FOREST COMBUSTION RECOGNITION

An Internship Report submitted in partial fulfillment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY IN
COMPUTER SCIENCE AND ENGINEERING

Submitted by

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Under the esteemed guidance of

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DEPARTMENT OFCOMPUTER SCIENCE & ENGINEERING
GITAM
(Deemed to be University)
VISAKHAPATNAM
OCTOBER 2020

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING GITAM INSTITUTE OF TECHNOLOGY

GITAM

(Deemed to be University)

DECLARATION

We, hereby declare that the internship review entitled "**FOREST COMBUSTION RECOGNITION**" is an original work done in the Department of Computer Science and Engineering, GITAM Institute of Technology, GITAM (Deemed to be University) submitted in partial fulfillment of the requirements for the award of the degree of B.Tech. in Computer Science andEngineering.

The work has not been submitted to any other college or University for the award of any degree or diploma.

Date:

RegistrationNo.	**Name:**	**Signature**
121710314017	Daliboyina Sasank Yadav	D.SasankYadav

SMARTBRIDGE
Let's Bridge the Gap

Date: 22/05/2020

SB ID: SB20200056743

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Mr./Ms. Daliboyina Sasank Yadav** pursuing B.Tech in Computer Science Engineering from Gitam University Visakhapatnam, Visakhapatnam has successfully completed his/her Summer Internship from **22/11/2017** to **22/05/2020.**

During this period he/she had learned the concepts of **Machine Learning with Python & IBM Watson** and successfully completed a project **"Forest Combustion Recognition Using Ai".**

Refer the enclosed **Certificate of Merit** for his/her performance during the tenure of Internship.

We wish him/her all the best for his/her future endeavours.

For SmartBridge Educational Services Pvt. Ltd.,

SmartBridge Educational Services Pvt. Ltd. Hyderabad

Jayaprakash.ch,
Program Manager
RSIP-2020

SMARTBRIDGE
Let's Bridge the Gap

In collaboration with IBM

Certificate of Merit

This is to certify that **Mr./Ms. Daliboyina Sasank Yadav** has completed his/her internship program from **22/11/2017** to **22/05/2020** with **Machine Learning with Python & IBM Watson** as the specialization and secured a SKILL INDEX **9** of 10

Career Readiness Factor (CRF)

Evaluation Metrics: (on a scale of 1 to 4)

1 - Rarely/poorlydisplayscharacteristic

2 - Occasionally displays characteristic

3 - Frequentlydisplayscharacteristic

4 - Always displayscharacteristic

NA – Not Applicable

Motivation/Enthusiasm	4
Leadership Qualities	4
Flexibility towards work	4
Professionalism/Work Ethics	4
Self-Confidence	4
Ability to work independently	4
Oral/written communication	4
Problem solving skills	4
Over All Score	32

Date: 22/05/2020

Jayaprakash. ch

Program Manager (RSIP-2020)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING GITAM

INSTITUTE OF TECHNOLOGY

GITAM

(Deemed to be University)

CERTIFICATE

This is to certify that the internship report entitled "**FOREST COMBUSTION RECOGNITION**" is a bonafide record of work carried out by **Daliboyina Sasank Yadav(121710314017)** student submitted in partial fulfillment of requirement for the award of degree of Bachelors of Technology in Computer Science andEngineering.

SUPERVISOR

Mr.S.Ravi Kanth

Assistant Professor

INTERNSHIP REVIEWER-1

Mrs. Ravi Bhramaramba

Professor

INTERNSHIP REVIEWER-2

Mrs.Venkata Ramana Mancha

Assistant Professor

ACKNOWLEDGEMENT

I have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and organizations. I would like to extend my sincere thanks to all of them.

I am highly indebted to **Mr.S.Ravi Kanth** sir for his guidance and constant supervision as well as for providing necessary information regarding the project & also for his support in completing the project.

I would like to express my gratitude towards my parents & members of SmartBridge for their kind cooperation and encouragement which helped me in completion of this project.

I would like to express my special gratitude and thanks to industry persons for giving me such attention and time.

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CHAPTER 1: ABSTRACT

Forest fires importantly influence our environment and lives. The ability of accurately predicting the area that may be involved in a forest fire event may help in optimizing fire management efforts. Given the complexity of the task, powerful computational tools are needed for predicting the amount of area that will be burned during a forest fire. The purpose of this study was to develop an intelligent system based on genetic programming for the prediction of burned areas, using only data related to the forest under analysis and meteorological data.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.

CHAPTER 2: INTRODUCTION

Forest fires are well-known events, especially during summer. Forest fires, regularly experienced in regions with hot, dry, or mediterranean climates, represent a risk to life and extant infrastructure. In Portugal, there are typically between 15000 and 25000 forest fires each year (Mateus and Fernandes 2014), burning from 150 000 ha to 250 000 ha. Notwithstanding the fact that these fires can cause extensive economic damage (typically with tangible repercussions for many years to come), they also threaten human life. Furthermore, the aftermath of forest fires can have other far-reaching consequences. For example, many physical, chemical, mineralogical, and biological soil properties can be affected by forest fires (Certini 2005). Negative effects resulting from high levels of burn severity include significant removal of organic matter, deterioration of both soil structure and porosity, considerable loss of nutrients through volatilization, ash entrapment in smoke columns, leaching, and erosion.

CHAPTER 3: PROFILE OF THE COMPANY

SMARTBRIDGE is an edTech organization with a vision to bridge the gap between academia & industry. There outcome-based experiential learning programs on emerging technologies (Internet of Things, Machine Learning, Data Science, Artificial Intelligence, Robotics) are building skilled entry - level engineers, for the corporate world. SmartBridge is in mission to build technology communities in academia to encourage students towards innovation & entrepreneurship. Since inception, they have trained thousands of students, faculty and working professionals on emerging technologies via technical bootcamps, hackathons, Summer & Winter Internship Programs.

Following are the Services provided by them for Academia & Students

- Technology Bootcamps
- Hackathons
- Hands-on Training Programs
- Professional Development Programs
- Summer Practice Schools

CHAPTER 4: PROBLEM DEFINITION AND SOLUTION

PROBLEM:

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.

SOLUTION:

The proposed Forest Fire Prediction model is based neural networks(CNN) incorporated to an alert system. The developmental approach of the proposed system includes two modules:

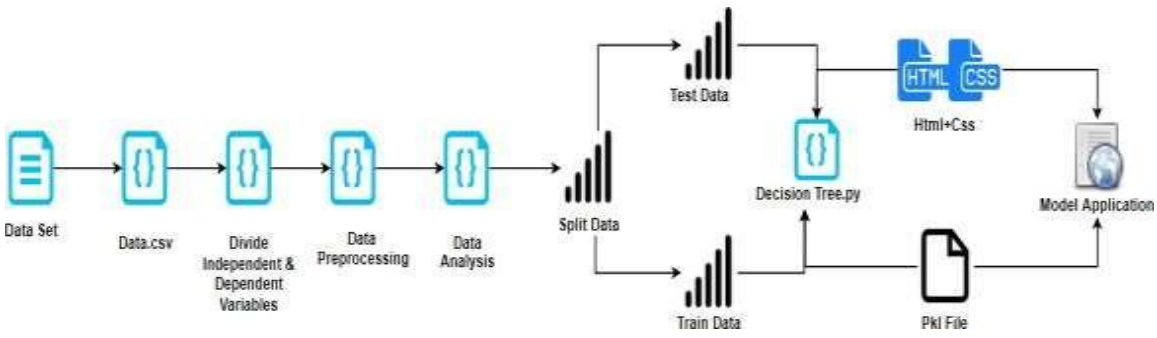
- **Forest Fire Identification:**Identification of fire affected areas.
- **Forest Fire Management:** Remedial measures for Forest Fire is all about detecting where the fire initiated in the forest.

CHAPTER 5: METHODOLOGY AND LEARNING

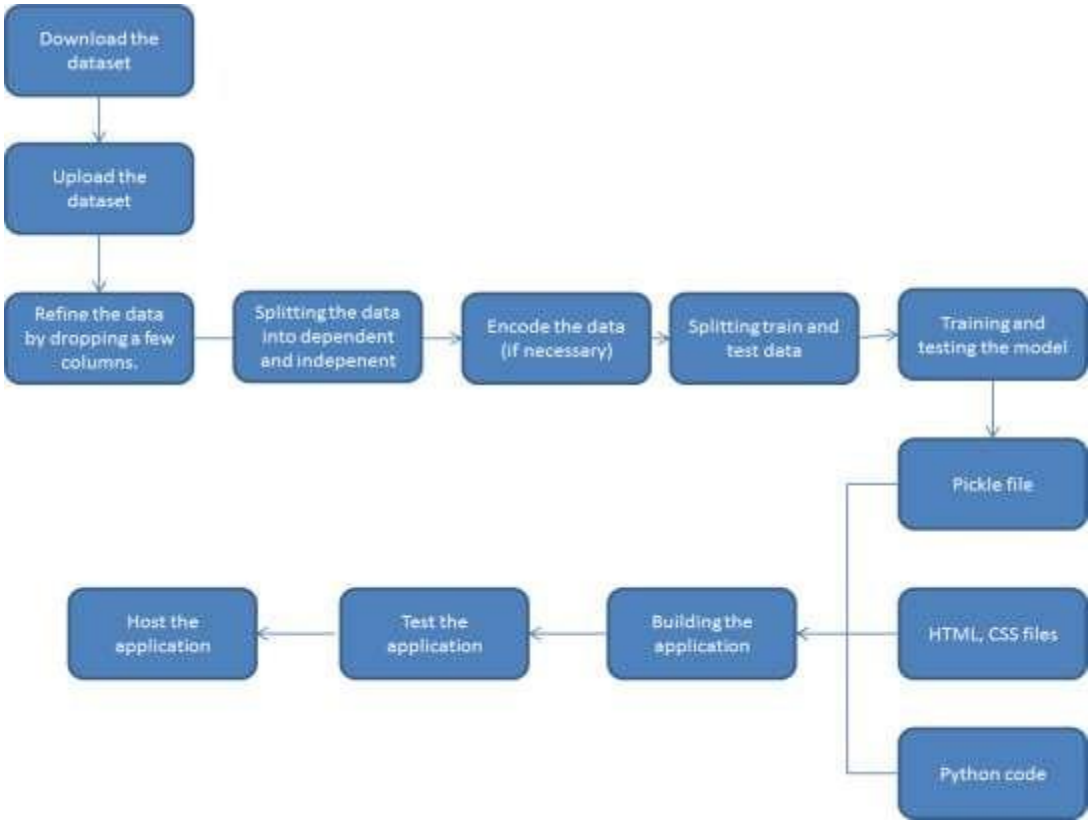
METHODS:

- Strategy: matching the problem with the solution.
- Data collection
- Dataset splitting into train data and test data.
- Dataset preparation and preprocessing
- Model Building
- OpenCV
- Mail Alert

Theoretical Analysis:



Flowchart



DATA COLLECTION: Data collection is the process of gathering and measuring information from countless different sources.

DATASET PREPERATION AND PREPROCESSING: Keras' ImageDataGenerator class to perform data augmentation has been used.

BUILDING CNN MODEL:

Steps to Build a Deep Learning Model

1. Defining the model architecture
2. Configure the learning process
3. Train The Model
4. Save the Model
5. Predictions

```
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Conv2D
from keras.layers import MaxPooling2D
from keras.layers import Flatten
```

```
Using TensorFlow backend.
```

```
model= Sequential()
```

```
model.add(Conv2D(32,3,3,input_shape=(64,64,3),activation='relu'))
```

```
/Users/avsuryanarayan/opt/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:1: UserWarning: Update your `Co
nv2D` call to the Keras 2 API: `Conv2D(32, (3, 3), input_shape=(64, 64, 3..., activation="relu")`
  """Entry point for launching an IPython kernel.
```

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

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

```
model.add(Dense(output_dim=128,activation='relu',init='random_uniform'))
```

```
/Users/avsuryanarayan/opt/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:1: UserWarning: Update your `De
nse` call to the Keras 2 API: `Dense(activation="relu", units=128, kernel_initializer="random_uniform")`
  """Entry point for launching an IPython kernel.
```

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

```
/Users/avsuryanarayan/opt/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:1: UserWarning: Update your `De
nse` call to the Keras 2 API: `Dense(activation="sigmoid", units=1, kernel_initializer="random_uniform")`
  """Entry point for launching an IPython kernel.
```

CONFIGURING THE LEARNING PROCESS:

This is accomplished with a call to the compile() method of the Sequential model class. Compilation requires 3 arguments: an optimizer, a loss function, and a list of metrics.

```
model.compile(optimizer='adam',loss='binary_crossentropy',metrics=['accuracy'])
```

TRAINING THE MODEL:

All that is left is to pass the data to the model for the training process to commence, a process which is completed by iterating on the training data.

```
model.fit_generator(x_train,samples_per_epoch=486,epochs=10,validation_data=x_test,nb_val_samples=210)
```

```
/Users/avsuryanarayan/opt/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:1: UserWarning: The semantics o
f the Keras 2 argument `steps_per_epoch` is not the same as the Keras 1 argument `samples_per_epoch`. `steps_per_epoc
h` is the number of batches to draw from the generator at each epoch. Basically steps_per_epoch = samples_per_epoch/b
atch_size. Similarly `nb_val_samples`->`validation_steps` and `val_samples`->`steps` arguments have changed. Update y
our method calls accordingly.
  """Entry point for launching an IPython kernel.
/Users/avsuryanarayan/opt/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:1: UserWarning: Update your `fi
t_generator` call to the Keras 2 API: `fit_generator(<keras.pre..., epochs=10, validation_data=<keras.pre..., steps_p
er_epoch=15, validation_steps=210)`
  """Entry point for launching an IPython kernel.

Epoch 1/10
15/15 [==============================] - 1311s 87s/step - loss: 0.5337 - accuracy: 0.7467 - val_loss: 0.2347 - val_ac
curacy: 0.8857
Epoch 2/10
15/15 [==============================] - 868s 58s/step - loss: 0.2656 - accuracy: 0.9009 - val_loss: 0.4359 - val_acc
uracy: 0.9048
Epoch 3/10
15/15 [==============================] - 888s 59s/step - loss: 0.2190 - accuracy: 0.9021 - val_loss: 0.1451 - val_acc
```

```
model.save('Forest_Forestfire_cnn.h5')
```

PREDICTION:

The last and final step is to make use of Saved model to do predictions.

```
In [31]: from keras.models import load_model
         import numpy as np

In [32]: !pip install opencv-python

         Requirement already satisfied: opencv-python in /Users/avsuryanarayan/opt/anaconda3/lib/python3.7/site-packages (4.2.
         0.34)
         Requirement already satisfied: numpy>=1.14.5 in /Users/avsuryanarayan/opt/anaconda3/lib/python3.7/site-packages (from
         opencv-python) (1.18.1)

In [41]: import cv2

In [43]: model=load_model('Forest_Forestfire_cnn.h5')

In [35]: from skimage.transform import resize

In [36]: def detect(frame):
             try:
                 img= resize(frame,(64,64))
                 img= np.expand_dims(img,axis=0)
                 if(np.max(img)>1):
                     img= img/255.0
                 prediction= model.predict(img)
                 print(prediction)
                 print(model.predict_classes(img))
             except AttributeError:
                 print("Shape not found")
```

OPENCV:

OpenCV is a cross-platform library using which we can develop real-time computer vision applications. It mainly focuses on image processing, video capture and analysis including features like face detection

```
In [15]: model.fit_generator(x_train,samples_per_epoch=486,epochs=10,validation_data=x_test,nb_val_samples=210)

         /Users/avsuryanarayan/opt/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:1: UserWarning: The semantics o
         f the Keras 2 argument `steps_per_epoch` is not the same as the Keras 1 argument `samples_per_epoch`. `steps_per_epoc
         h` is the number of batches to draw from the generator at each epoch. Basically steps_per_epoch = samples_per_epoch/b
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         t_generator` call to the Keras 2 API: `fit_generator(<keras.pre..., epochs=10, validation_data=<keras.pre..., steps_p
         er_epoch=15, validation_steps=210)`
           """Entry point for launching an IPython kernel.

         Epoch 1/10
         15/15 [==============================] - 1311s 87s/step - loss: 0.5337 - accuracy: 0.7467 - val_loss: 0.2347 - val_ac
         curacy: 0.8857
         Epoch 2/10
         15/15 [==============================] - 868s 58s/step - loss: 0.2656 - accuracy: 0.9009 - val_loss: 0.4359 - val_acc
         uracy: 0.9048
         Epoch 3/10
         15/15 [==============================] - 888s 59s/step - loss: 0.2190 - accuracy: 0.9021 - val_loss: 0.1451 - val_acc
```

MAIL ALERT:

Simple Mail Transfer Protocol (SMTP) is a protocol, which handles sending e-mail and routing e-mail between mail servers.

Python provides smtplib module, which defines an SMTP client session object that can be used to send mail to any Internet machine with an SMTP or ESMTP listener daemon.

```
2]: model=load_model('Forest_Forestfire_cnn.h5')

3]: img=image.load_img("/Users/avsuryanarayan/Downloads/Forest_Dataset/Test_set/Forestfire/images (14).jpeg",target_size=(6

4]: x=image.img_to_array(img)
    x=np.expand_dims(x,axis=0)

6]: import smtplib
    pred = model.predict_classes(x)
    if pred[0]==1:
        gmail_user = 'ghanasaichandan14737'   #email id without @gmail.com
        gmail_password = 'ghana2038'
        #email properties
        sent_from = gmail_user
        to = ['ghana2038@gmail.com']
        subject = 'Alert'
        email_text = """Alert for fallen detection"""
        server = smtplib.SMTP_SSL('smtp.gmail.com',465)
        server.ehlo()
        server.login(gmail_user, gmail_password)
        server.sendmail(sent_from, to, email_text)
        server.close()
        print ('Email sent!')

    Email sent!
```

ghanasaichandan14737@gmail.com
to

Alert for fallen detection

An SMTP object has an instance method called sendmail, which is typically used to do the work of mailing a message. It takes three parameters −

- The sender − A string with the address of the sender.
- The receivers − A list of strings, one for each recipient.
- The message − A message as a string formatted as specified in the various RFCs.

CHAPTER 6: CONCLUSION

RESULT:

Based on all the inputs and information entered by the user ,the model is built and predicts the forest fire combustion by giving an alert message to the user wherever present and so, could protect the forest.

ADVANTAGES AND DISADVANTAGES:

1. ADVANTAGES:

a) This model gives perfect prediction.

b) Accurate performance.

c) Alert when finds out a small fire.

d) Easy interface.

e) No ambiguity results.

f) Reduced heat and smoke damage. Significantly less heat and smoke will be generated when the fire is extinguished at an early stage.

2. DISADVANTAGES:

a) Preface idea on data processing, building apk required.

b) The already affected area can't be rebuilt/recover.

CONCLUSIONS:

The paper presented a forest fire risk prediction mechanism, based only on meteorological data and independent of any weather prediction mechanism. The results demonstrates the ability to predict forest fire risk with a limited amount of data and has shown that support vector machines can be used for a two-class prediction of fire risk with a very high accuracy of up to 92% for August as well as four classes prediction with a low error on the number of fires as well as on the predicted scale.

FUTURE SCOPE:

In the evolving population as population increases number of resources and protection to those should also increase. Waiting for firestation to come in a later our model predicts in a fast by alerting them before the situation gets worse.

CHAPTER 7: REFERENCES

REFERENCES:

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2. DATA PREPROCESSING USING CNN: (https://towardsdatascience.com/data-preprocessing-and-network-building-in-cnn-15624ef3a28b)
3. VIDEO PROCESSING USING OPENCV: (https://opencv.org/about/)
4. MESSAGE ALERT PREDICTION: (https://www.tutorialspoint.com/python/python_sending_email.htm)