DESIGN AND IMPLEMENTATION OF A LIGHT WEIGHT CNN MODEL FOR FIRE DETECTION

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Abstract
When compared to traditional fire recognition frameworks based on sensors, vision-based fire detection frameworks have recently gained popularity. The need for video perception in private, modern, business areas, and wooded areas has expanded the application of a vision-based fire system. Recently, a number of fire-related accidents have occurred as a result of inadequate surveillance or the inability to cover those uncertain regions such as restricted areas in forests or factory buildings. To avoid such mishaps, we propose a method based on Convolution neural networks.

Keywords – Fire detection, Image classification.CNN, Video analysis.

1. INTRODUCTION

The first to recognize checking figures were evolutionary neural networks and deep learning in the late 1990s. In the last decade, on the other hand, CNNs have been widely used. The primary reason for this is the increase and decrease in the performance of GPUs. Initially, GPUs were designed to perform countless millions of matrix operations per second. As a large number of matrix operations are required for neural networks. GPUs are better optimized than central processing units for neural networks (CPUs). We chose just to detect fires and smoke for this article, because early detection is one of the most common cases in which the number of victims is reduced and fire-related disasters prevented.

In 2018, 1,318,500 fires have been reported by the NFPA report, resulting in a total of 3,655 civilian fire killings, 15,200 civilian fire wounds, and a direct loss of $25.6 billion. A fire victim was reported every 2 hours and 24 minutes and a fire injury was reported every 35 minutes. Domestic fires killed 2,720 people, making up close to 74% of all deaths.Of the 36,746,500 calls, 4 fires were reported, 8% were reported to be false alarms. Modern smoke detectors are mostly ionizing, photoelectric or laser based. In an outdoor environment, however, they are not very reliable. The availability of software open source helps in the quick delivery of CNN deployments.

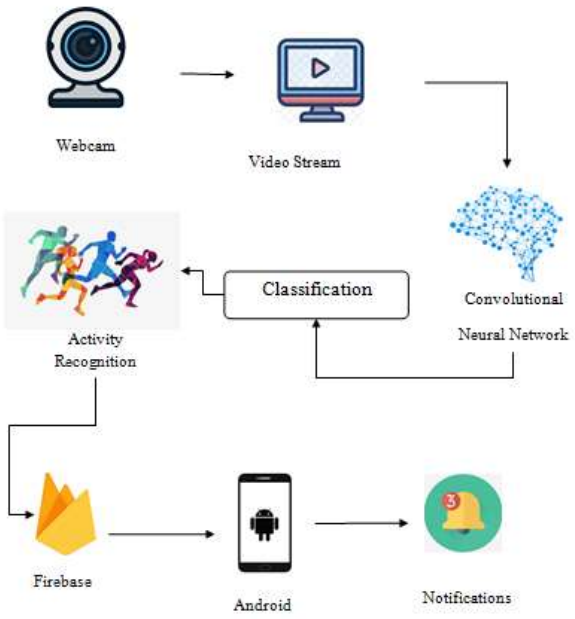
2. EXISTING SYSTEM

Researchers introduced traditional as well as learned fire detection methods for the detection of fire. In literature, both color and motion characteristics are used in traditional methods for fire detection. Use color detection features such as HSI, YUV, YCbCr, RGB, and YUC to explore different color models for Fire detection. High levels of false alarms are the major problem with these methods. Several efforts were made to solve this problem by combining color information with motion, fire form analyses and other features.

3. PROPOSED SYSTEM

The work proposed offers a cost-effective RCNN-based fire detection system for videos captured in uncertain scenarios. Our approach uses lightweight, deep neural networks with no dense completely connected layers, which makes them computer-costly. The information passes through the firebase once a fire is detected. Firebase's a database type. The firebase then sends a message to an android smart phone.

4. SYSTEM ARCHITECTURE



5. MODULE DESCRIPTION

The proposed system consists of the following modules

- Dataset Creation
- Frame By Frame Detection
- Input Identification

5.1 CREATION OF DATASET

Collect fire and non fire images and train fire images separately as well as non-fire images. There is now a trained dataset, compared to the video sequence and with well defined fire pictures.

5.2 DETECTION OF FRAMES

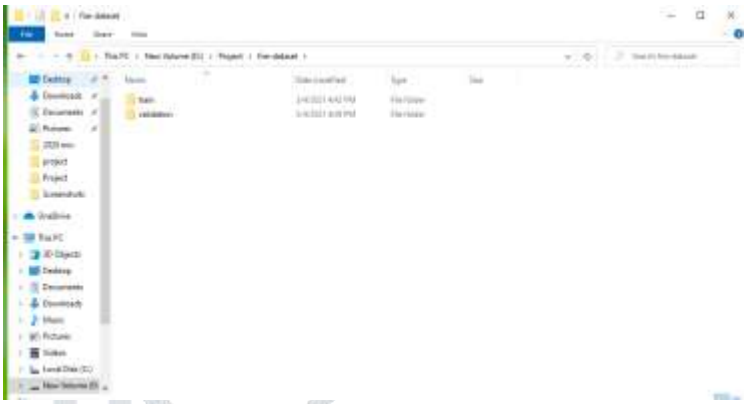
The images are divided into frames and the frame is again divided into pixels by means of the CNN monitoring algorithm.

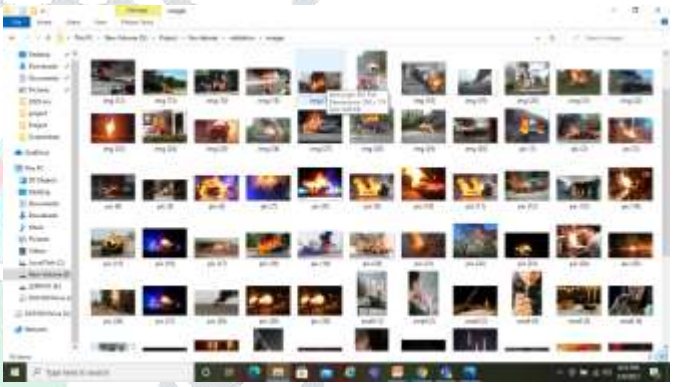
5.3 IDENTIFICATION OF INPUTS

A CNN model is now provided with data indicating whether or not the input is fire. In the background a red warning will be given if the input is a fire for a few seconds. In the background it shows a green otherwise for a non fire.

5. SYSTEM IMPLEMENTATION

The work has been implemented in python 3.7,operating system used is windows 10 (64bits) and tool is Anaconda (JUPYTER IDE).





6. CONCLUSION

In this paper, we present and compare our fire detection network with existing CNNs. The CNNs were compared using two different data sets for the training of CNNs for fire detection from the images. A lightweight CNN model with high precision results was designed. After training, the fire detection network model was smaller. Two data sets were used to measure the accuracy of the model fire detection network and found to be between 77 and 81 percent. In terms of run time the best time for each image processing on both data sets was shown by our fire detection network model. The measured fire detection network time for thedataset1 reached 0,052s per picture. DataSet2 showed a 0.109s per picture fire-detection network model. We have also shown potential future development steps for fire detection systems in this paper.

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