7 TEXT OR CAPTION DETECTION

This scheme uses data from closed caption in commercial detection. Normally programs contains closed caption as “coming soon”, “coming up next”, “when we come back”, “aage dekhiye”, countdown timer such as “2:00” at end of break and so on. This entire caption indicates upcoming commercial break or ending commercial break. For detecting commercials, [15] uses caption based technique. [15] identify three segments of closed caption text, potential commercial segment, and segment before and following this segment immediately. Author [15] has partitioned each segment into windows of equal temporal length . and finally compute inter window similarity for each segment and finally identified commercial segment as the one having average inter window similarity lower than those of surrounding segments.

IV. COMPARISON OF EXISTING WORK:

Title	Publication	Description	Dataset and genre and color space (if applicable)	comment
Recognizing commercials in real time using three visual descriptors and decision tree [6]	IEEE, 2006	extracted visual features named 1) Separating block descriptor 2) Static area Descriptor 3) Hard Cut Descriptor. The extracted features are logically combined using decision tree to produce classification as commercial or non-commercial.	200 video from in all 400 min recording collected from popular German TV channels. Color space used : YCbCr	Separating block descriptor based on use on blank frame is absolute on as editor do not insert blank frame now a days. Also static are descriptor method depends upon channel logo flashing only during non-commercial is also a absolute strategy now
TV commercial detection in news program videos [5]	IEEE, 2005	Number of cuts and strong cuts are detected in 1 minute video . if cuts and strong cuts exceeds threshold then this 1 minute segment is classified as commercial video. The boundaries of commercial break thus identified are refined using coherence between commercial and news program	Fourty five minute long news program videos from Taiwan TV station. Color space used : YUV	Method not able to detect commercials having long shots comes at start of commercial break. Boundaries refinement technique unable to find exact commercial block boundary
Commercial Detection In Program Videos	IEEE, 2009	Combined the result of commercial as duplicate sequence, logo detection and	120 hours of broadcast news videos from CCTV	Unable to handle transparent and animated logos. Also not able to handle self- advertisement of



[7]		color and audio feature to detect commercials	evening news and CNN news headline are used as database	programs as commercials.
Automatic detection of TV commercial blocks: A new approach based on digital on-screen graphics classification	IEEE, 2017	identify different digital on-screen graphics (DOG) that appear on TV during commercials and during program. Classify them as TV channel logo or non-TV channel logo on the basis of their duration on AIR	2575 second video from Portuguese TV channel video is collected and three video sequence were created	Effective scheme to identify commercials without prior knowledge. High dynamic TV channel LOGO must be handled. Comparison between newly acquired DOG and DOG in database can be improved. Scheme must be practiced with larger dataset and for long duration videos.
CNN-based Commercial Detection in TV Broadcasting	ICNCC , 2017	Identified shot using Manhattan distance on color features. On the shot identified this way Author used Inception-V3 Convolution neural network to identify shot features. SVM uses the shot identified this way to identify shot as commercial or non-commercial	Video broad-casting data crawled from TV station.	New method of commercial detection using transfer learning.
Commercial block detection in broadcast news videos [12]	ICVGI P, 2014	Video features such as Edge change ratio , short length frame difference, Text distribution and audio features such as ZCR,STE, FMCC, Fundamental frequency are passed to SVM classifier to classify commercial and non-commercial	54 hours of broadcast news videos, 18 hours from each of the three Indian English news channels NDTV, TIMES NOW and CNN-IBN.	As per Indian regulation loud audio in commercials is now forbidden. Hence the audio techniques used need to revised for future use.

V. CONCLUSION

Our paper includes the work done in field of commercial detection until now. Discuss the difficulties associated with each work. The knowledge based methods provide accuracy but heavily depends on recent trends in broadcast editing. Fusion of knowledge based techniques ,transfer based learning or DOG technique can be adopted to achieve higher accuracy with computational efficiency.

REFERENCES

- [1] <https://www.statista.com/statistics/233489/tv-advertising-revenue-in-india-from-2011/>
- [2] R. Lienhart, C. Kuhmunch and W. Effelsberg, "On the detection and recognition of television commercials," *Proceedings of IEEE International Conference on Multimedia Computing and Systems*, Ottawa, Ontario, Canada, 1997, pp. 509-516.
- [3] A. Gomes, M. P. Queluz and F. Pereira, "Automatic detection of TV commercial blocks: A new approach based on digital on-screen graphics classification," *2017 IEEE 11th International Conference on Signal Processing and Communication Systems (ICSPCS)*, Gold Coast, QLD, 2017, pp. 1-6.



- [4] M. Li, Y. Guo and Y. Chen, "CNN-based Commercial Detection in TV Broadcasting", *Proceedings of the 2017 VI International Conference on Network, Communication and Computing (ICNCC)*, 2017, Kunming, China, pp 48-53
- [5] Jen-Hao Yeh, Jun-Cheng Chen, Jin-Hau Kuo and Ja-Ling Wu, "TV commercial detection in news program videos," *2005 IEEE International Symposium on Circuits and Systems*, Kobe, 2005, pp. 4594-4597 Vol. 5.
- [6] R. Glasberg, C. Tas and T. Sikora, "Recognizing Commercials in Real-Time using Three Visual Descriptors and a Decision-Tree," *2006 IEEE International Conference on Multimedia and Expo*, Toronto, Ont., 2006, pp. 1481-1484.
- [7] L. Zhen, "Commercial Detection in Program Videos," *2009 IEEE International Forum on Computer Science-Technology and Applications*, Chongqing, 2009, pp. 107-110.
- [8] S. Bendale and B.J.Talati, "TV COMMERCIAL DETECTION IN SERIAL VIDEOS", *International journal of computer engineering and Technology (IJCET)*, vol 4, issue 3, 2013, pp 86-92
- [9] Swati D. Bendale, Bijal.J.Talati, —Analysis of Popular Video Shot Boundary Detection Techniques in Uncompressed Domain|| , *International Journal of Computer Applications (0975 – 8887) Volume 60–No.3*, (2012)
- [10] X. Wu and S. Satoh, "Ultrahigh-Speed TV Commercial Detection, Extraction, and Matching," in *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 23, no. 6, pp. 1054-1069, June 2013.
- [11] Chen JC., Yeh JH., Chu WT., Kuo JH., Wu JL. (2005) Improvement of Commercial Boundary Detection Using Audiovisual Features. In: Ho YS., Kim H.J. (eds) *Advances in Multimedia Information Processing - PCM 2005*. PCM 2005.
- [12] Vyas, A., Kannao, R., Bhargava, V., and Guha, P. "Commercial block detection in broadcast news videos". 2014. *Proceedings of the 2014 Indian Conference on Computer Vision Graphics and Image Processing*. ACM (2014)
- [13] Xian-Sheng Hua, Lie Lu and Hong-Jiang Zhang, "Robust learning-based TV commercial detection," *2005 IEEE International Conference on Multimedia and Expo*, Amsterdam, 2005, pp. 4
- [14] Z. Feng, J. Neumann, "Real time commercial detection in videos," 2013. [online] Available: <https://www.cse.msu.edu/~fengzhey/downloads/projects/before2015/Comcast-2013.pdf>.
- [15] R. Ganesh, A. Bagga, "A Text-based for Detection and Filtering of Commercial Segments in Broadcast News", proceedings of Irec, Spain, 2002 [online] Available: <http://www.lrec-conf.org/proceedings/lrec2002/pdf/326.pdf>
- [16] Zheng Cao, Ming Zhu, "An Efficient Method of TV Commercial Detection and Retrieval." URL: www.tech-ex.com/article-images/448644/1-14.pdf