FOREST COMBUSTION RECOGNITION USING AI

Project Report

SMARTBRIDGE IN COLLABORATION WITH IBM

PROJECT BY

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INTRODUCTION:

Overview -

Forest fires are as old as the forests themselves. They pose a threat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the bio-diversity and the ecology and environment of a region. During summer, when there is no rain for months, the forests become littered with dry senescent leaves and twinges, which could burst into flames ignited by the slightest spark.
Forest fires are a major environmental issue, creating economic and ecological damage while endangering human lives. There are typically about 100,000 wildfires in the United States every year. Over 9 million acres of land have been destroyed due to treacherous wildfires. It is difficult to predict and detect Forest Fire in a sparsely populated forest area and it is more difficult if the prediction is done using ground-based methods like Camera or Video-Based approach. Satellites can be an important source of data prior to and also during the Fire due to its reliability and efficiency.

Purpose -

The major purpose of this project is to develop an accurate model to predict forest fires through images with help of deep learning methods of convolutional neural networks. This is mainly to erase the Human error which cannot be controlled.

LITERATURE SURVEY

Existing Problem:

The problem with forest fires is that the forests are usually remote, abandoned/unmanaged areas filled with trees, dry and parching wood, leaves, and so forth that act as a fuel source. These elements form a highly combustible material and represent the perfect context for initial-fire ignition and act as fuel for later stages of the fire. This is the deficiency that the present invention attempts to remedy, by means of detection of a forest fire at the very early stage, so as to enhance or ensure the chance to put it out before it has grown beyond control or causes any significant damage.

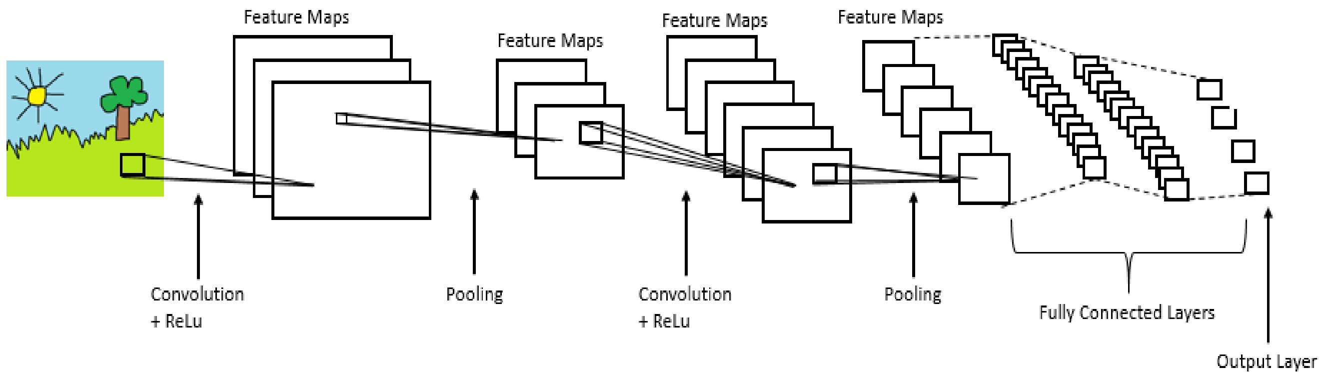
Proposed Solution:

The proposed Forest Fire Prediction model is based on neural networks(CNN) incorporated into an alert system.
There are a number of monitoring systems used by authorities. These include observers in the form of patrols or monitoring towers, aerial and satellite monitoring and increasingly promoted detection and monitoring systems based on optical camera sensors, and different types of detection sensors or their combination.
The developmental approach of the proposed system includes two modules:

- Forest Fire Identification: Identification of fire-affected areas.
- Forest Fire Management: Remedial measures for Forest Fire is all about detecting where the fire initiated in the forest.

THEORETICAL ANALYSIS:

BLOCK DIAGRAM:



HARDWARE/SOFTWARE DESIGNING

Hardware requirements:

- Laptop/Desktop
- Image Capturing Sensors
- Proper Network Connection

Software requirements:

- Python – 3.6
- Keras – 2.2.4
- Tensorflow – 1.13.0
- OpenCV
- Jupyter Notebook.

EXPERIMENTAL INVESTIGATIONS:

DATA COLLECTION

The data is labeled into two categories:

- Forestwithfire
- Normalforest

Total number of images - 399

The total number of images used as training data -319.

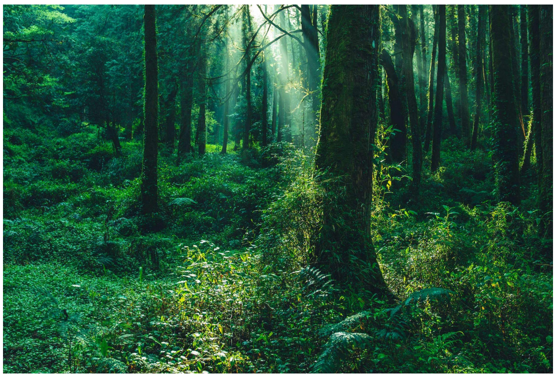
- No. of images for class Forestwithfire - 160
- No. of images for class Normalforest - 159

The total number of images used as test data -80

- No. of images for class Forestwithfire - 40
- No. of images for class Normalforest - 40

A sample of images used is shown in Figures.

Forestwithfire



Normalforest

DATA PREPROCESSING

In [11]:
```
from keras.preprocessing.image import ImageDataGenerator
train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
test_datagen=ImageDataGenerator(rescale=1./255)
```

ImageDataGenerator -a technique that can be used to artificially expand the size of a training dataset by creating modified versions of images in the dataset.

MODEL BUILDING:

The Libraries we imported are as follows:

```
#importing the libraries
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Convolution2D
from keras.layers import MaxPooling2D
from keras.layers import Flatten
import warnings
warnings.filterwarnings('ignore')
```

Every Keras model is either built using the Sequential class, which represents a linear stack of layers, or the functional Model class, which is more customizable. We'll be using the simpler Sequential model since our CNN will be a linear stack of layers.

```
model =Sequential()
```

```
WARNING:tensorflow:From C:\Users\DELL\Anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:74: The name tf.get_defau
lt_graph is deprecated. Please use tf.compat.v1.get_default_graph instead.
```

```
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
```

```
WARNING:tensorflow:From C:\Users\DELL\Anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:517: The name tf.placehol
der is deprecated. Please use tf.compat.v1.placeholder instead.

WARNING:tensorflow:From C:\Users\DELL\Anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:4138: The name tf.random_
uniform is deprecated. Please use tf.random.uniform instead.
```

```
model.add(MaxPooling2D(pool_size=(2,2)))
```

```
WARNING:tensorflow:From C:\Users\DELL\Anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:3976: The name tf.nn.max_
pool is deprecated. Please use tf.nn.max_pool2d instead.
```

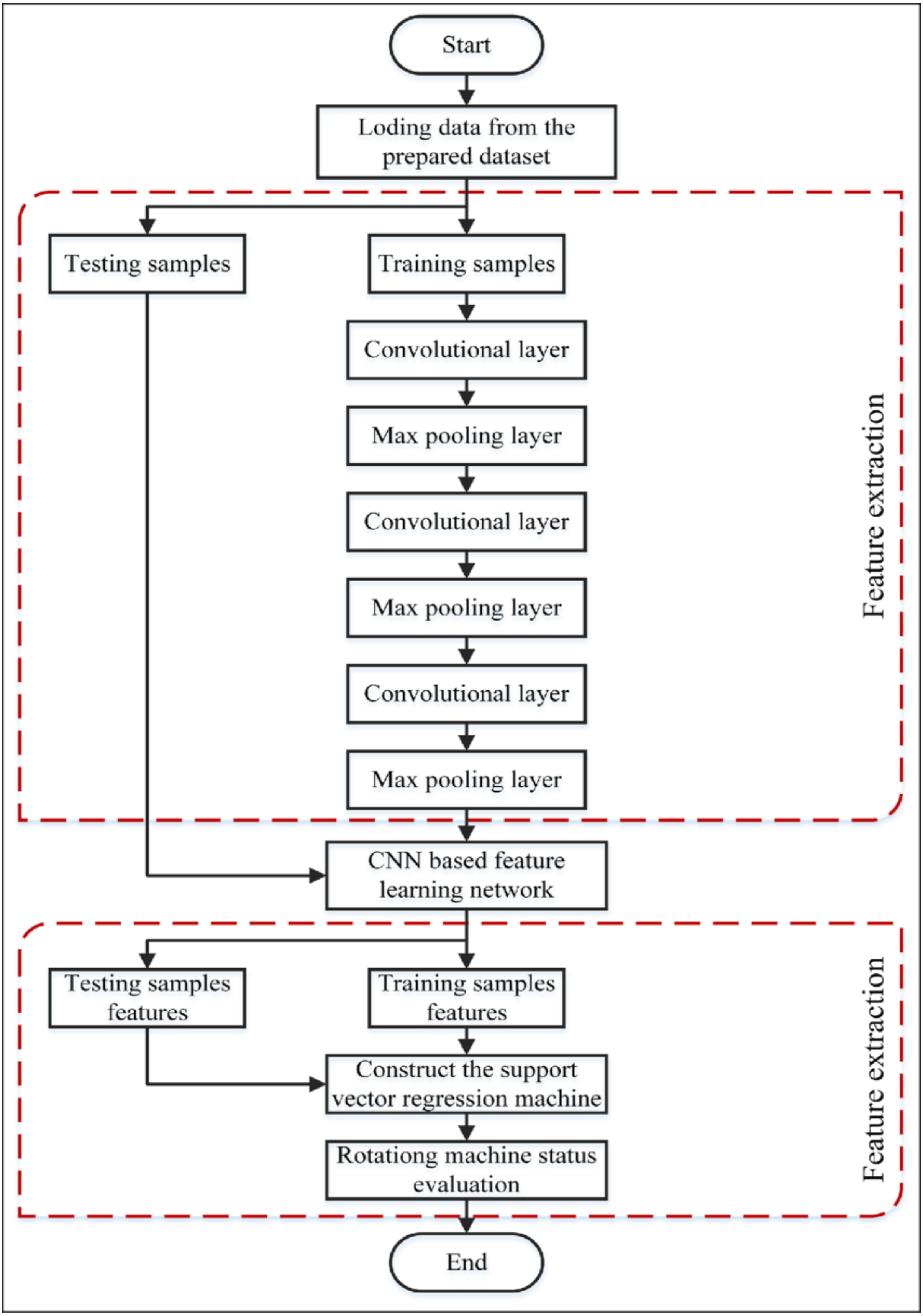
```
model.add(Flatten())
```

```
model.add(Dense(output_dim=150,init='uniform',activation='relu'))
```

```
model.add(Dense(output_dim=64,init='uniform',activation='relu'))
```

```
model.add(Dense(output_dim=1,activation='sigmoid',init='uniform'))
```

FLOWCHART



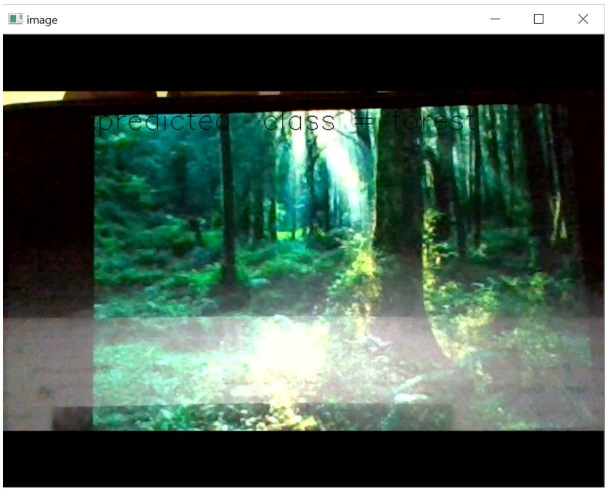
Start
Loding data from the prepared dataset
Testing samples
Training samples
Convolutional layer
Max pooling layer
Convolutional layer
Max pooling layer
Convolutional layer
Max pooling layer
Feature extraction
CNN based feature learning network
Testing samples features
Training samples features
Construct the support vector regression machine
Rotationg machine status evaluation
Feature extraction
End

<u>RESULT</u>

1) Forest on fire

In this case, an alert will be sent to the corresponding email address regarding the forest fire.

2) Normal Forest



In this case, no alert prompt will generate until a forest fire is detected.

ADVANTAGES

The advantages of vision-based fire detection techniques are listed here:
i) The fast response to fires.
ii) The location of the fire is sensed using this method, not just the radiation.
iii) The captured images can be analyzed and it can be used for future purposes and storage.
iv) It can be used for outdoor places which covers large area.
v) Early detection of fire can significantly shorten the reaction time and also reduce the potential damage as well as the cost of fire fighting

DISADVANTAGES

i) If the image capturing sensors or cameras are ground-based then the heat from the fire could damage the system.
ii) If the sensors or cameras are made to be heat resistant then the implementation cost will go up.
iii) In the case of the satellite-based system, the coverage of the area is not 24 x 7 and hence could create a delay in alerting.
iv) Since the accuracy of prediction is not 100% false-positive cases can be generated causing panic.

APPLICATIONS

Areas destroyed by these fires are large and produce more carbon monoxide than the overall automobile traffic.
Monitoring of the potential risk areas and early detection of fire can significantly shorten the reaction time and also reduce the potential damage as well as the cost of fire fighting

CONCLUSION

We would like to conclude by stating that in this project we developed an accurate model to predict forest fires through images with help of deep learning methods of convolutional neural networks. It aimed at performing a short-term estimation of forest fire risks to enhance the response time of existing forest fire prevention, detection, and monitoring systems. The objective is to detect the fire as fast as possible and its exact localization and early notification to the fire units is vital. This is the deficiency that the present invention attempts to remedy, by means of detection of a forest fire at the very early stage, so as to enhance or ensure the chance to put it out before it has grown beyond control or causes any significant damage.
The results can be further improved by doing the steps mentioned in the future scope of this project.

FUTURE SCOPE

1. The size of the dataset needs to be increased in order to provide better accuracy and reduce the risks of false alarms.

2. Including a variety of flora image sets so that the model does not gets confused between forest fires and the trees leaves with more red highlights.

3. Experimenting with more layers and neural networks to improve the result.

4. A mobile-based application can be developed for quick alerts.

5. The precision of results can be improved by incorporating the model with better sensors or cameras.

6. Adding a smoke detection system to this could develop a better model for completing the objective of the project

BIBLIOGRAPHY:

Keras.io

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