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Video Summarization Using Keyframe Analysis

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Abstract
Recent advances in multimedia technologies and internet services mean that capturing and uploading videos is so easy that enormous quantities of new videos are available online every second. It is very tedious and time-consuming to go through the entire video and it is also difficult to manage with this colossal storage. This creates the desperate need for a briefer representation of videos to browse them more effectively and efficiently and retain their essential information, not only for entertainment benefits but also for commercial applications. This paves the way to an emerging research area known as video summarization, which can be either set keyframe same or video skims. Over the past few decades, research in video summarization started flourishing rapidly and branching into new areas within the prevailing Big data era. Despite various studies having been conducted, the major challenge remains ineffective feature extraction, similarity measurement, and appropriate summary length determination, which generates the need for the development of effective and efficient automatic video summarization techniques.
Keywords: Video Summarization, Motion Descriptors, Keyframe, Vision, Deep Learning.

Introduction

In today's world, One of the most effective and efficient ways of capturing and storing digital media is video. Keyframes are called representative frames. Keyframes contain the most informative frames, which may capture the main information in a video in terms of content. Keyframing is used to summarize essential video content in a short time. Keyframes can generate summaries of the videos to provide browsing capabilities to users.There are two techniques used for video summarization: static video summarization, which is video summary, and dynamic video summarization, which is video skimming. If we want to reduce the length of the video which is archived by video summary static video summarization that video summary, is a fast and powerful application. There are different approaches are applied for different requirements like sports, nature, etc. Video summarization methods have recently attracted most researchers. The high-level feature vectors that are deep features are extracted using CNN. After that by using the high-level feature vectors to summarize the video. High-level features can SIFT, interest point from an image, edge detection, etc**.**

Related Work

1. Material and Methods:

Video summarization using keyframe analysis involves selecting a few keyframes from a video that can represent the content of the entire video. Here are the materials and methods required for video summarization using keyframe analysis:

Materials:

A computer with a fast processor and sufficient memory
Video dataset for testing and training the model
Python programming language
OpenCV library for image processing
Scikit-learn library for clustering algorithms
Matplotlib library for visualization

Method:

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Pre-processing: The first step is to preprocess the video by extracting frames from the video. This can be done using OpenCV library.
Feature extraction: Extracting features from each frame is important to represent each frame uniquely. Feature extraction can be done using techniques such as edge detection, color histograms, and optical flow.
Clustering: The next step is to cluster the frames based on their similarity. K-means clustering is a popular clustering algorithm that can be used for this purpose. Scikit-learn library provides an implementation of this algorithm in Python.
Keyframe selection: After clustering, we can select keyframes from each cluster. A common method is to select the frame that is closest to the centroid of each cluster. Another method is to select the frames that have the highest saliency score.
Video summarization: Finally, we can create a summary of the video by combining the selected keyframes. The summary can be created by stitching the keyframes together in chronological order or by using techniques such as dynamic time warping to create a summary that reflects the temporal structure of the video.
Overall, the process involves pre-processing, feature extraction, clustering, keyframe selection, and video summarization. With the right material and work.

2. Algorithm

Convolutional Neural Network Algorithm

CNNs (Convolutional Neural Networks) can be used in video summarization using keyframe analysis by first training the network to identify relevant frames or keyframes in a video sequence. This can be done by presenting the CNN with a large dataset of video frames and corresponding labels indicating whether each frame is a keyframe or not. The CNN can then learn to identify keyframes by recognizing patterns and features that are common to important frames.
Once the CNN has been trained, it can be used to analyze new video sequences and identify keyframes. This is typically done by presenting the network with a sequence of frames and using it to generate a score for each frame indicating its importance. Frames with higher scores are then selected as keyframes, and used to create a summary of the video.
There are several different architectures and techniques that can be used to implement a CNN-based video summarization system using keyframe analysis, and the exact details will depend on the specific application and requirements. However, some common approaches include using multi-layer CNNs with pooling layers to reduce the dimensionality of the input, and using various loss functions to train the network to identify keyframes.
Overall, CNNs can be a powerful tool for video summarization using keyframe analysis, and are often used in combination with other techniques such as clustering and optimization to generate more accurate and effective summaries.

Algorithm 1: Conventional Neural Network.

Input: The dataset, input data (video) is implemented as input. The data is collected from dataset repository**.**

Output: In this step, We can give an input, with the help of algorithm, we can summarize the content and stored in text file**.**

Procedure:

The Proposed methodology steps are as follows:

Step 1: Take a video as input. In this, we take a video as input.

Step 2: Convert a video into frames. We convert a video into frames

Step 3: Redundancy Elimination. We eliminate the same frames by using similarity measure techniques and reduce the redundancy among frames.

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Step 4: Feature extraction by CNN.
Step 5: Calculate the similarity measure between frames. If the threshold is minimum take it as a keyframe and if the threshold is greater take it as a non-keyframe
Step 6: Now make a video summary of selected keyframes.

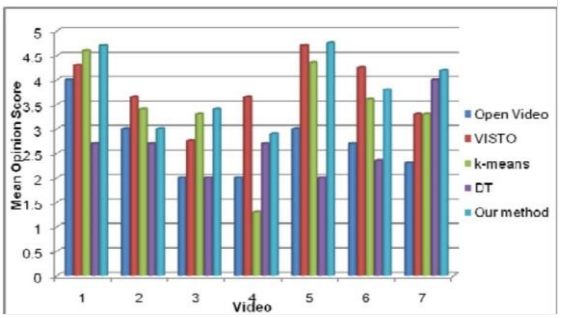
4. Result:

It is observed that Convolutional Neural Network classifier achieved the best performance of more than 90% of accuracy. However, the other classifiers obtained accuracy of not less than 85%. Hence, in this research we can claim that CNN is highly suitable with contours for feature extraction model. In contrast, SVM and KNN is a classification approach, which classifies a sample according to the majority vote of its neighbours. The number of neighbours in this research is fixed as one with the city block distance metric. were less suitable with the contours. On the other hand, conventional feature extraction method extracts each type of feature separately and manually consuming a lot of time. For example, if the shape features are considered in this work, different sets of processes will be required for segmentation followed by shape feature extraction. Thus, machine learning approach is more practical and appropriate than conventional methods for developing an automated plant species classification system.

Table 1: Performance of the Classifiers without Feature Selection

TABLE 3
COMPARATIVE ANALYSIS OF VIDEO SUMMARIZATION METHODS BASED WITH EXISTING RESEARCHES

Factors Covered	Bora and Sharma (2018).	Murugan et al. (2018).	Khan and Pawar (2015).	Patil, and Phalke (2019).	Workie et al. (2020).	This Paper
Domain Direction	0	0	1	0	1	1
Motion Based	0	1	1	1	0	1
Event Based	1	1	1	1	1	1
Attention Based	1	0	0	1	1	1
Object Based	1	1	1	1	1	1
Color Based	0	1	1	1	0	1
Clustering Based Approaches	0	0	1	1	0	1
Shot Detection Based Approaches	0	1	1	1	1	1
Trajectory based Approaches	1	0	0	0	0	1
Sparse dictionary learning:	1	0	0	0	0	1
Applications	1	0	0	0	1	1
Datasets	1	1	0	0	0	1
Total Score	7	7	7	7	7	14



5. Conclusion:

In conclusion, video summarization using keyframe analysis is an effective technique for creating concise and informative representations of video content. Key frame extraction is quite possible by using different approaches.
One such example is shot-based key frame extraction. Now it has been updated the lengthy video will be divided into short frames and then club these frames and then give a shot video. But in this, we can support only one format of videos. By using this technique we have done background separation and foreground mask. We can display multiple frames at a time in a single shot. We can rearrange the keyframes then we can display the summarized video. By selecting keyframes from a video, a summary can be generated that captures the essential information and reduces the viewing time of the original video. Video summarization has numerous applications in various fields such as

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education, entertainment, and security. However, the effectiveness of the summarization heavily depends on the quality of keyframe selection and the chosen summarization algorithm. Thus, further research is needed to improve the accuracy and efficiency of keyframe analysis and video summarization techniques.

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