A PROJECT REPORT

ON

EARLY DETECTION OF FOREST FIRE USING DEEP LEARNING

DEGREE

In

COMPUTER SCIENCE AND ENGINEERING

P.S.R.ENGINEERING COLLEGE SIVAKASI-626140

By

TEAM ID:PNT2022TMID13306

TEAM MEMBERS

K.Manoj- 951919CS053
S.Gokul – 951920LCS26
G.Bharath– 951919CS013
M.Muthukumar– 951919CS057

Under the Faculty Mentor of

Mr. D. Arun Shunmugam(Assistant Professor, Dept. of CSE)

ABSTRACT :

Forest fire is an alarm in condition which occurs in boreal, tropical as well as temperal forests due to natural causes such as volcanic eruption, high atmospheric temperature and dryness (low humidity) and man made causes such as cigarettes discarded with flame,campus left unattended, burning of debris equipment use and malfunctions, leftovers of ignited flammable products which not only causes harmful effects on the ecosystem but also for human beings who are living in the forest(tribes) as well as the surrounding areas. So it is necessary to prevent fires that are occurring in the forest. Which saves not only the natural resources but also has a good impact in uplifting the quality of environment.

AIM :

Forest and urban fires have been and still are serious problem for many countries in the world. Currently, there are many different solutions to fight forest fires. These solutions mainly aim to mitigate the damage caused by the fires, using methods for their early detection. In this paper, we discuss a new approach for fire detection and control, in which modern technologies are used. In particular, we propose a platform that uses Unmanned Aerial Vehicles (UAVs), which constantly patrol over potentially threatened by fire areas. The UAVs also utilize the benefits from Artificial Intelligence (AI) and are equipped with on-board processing capabilities. This allows them to use computer vision methods for recognition and detection of smoke or fire, based on the still images or the video input from the drone cameras. Several different scenarios for the possible use of the UAVs for forest fire detection are presented and analyse in the paper, including a solution.

INTRODUCTION:

The main objective of a project is to detect the fires occurring in the forest. For this we have created a convolution neural network that predicts the fire.This project is an attempt to use convolutional neural networks (CNN) to detect the presence or the start of a forest fire in an image. The model could be process in open cv and applied in real-time to low-framerate surveillance video (with fires not moving that much fast, this assumption is somewhat sound) and give alert in case of fire.

EXISTING SOLUTIONS:

1. Aerial monitoring of forest fire using drone Cameras operated in remote locations

2. Use of various sensors such as smoke, flame, gas etc…to sense and detect fire

3. Human surveillance for forest

4. Thermal imaging of forest

5. Use of satellite images to detect fire

PROPOSED SOLUTION:

Using deep learning (convolutional neural network) to predict the forest fire.

The process is briefly described below:

COLLECTION OF DATASET:

The model is trained on a provided dataset which contains images of : 'fire' and 'no fire', totally around 1900 images. These images are mostly of forest or forest-like environments like sea shore, river banks, ponds, beach, etc….

DATA PROCESSING:

First importing the required libraries and then splitting the collected data into training as well as testing.1520 images are used for training and 380 images are used for testing. Then we perform data augmentation where we increase our availabe datasets by rotating, flipping,shearing, scaling, cropping,etc..This helps in reducing the chances of overfitting when training our model.Now we have more data to perform better.

BUILDING THE MODEL:

Importing the required libraries and since we are building our model to get 1 input and give back 1 output we are initiating the model as sequential. Adding the convolution layer,max pooling layer as well as flatten layer. Then passing it to a fully connected layer which is nothing but a Artificial neural network layers(i.e the input layer, hidden layer, output layer). The activation function for hidden layer is specified as relu(rectified linear activation function) and the activation function for output layer is given as sigmoid. Then the model is compiled with optimizer as adam , loss function as binary-cross-entropy(since our model is a binary classification model and setting the metrics to accuracy. Training the model, setting epoch value as 10.

Input Layer — Convolution Layer — Pooling Layer — Dense Layer — Output Layer
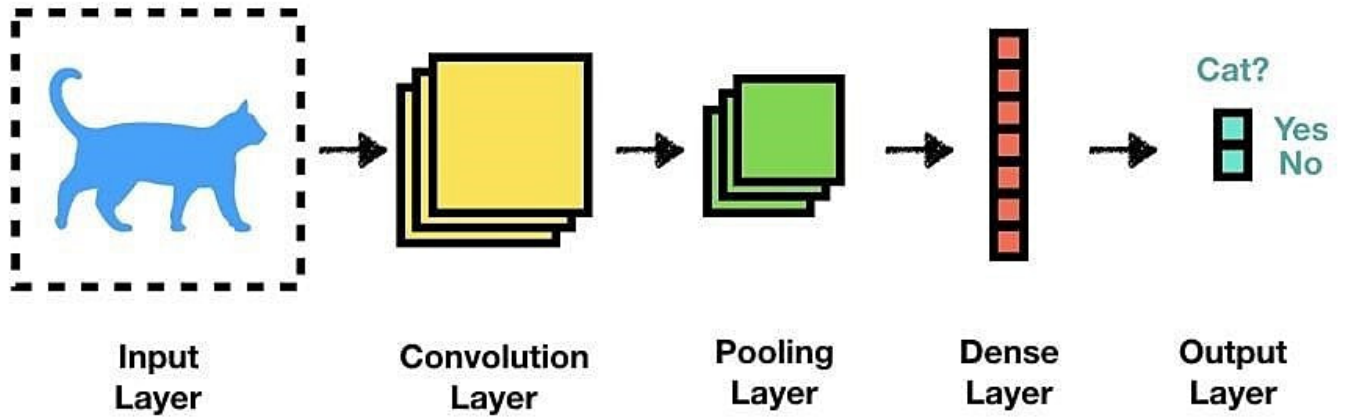
Accuracy vs loss(during training):

Epoch	Accuracy	Loss	Val-loss	Val-accuracy
1	0.8612	0.5750	0.9289	0.2057
2	0.9151	0.2386	0.9151	0.1584
3	0.9461	0.1595	0.9316	0.1794
4	0.9526	0.1530	0.9026	0.2408
5	0.9480	0.1525	0.9237	0.1976
6	0.9342	0.1873	0.9289	0.1569
7	0.9507	0.1657	0.9421	0.1541
8	0.9533	0.1549	0.9316	0.1917
9	0.9513	0.1451	0.9368	0.1848
10	0.9520	0.1589	0.1496	0.9447

After this saving our model in .H5 format.

TESTING THE MODEL:

Then testing our model by providing the data that is allocated for testing. We can use our saved model file for video analysis of forest fire and use it in real time surveillance camera for real time prediction.

REFERENCES:

1. Zhentian Jiao1, Youmin Zhang, Jing Xin, Lingxia Mu,

    Yingmin Yi,Han Liu and Ding Liu, "A Deep Learning based forest fire detection approach using UAV and YOLOv3," 1st International Conference on Industrial Artificial Intelligence (IAI), 2019

2. Qingjie Zhang, Jiaolong Xu, Liang Xu and Haifeng

    Guo, "DeepConvolutional Neural Networks for forest fire detection," in Proceedings of the 2016 International Forum on Management, Education and Information Technology Application, Atlantis Press, 2016.

3. Qi-xing ZHANG, Gao-hua LIN, Yong-ming ZHANG,

    Gao XU, Jin-junWANG, "Wildland forest fire smoke detection on Faster R-CNN using synthetic smoke images," 8th International Conference on Fire Science and Fire Protection Engineering(on the Development of Performancebased Fire Code), 2017.

4. Genovese, Angelo and Labati, Ruggero and Piuri, Vincenzo and

Scotti,Fabio, "Wildfire smoke detection using computational intelligence techniques," IEEE International Conference on Computational Intelligence for Measurement Systems and Applications Proceedings, 2011.

5. C. Yuan, Z. X. Liu, and Y. M. Zhang, "UAV-based forest fire detection and tracking using image processing techniques," in 2015 International Conference on Unmanned Aircraft Systems. IEEE, 2015, pp. 639–643.

6. C. Yuan, Z. X. Liu, and Y. M. Zhang, "Aerial images based forest fire detection for firefighting using optical remote sensing techniques and unmanned aerial vehicles," Journal of Intelligent & Robotic Systems, vol. 88,no. 2-4, pp. 635–654, 2017.

7. X. Z. Chunyu Yu, Zhibin Mei, "A real-time video fire flame and smokedetection algorithm," in Asia-Oceania Symposium on Fire Science and Technology, 2013.

8. YongMin Liu, YiMing Liu, HongLei Xu, Kok Lay Teo, "Forest firemonitoring, detection and decision making systems by wireless sensor network," IEEE Chinese Control And Decision Conference (CCDC), 2018.

9. Pulkit Chugh, Eric Tom Mathews, G. Barath Kumar, "Forest firedetection through UAV imagery using CNNs," unpublished.

10.A. Koubaa and B. Qureshi, "Dronetrack: Cloud-based real-time object