**A novel approach for image and video -based forest fire detection using Deep and Transfer Learning.**

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Keywords— Deep Learning, Forest Fire, Transfer Learning

1. Area

Deep Learning, Transfer Learning, Image and Video Processing.

2. Question

Can Deep and Transfer Learning be used as an alternative to detect the Forest Fire based on image and video data in order to prevent the significant loss of forest land?

3. Value

Gradually increasing temperature on the earth over the years has shown an adverse effect on Weather, Seasons, Glaciers, Sea Temperature. Out of these Forest, Fires are most destructive as it leads to significant loss of earth’s flora and fauna. Smoke generated due to fire leads to an additional increase in Environment pollution. Forests are not only providing shelter and protection to the living beings but also it is a large source of food, Wood and other essential supply. To protect the forest from this imminent danger we need a solution that is most reliable and accurate. (M. Rahul et al.2020)

There are two main reasons for the start of forest fires one Human Activities and Second Naturally. The impact of these fires is such that they can spread in a large area very quickly burning millions of acres. According to National Interagency Fire Centre, 58 thousand Forest Fires burned in total 10 million acres of forest land in the United States of America. This gives us a view of how crucial is the problem for the entire world.

Monitoring the forest area is one of the solutions for this problem but it will require a large number of human resources and infrastructure to monitor large forest areas. This paper introduces a novel approach for accurately detecting Forest Fires using Deep and Transfer Learning. This would help alarming concerned authorities, who can then take necessary actions to prevent the spread of fire.

4. Justification

M.Rahul et al.(2020) indicated that the research work done in this research area is not based on achieving high detection rates. The models used, consist of steps pre-processing and data augmentation. VGG16, ResNet50, and DenseNet121 are used for the detection and classification of images. Images are getting classified as Fire or No Fire based on the probabilities. There is a scope of improvement in terms of accuracy. Specificity and Sensitivity metrics are not used to evaluate the model accuracy. Image Augmentation is used to increase the Training Dataset due to which model could be less reliable if implemented on large scale. Out of Implemented models ResNet 50 obtained 92 % accuracy. (M. Rahul 2020)

An image-based fire detection has helped to prevent significant loss by alarming users of the system. However, earlier implemented models have given Lesser Accuracy, Delay in the detection and the need for a significant amount of computational power. Missed detections, false alarms are the drawback of earlier implemented models. CNN models of Faster-RCNN (Faster Regions with CNN features), R–FCN (Region-based Fully Convolutional Network), SSD (Single Shot MultiBox Detector), and YOLO v3 (You Only Look Once Version 3) were implemented for forest fire and smoke detection. This research not only classifies the image Fire or No fire and Smoke and No Smoke, but it also highlights the portion of the image which contains features of smoke and fire. Apart from accuracy fps (Frames per Second) used to detect the Fire or Smoke is used as an evaluation metric. YOLO v3 has provided the best results with 84% accuracy and 28 fps. (Pu Li et al. 2020)

Implementing Long Short-Term Memory (LSTM) has achieved success when applied to Machine Translation, Handwriting Recognition, Object Detection. Currently implemented solutions are not reliable for large forest areas as they serve as the point sensors in space. Forest fire detection models are based on either fire or smoke detection. A video-based dataset with a sequence of 20 frames at 5 frames per second is used to detect the fire and smoke. It uses both past and future information extracted from the sequence to make the classification. A Bidirectional LSTM model implemented has provided an accuracy of 97.8 % which is better than traditional CNN models. (Y. Cao et al. 2019)

The dataset is publicly available for research and it is already classified as Fire, No Fire and Smoke, No Smoke. Therefore, data will be ethical to use for the implementation.

References

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