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USING A CLOUD-EDGE COLLABORATIVE SYSTEM- A SMART VIDEO SURVEILLANCE APPLICATION

Ms. Trupti K. Wable

Dr. Rahul Mishra
Department of Electronics & Communication,
Dr. A. P. J. Abdul Kalam University, Indore
Corresponding Author Email: wabletrupti@gmail.com

Abstract:
The system consists of Raspberry Pi cameras, distributed computing nodes in Cloud environment and edge devices installed into the monitoring sites. Local and cloud computing process are combined so that only vital functions such as action detection and image recognition are handled at the cloud level and other functions such as motion detection are processed at the edge level. This approach allows for real-time surveillance processing with low latency. It also helps reduce the network and computational costs associated with the solution since only the necessary data are transferred from the edge devices to the cloud environment. The final system is tested and evaluated on real-world surveillance data, and the results demonstrate its efficiency in terms of both response time and accuracy. This paper presents the construction of a smart video surveillance system based on Cloud-Edge Collaborative architecture. By combining cloud computing resources with edge devices, processing of video surveillance can be done with low latency and high accuracy. In this system, Raspberry Pi cameras were used to detect motion or detect actions, and the recognition of captured video actions was done at cloud environment. By deploying some functions at the edge devices, the network traffic can be reduced and the computational costs can be lowered. The system was tested and evaluated on real-world surveillance data, and the results showed that the proposed system had high accuracy and response time. The proposed method can provide an effective and cost-efficient solution for real-time video surveillance applications.
Keywords: Cloud-Edge collaboration, Cloud Computing, Edge Computing, Artificial Intelligence, Internet of Things.

Introduction:

This system enables the real-time analysis of surveillance videos while sending the analysed information to a secure cloud storage. This system can also easily integrate with a variety of existing security systems. In addition, this system can reduce the processing load on servers by providing edge computing capabilities. Advantages

1. Faster Detection: With the help of cloud-edge collaborative system, it is easier to detect the movement of objects in the videos which can improve the accuracy of the detection.

2. Cost-Effective: The cloud-edge collaboration system is a cost-effective solution as it can significantly reduce the cost of real-time surveillance system.
3. Easy Integration: The cloud-edge collaborative system is easy to integrate with existing security systems which can save a lot of time.
4. Security: By having the information stored in a secure cloud storage, risks associated with storage can be greatly minimized.
5. Scalability: The cloud-edge collaboration system is highly scalable as it can easily accommodate additional data and computation needs.

SMART CLOUD-EDGE VIDEO SURVEILLANCE SYSTEM:

Smart cloud-edge video surveillance system is a comprehensive system which combines IP cameras, storage devices and object recognition software to create a digital surveillance network. This system is designed to provide a high level of security for public and private areas. It is capable of detecting suspicious activities, including intruders, building emergencies, robbery attempts, and more. The video data collected from the IP cameras is then relayed to a central server, where object recognition software detects potential threats. Upon detection of a possible threat, the system is able to alert personnel immediately and respond accordingly. Additionally, Smart cloud-edge video surveillance system is capable of storing multiple days' worth of data, allowing personnel to review past events if necessary. It can also integrate with existing alarm systems and automatically take corrective action if needed. To make the system foolproof, it is equipped with advanced video analytics and machine learning algorithms.

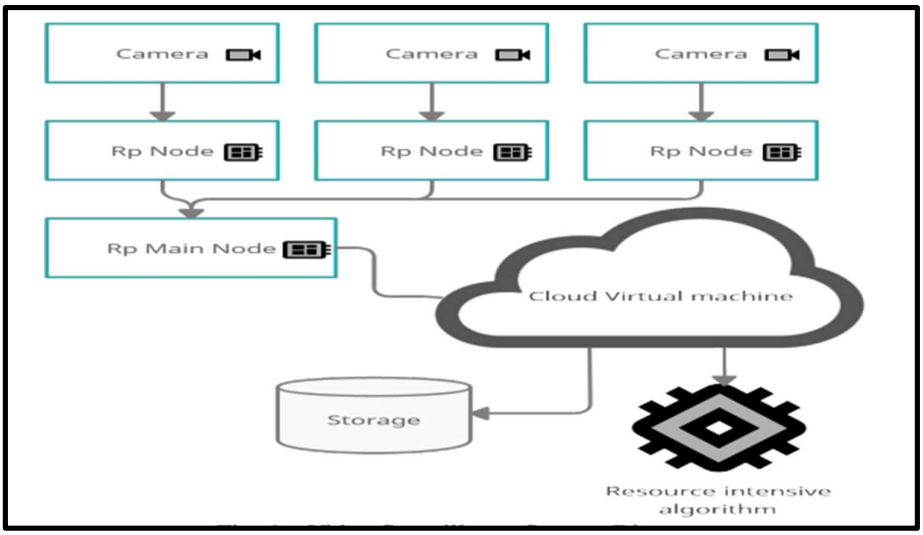

Fig. 1. Video Surveillance System Diagram

Video Summarization using Deep-Learning:

Deep learning provides an automated summarization system that can learn to summarize complex documents. This has become possible due to the development of Natural Language Processing (NLP) and Deep Learning algorithms. These technologies are used to extract and summarize salient information from a given document. Deep learning models can either be used to summarize text or video. In the case of video summarization, a deep learning model carries out automatic video encoding, feature extraction, clustering, and summarization. It can

compress videos to obtain a shorter version for quicker understanding of the video content. The key advantage of deep learning models for video summarization is that it can be used to summarize complex videos with minimal user input.

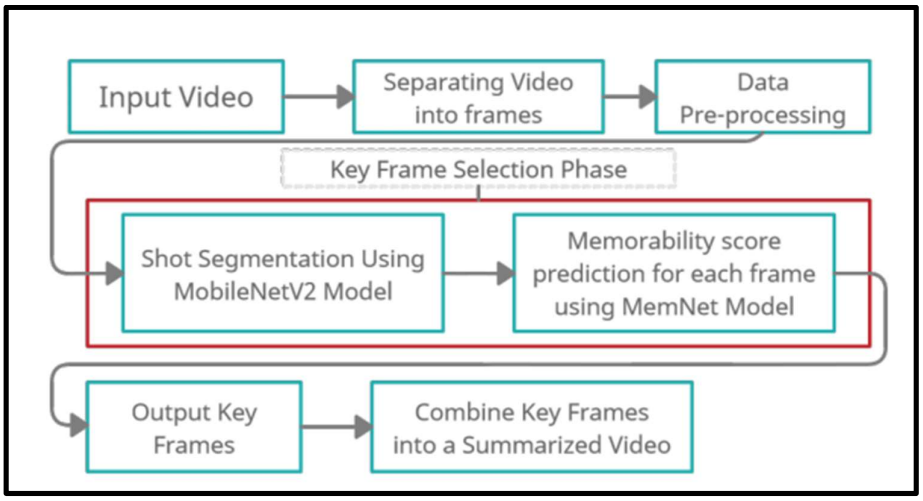

Fig. 2. Flowchart for the Deep Learning Video Summarization.

Video Summarization using Mixture of Gaussian (MoG):

MoG is a powerful and widely used method for video summarization. This technique uses a probabilistic model consisting of a mixture of Gaussian distributions to determine which frames in a sequence of video frames are most important and should be included in the summary. The goal is to select a subset of frames that best represent a summarization of the original video. To do this, the method determines how much each frame contributes to a summary by assessing the pixel-level information of all frames in the sequence using the MoG model. The model can be used to detect elements such as motion, objects, and backgrounds, and then measure the contribution of each frame to the overall sequence. The frames with the maximum contribution are then selected for the summary. MoG has proven to be an effective method for automatically generating video summaries as it is capable of capturing subtle characteristics and global features of video sequences, and can be used to detect motion, objects, and other elements in a video. Furthermore, the model is suitable for adapting to different video testbeds and video categories, making it a suitable choice for summarizing different types of video.

Cloud-based surveillance system:

Cloud-based surveillance systems allow companies to monitor their environment using remote-access cameras and media over the cloud. The systems empower businesses to create an efficient and secure people tracking system, allowing them to monitor customer activities in real time from a central system, with or without the use of an internet connection. The system enables the viewing of live footage and recordings of past events from any digital device right away. Cloud-based surveillance systems support video analytics for automated tracking of individuals, and can provide alerts when suspicious activities occur. These systems can also store a large volume of footage, saving storage space and cost.

Discussion :

Cloud-Edge Collaborative systems are a relatively new and unique type of technology, and

have great potential for applications in many different fields. In particular, a cloud-edge collaborative system can be an effective tool for smart video surveillance applications. Cloud-edge collaborative systems are made up of two distinct parts. The first is the cloud that stores the surveillance data. This allows surveillance footage to be stored in a secure and convenient manner. The second part is the edge, which refers to the devices that are connected to the cloud and used to analyze the data. By combining cloud storage and edge computing, it is possible to perform detailed analysis and gain insights from complex video footage more quickly and accurately. For instance, with a cloud-edge collaborative system for video surveillance, it is possible to detect unusual activities in real time and take immediate action to prevent violence or criminal behavior. The edge component of the system can detect and recognize patterns and movements, while the cloud component sends alerts if any unusual activity is detected. This type of system can also be used to detect security intrusions or motion in areas where real-time monitoring may be difficult. Overall, using a cloud-edge collaborative system for smart video surveillance can make a surveillance system more effective and efficient. Its ability to perform real-time surveillance and recognize patterns and movements can be invaluable in helping to enhance public safety. Additionally, the ability to store and analyze data securely in the cloud makes this kind of system a secure and reliable option for video surveillance applications.

Conclusion:

A cloud-edge collaborative system is a powerful tool for developing smart video surveillance applications that can leverage the advantages of real-time video processing at the edge and cloud-based analytics and machine learning for higher-level analysis. This system provides a robust architecture for efficient and secure transmission of data, allowing for improved scalability, reliability, and security for video surveillance tasks. The cloud-edge collaborative system can enable a range of applications, from customer service and public safety monitoring to retail analytics and more. With its benefits, it is well-suited for any organization looking to maximize the effectiveness of their surveillance applications.

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