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Deep-Learning-Based Forest Fire Response System with CCTV Images

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ABSTRACT*:* An effective forest-fire response is critical for minimizing the losses caused by forest fires. The purpose of this study is to construct a model for early fire detection and damage area estimation for response systems based on deep learning. First, we implement neural architecture search-based fire detection. Networks play a crucial role in the application of deep learning-based models, as they have a significant impact on the performance of the model. A CNN model is used as a regression model to estimate the damaged area. The CNN estimates the damage area with less error and increased generalization. Thus, both proposed models demonstrate their robustness and suitability for implementation in real-world systems.

I. INTRODUCTION

Forests contribute to significant ecological and economic functions in ecosystem . In addition, forests are important heritage sites for human beings.However, forest fires can cause tremendous damage to human life and property and adversely affectforest ecosystems in the long term.Therefore, forest fires must be prevented; however, they are difficult to prevent because of their diverse causes. The initial response to forest fires is an important factor in reducing accidents.

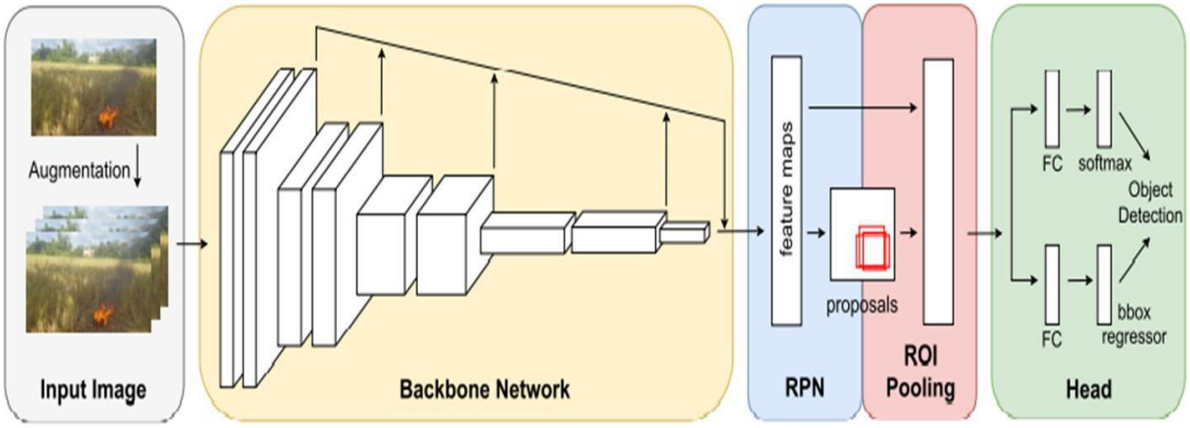
II. OBJECTIVE

Motivation for analyzing the forest fires early detection and prevention systems are the positive aspects of one such system present in a country. The system should give all necessary items required for early warning and prevention of forest fires. In general architecture of a Forest Fire System, with a server-side computational unit, data providers and users.

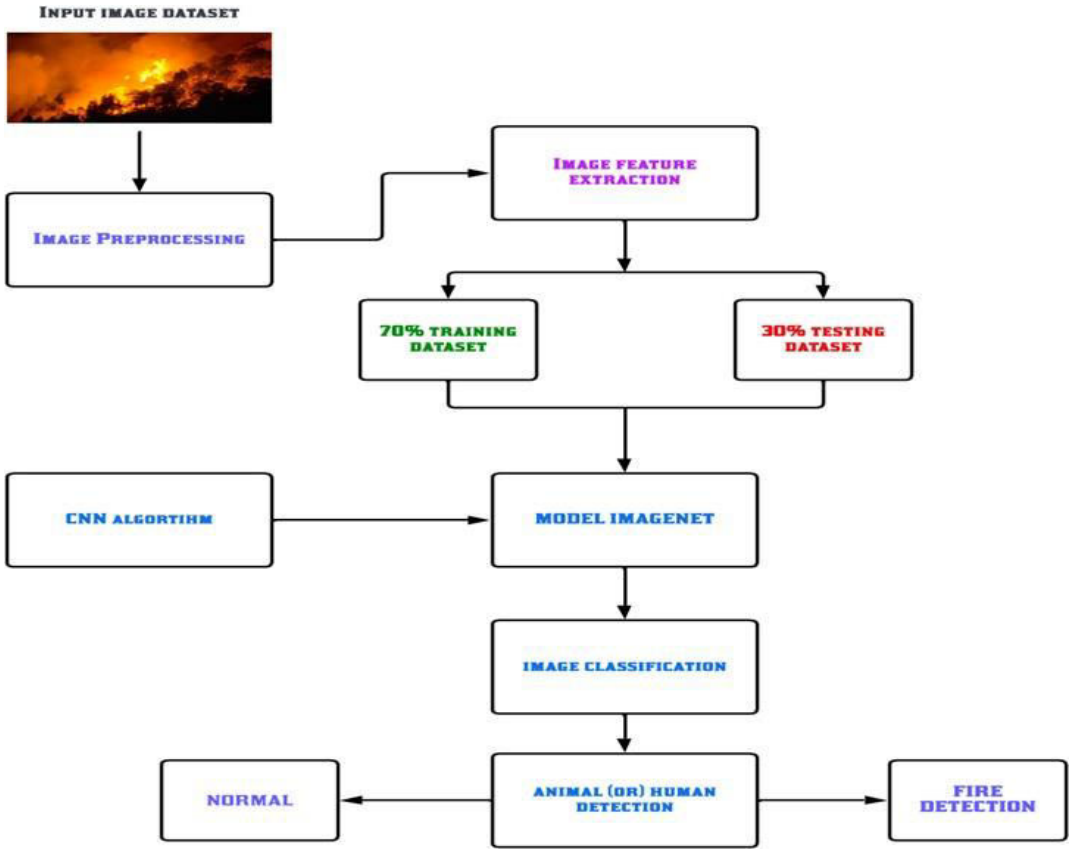
III. PROPOSED METHOD

Our Proposed System is based on implementation of a forest-fire response system with two primary aspects: detection and damage estimation. By deep learning method we uses spatial segmentation and motion flow estimations to detect fire from images. By the use of motion compensation techniques, high accuracy is achieved in the results. By the use of motion compensation techniques, high accuracy is achieved in the results. Propose an approach for forest-fire response systems by using deep learning. In this process, we analyzed and preprocessed the training dataset to solve the unbalancing problem between classes. In addition, we compared our model with Cnn models.

ARCHITECTURE DIAGRAM



3.3 BLOCK DIAGRAM



2. MODULES

- Image Preprocessing
- Detecting Forest Fire
- Feature extraction
- Convolutional Neural Network (CNN)
- Fire detection and damaged area estimation

IMAGE PREPROCESSING

An image classification task determines the category of a given input animal image in forest fire dataset. It is a basic task in high-level image understanding and can be divided into binary- and multi classification tasks. After multiple convolution-and-pooling operations via a CNN, an image is classified in the output layer following the requirements. Activation function of the output layer is the only difference between binary and multi classification tasks. An image classification task for animal track image analysis easily identified and then necessary actions can be taken to prevent accidents is a high performance in natural image classification, including Convolution neural network (CNNs) can be used in JPG/PNG image classification.

DETECTING FOREST FIRE

Forest fire is a very prominent feature in the image since it is a forest fire. The empty forest fire needs to be found before 2km when train running. Since track is straight lines, edge detection can be used for the same. Canny edge detection is found to give very good results once the thresholds are tuned properly. Image can be filtered before edge detection to remove noise. Edge detection results in a cluster of number of lines. We need to extract the forest fire out of it. Humans or animals crossing the forest fire than alarm detected automatic send message to forest fire dept.

FEATURE EXTRACTION

In machine learning, pattern recognition, and image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretations.Feature extraction is related to dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be redundant, then it can be transformed into a reduced set of features (also named a feature vector). Determining a subset of the initial features is called feature selection. The selected features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data.

CONVOLUTION NEURAL NETWORK (CNN)

Convolutional Neural Networks specialized for applications in image recognition. CNN is mainly used in image analysis tasks like Image recognition, Object detection & Segmentation. Convolutional Layer in a typical neural network each input neuron is connected to the next hidden layer. Only small region of the input layer neurons connect to the neuron hidden layer. Pooling Layer is used to reduce the dimensionality of the feature map. There will be multiple activation & pooling layers inside the hidden layer of the CNN. Fully Connected Layers form the last few layers in the network. The input to the fully connected layer is the output from the final Pooling or Convolutional Layer, which is flattened and then fed into the fully connected layer.

FIRE DETECTION AND DAMAGE AREA ESTIMATION

The forest fire curve of the search for the subnet in the trained CNN model we used. The highest candidate score in each epoch increased as the evolutionary search proceeded. From this, the best architecture performance was selected. The searched is combination of shuffle block, which is a unit of CNN. The shuffle block is a light-weight block based on the inference rate, not the flops. Therefore, the CNN the best performance in light-weight object detection models. In this study, we define the search space using shuffle block. Each layer of our search space is a shuffle block with different kernel sizes or skips layers. This pattern indicates the feature extraction, the important part of object detection. As much information as possible must be extracted from input images to create a pattern useable for detection.

IV. CONCLUSION

An appropriate forest-fire response is critical for mitigating losses and providing authorities with an effective solution. The first two stages of a forest-fire response system are early fire detection and damage area estimation. When a forest fire occurs and is detected using an early fire detection model, the damaged area is approximated using the current state of the forest. The biggest challenge in the future is to integrate these modern technologies in order to make the forest

fire detection and prevention systems more efficient and useful.

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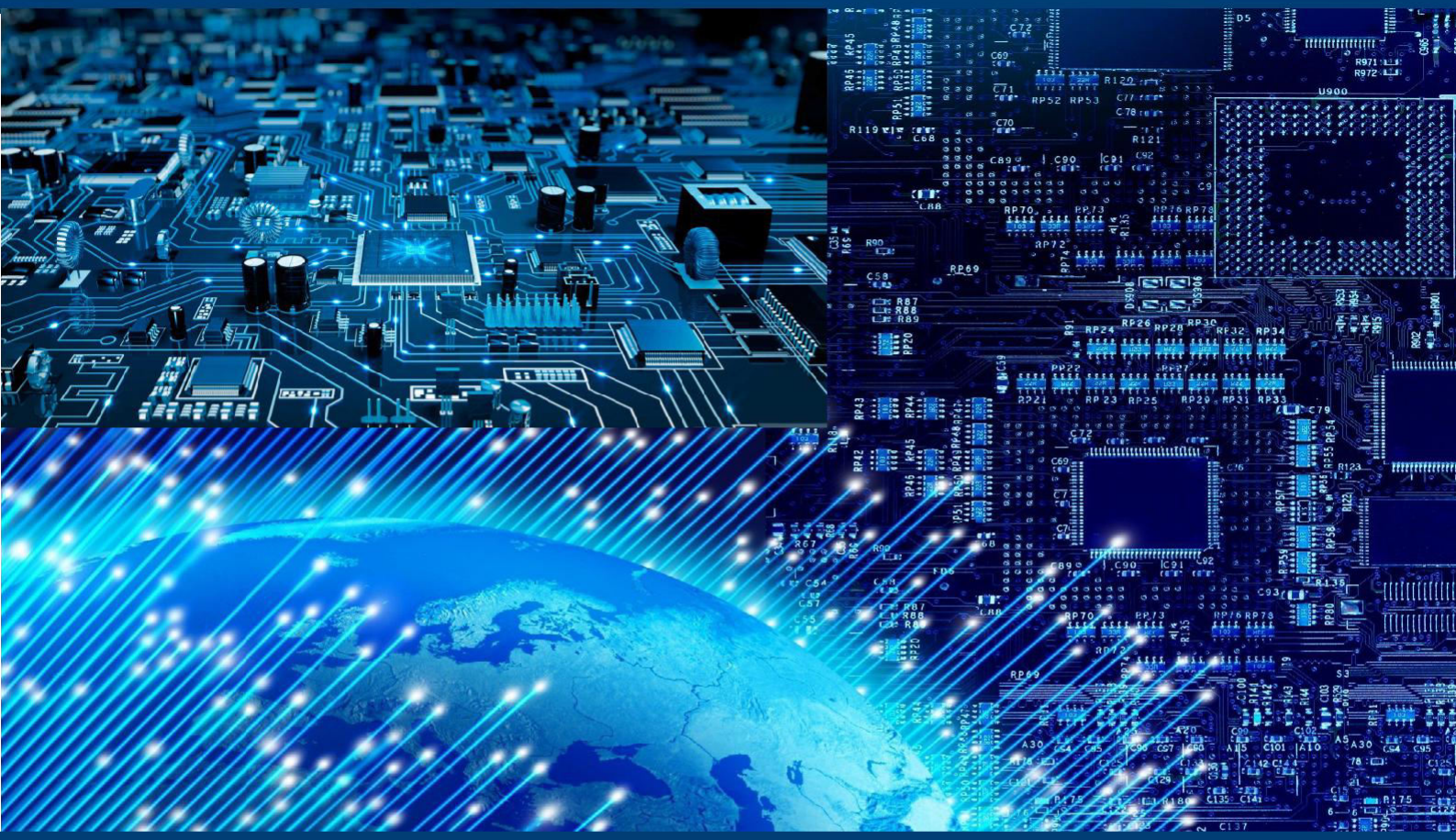

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