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PROJECT REPORT ON

# Emotion Detection using OpenCV & Python

**COURSE : CSPC-204 MACHINE LEARNING**

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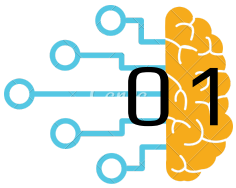
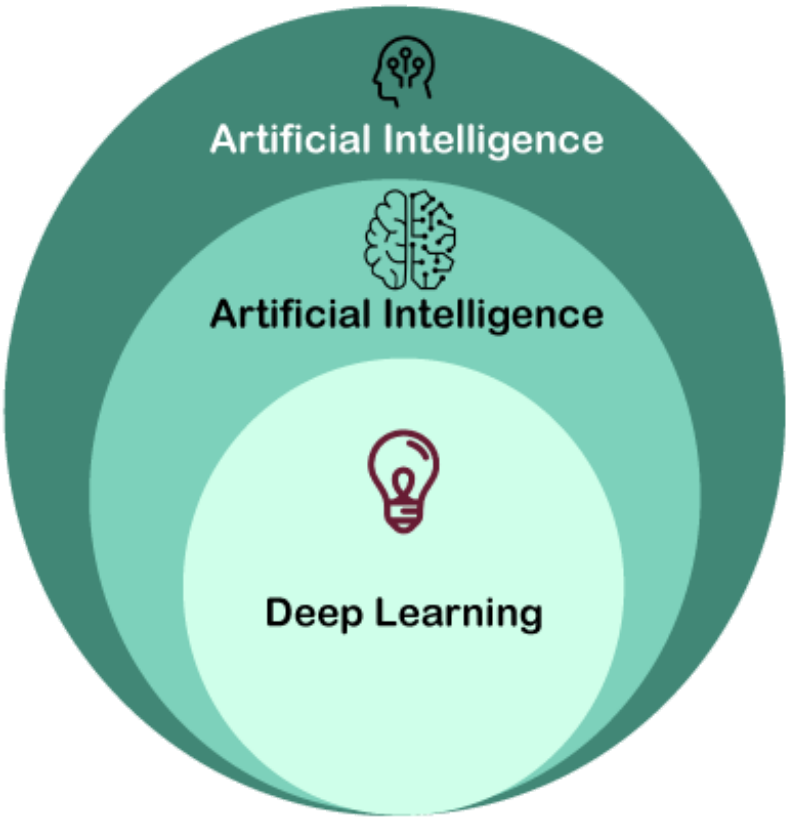



# 1.ABSTRACT

AUTOMATIC EMOTION RECOGNITION BASED ON FACIAL EXPRESSION IS AN INTERESTING RESEARCH FIELD, WHICH HAS PRESENTED AND APPLIED IN SEVERAL AREAS SUCH AS SAFETY, HEALTH AND IN HUMAN MACHINE INTERFACES. RESEARCHERS IN THIS FIELD ARE INTERESTED IN DEVELOPING TECHNIQUES TO INTERPRET, CODE FACIAL EXPRESSIONS AND EXTRACT THESE FEATURES IN ORDER TO HAVE A BETTER PREDICTION BY COMPUTER. WITH THE REMARKABLE SUCCESS OF DEEP LEARNING, THE DIFFERENT TYPES OF ARCHITECTURES OF THIS TECHNIQUE ARE EXPLOITED TO ACHIEVE A BETTER PERFORMANCE. THE PURPOSE OF THIS PAPER IS TO MAKE A STUDY ON RECENT WORKS ON AUTOMATIC FACIAL EMOTION RECOGNITION FER VIA DEEP LEARNING. WE UNDERLINE ON THESE CONTRIBUTIONS TREATED, THE ARCHITECTURE AND THE DATABASES USED AND WE PRESENT THE PROGRESS MADE BY COMPARING THE PROPOSED METHODS AND THE RESULTS OBTAINED. THE INTEREST OF THIS PAPER IS TO SERVE AND GUIDE RESEARCHERS BY REVIEW RECENT WORKS AND PROVIDING INSIGHTS TO MAKE IMPROVEMENTS TO THIS FIELD.

# 2.INTRODUCTION

MACHINE LEARNING AND DEEP LEARNING ARE THE TWO MAIN CONCEPTS OF DATA SCIENCE AND THE SUBSETS OF ARTIFICIAL INTELLIGENCE. MOST OF THE PEOPLE THINK THE MACHINE LEARNING, DEEP LEARNING, AND AS WELL AS ARTIFICIAL INTELLIGENCE AS THE SAME BUZZWORDS. BUT IN ACTUALITY, ALL THESE TERMS ARE DIFFERENT BUT RELATED TO EACH OTHER. HERE IS A BRIEF OVERVIEW OF ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND DEEP LEARNING.




**ARTIFICIAL INTELLIGENCE :** AL IS INTELLIGENCE DEMONSTRATED BY MACHINES, UNLIKE THE NATURAL INTELLIGENCE DISPLAYED BY HUMANS AND ANIMALS, WHICH INVOLVES CONSCIOUSNESS AND EMOTIONALITY.

**MACHINE LEARNING :** MACHINE LEARNING IS THE STUDY OF COMPUTER ALGORITHMS THAT IMPROVE AUTOMATICALLY THROUGH EXPERIENCE AND BY THE USE OF DATA. IT IS SEEN AS A PART OF ARTIFICIAL INTELLIGENCE.

**DEEP LEARNING :** DEEP LEARNING IS PART OF A BROADER FAMILY OF MACHINE LEARNING METHODS BASED ON ARTIFICIAL NEURAL NETWORKS WITH REPRESENTATION LEARNING. LEARNING CAN BE SUPERVISED, SEMI SUPERVISED OR UNSUPERVISED.

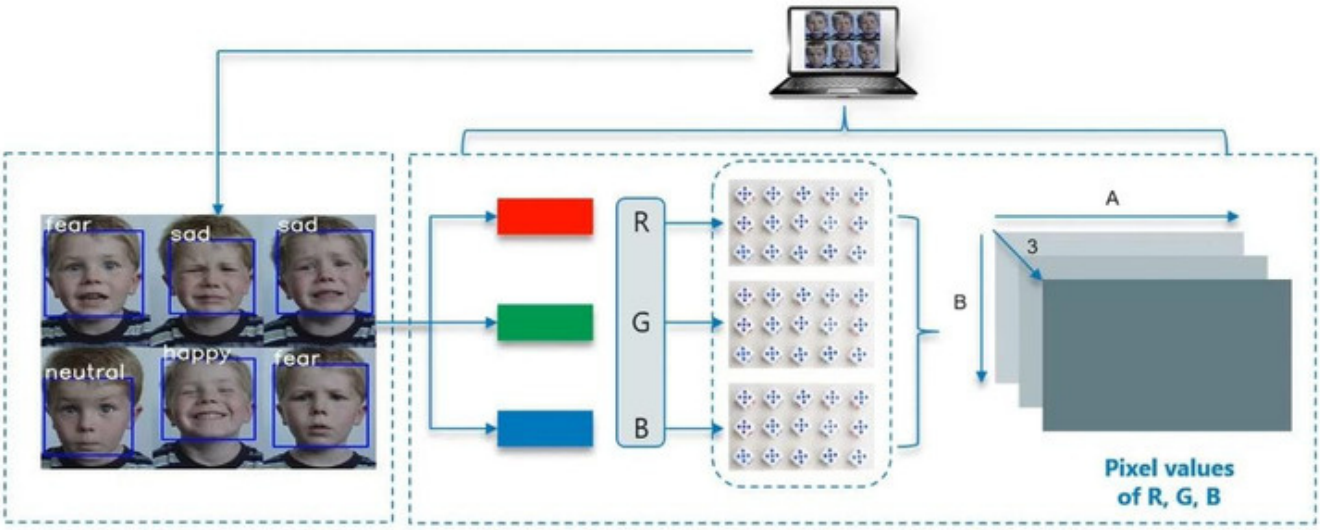
## IMAGE PROCESSING : AN OVERVIEW

IMAGE PROCESSING (IP) IS A COMPUTER TECHNOLOGY APPLIED TO IMAGES THAT HELPS US PROCESS, ANALYZE AND EXTRACT USEFUL INFORMATION FROM THEM.

IT IS AMONG RAPIDLY GROWING TECHNOLOGIES AND HAS EVOLVED WIDELY OVER THE YEARS. TODAY, SEVERAL COMPANIES AND ORGANIZATIONS OF DIFFERENT SECTORS USE IMAGE PROCESSING FOR SEVERAL APPLICATIONS SUCH AS VISUALIZATION, IMAGE INFORMATION EXTRACTION, PATTERN RECOGNITION, CLASSIFICATION, SEGMENTATION, AND MANY MORE!

PRIMARILY, THERE ARE TWO METHODS FOR IMAGE PROCESSING: ANALOGUE AND DIGITAL IMAGE PROCESSING. THE ANALOGUE IP METHOD IS APPLIED TO HARD COPIES LIKE SCANNED PHOTOS AND PRINTOUTS, AND THE OUTPUTS HERE ARE USUALLY IMAGES. IN COMPARISON, THE DIGITAL IP IS USED IN MANIPULATING DIGITAL IMAGES BY USING COMPUTERS; THE OUTPUTS HERE ARE USUALLY INFORMATION CONNECTED WITH THAT IMAGE, SUCH AS DATA ON FEATURES, CHARACTERISTICS, BOUNDING BOXES, OR MASKS.

AS DISCUSSED WITH MACHINE LEARNING AND DEEP LEARNING IMAGE PROCESSING TECHNIQUES CAN BECOME MORE POWERFUL



HERE ARE SOME FAMILIAR USE CASES THAT LEVERAGE ML IMAGE PROCESSING TECHNIQUES :

- **MEDICAL IMAGING / VISUALIZATION :** HELP MEDICAL PROFESSIONALS INTERPRET MEDICAL IMAGING AND DIAGNOSE ANOMALIES FASTER.
- **LAW ENFORCEMENT & SECURITY :** AID IN SURVEILLANCE & BIOMETRIC AUTHENTICATION.
- **SELF-DRIVING TECHNOLOGY :** ASSIST IN DETECTING OBJECTS AND MIMICKING HUMAN VISUAL CUES & INTERACTIONS.
- **GAMING :** IMPROVING AUGMENTED REALITY AND VIRTUAL REALITY GAMING EXPERIENCES.
- **IMAGE RESTORATION & SHARPENING :** IMPROVE THE QUALITY OF IMAGES OR ADD POPULAR FILTERS ETC.
- **PATTERN RECOGNITION :** CLASSIFY AND RECOGNIZE OBJECTS/PATTERNS IN IMAGES AND UNDERSTAND CONTEXTUAL INFORMATION.
- **IMAGE RETRIEVAL :** RECOGNIZE IMAGES FOR FASTER RETRIEVAL FROM LARGE DATASETS.

# 3. OUR PROJECT

THIS SECTION GIVES AN OVERVIEW OF OUR MINI PROJECT ON "EMOTION DETECTION USING OENCV & PYTHON".

## PYTHON LIBRARIES USED IN THE PROJECT

**OPENCV :** OPENCV IS AN OPEN-SOURCE LIBRARY FOR THE COMPUTER VISION. IT PROVIDES THE FACILITY TO THE MACHINE TO RECOGNIZE THE FACES OR OBJECTS.

**NUMPY :** NUMPY IS A LIBRARY FOR THE PYTHON PROGRAMMING LANGUAGE, ADDING SUPPORT FOR LARGE, MULTI-DIMENSIONAL ARRAYS AND MATRICES, ALONG WITH A LARGE COLLECTION OF HIGH-LEVEL MATHEMATICAL FUNCTIONS TO OPERATE ON THESE ARRAYS.

**PANDAS :** IT IS A SOFTWARE LIBRARY WRITTEN FOR THE PYTHON PROGRAMMING LANGUAGE FOR DATA MANIPULATION AND ANALYSIS.

**KERAS :** IT IS AN OPEN-SOURCE SOFTWARE LIBRARY THAT PROVIDES A PYTHON INTERFACE FOR ARTIFICIAL NEURAL NETWORKS.

## STEPS TAKEN FOR EXECUTION

- DOWNLOADING THE DATASET AND WRITING CODE FOR THE PROJECT.
- INSERTING THE DATASET IN PYTHON NOTEBOOK.
- INSTALLATING THE REQUIRED PACKAGES & RUNNING THE CODE IN PYTHON INTEGRATED ENVIRONMENT.
- INSERTING AN IMAGE AND CHECKING IF IT'S CORRECTLY DETECTING THE EMOTION.
- THEN RUNNING THE VIDEOTESTER.PY CODE IN VISUAL STUDIO CODE.
- THEN FINALLY DETECTING THE EMOTION THROUGH WEBCAM.

## UNDERSTANDING THE CODE THROUGH CODE SNIPPETS

### Import libraries

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

from keras.layers import Flatten, Dense
from keras.models import Model
from keras.preprocessing.image import ImageDataGenerator , img_to_array, load_img
from keras.applications.mobilenet import MobileNet, preprocess_input
from keras.losses import categorical_crossentropy
```

### Train and create model

```
# Train model

base_model = MobileNet( input_shape=(224,224,3), include_top= False )

for layer in base_model.layers:
  layer.trainable = False


x = Flatten()(base_model.output)
x = Dense(units=7 , activation='softmax' )(x)

# creating our model.
model = Model(base_model.input, x)
```

## Prepare data using data generator

```
train_datagen = ImageDataGenerator(
      zoom_range = 0.2,
      shear_range = 0.2,
      horizontal_flip=True,
      rescale = 1./255
)

train_data = train_datagen.flow_from_directory(directory= "/content/train",
                                               target_size=(224,224),
                                               batch_size=32,
                                              )


train_data.class_indices
```

## Visualize the data

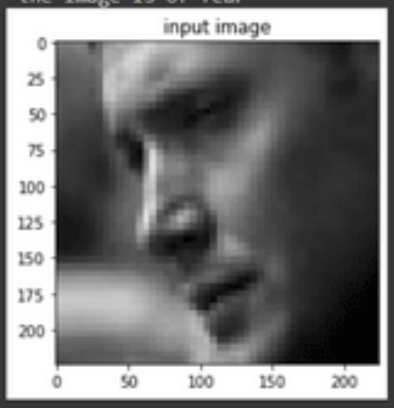
```
t_img , label = train_data.next()
def plotImages(img_arr, label):
  count = 0
  for im, l in zip(img_arr,label) :
    plt.imshow(im)
    plt.title(im.shape)
    plt.axis = False
    plt.show()

    count += 1
    if count == 10:
      break
plotImages(t_img, label)
```

## Test the data

```
path = "/content/test/angry/PrivateTest_1054527.jpg"
img = load_img(path, target_size=(224,224) )

i = img_to_array(img)/255
input_arr = np.array([i])
input_arr.shape

pred = np.argmax(model.predict(input_arr))

print(f" the image is of {op[pred]}")

plt.imshow(input_arr[0])
plt.title("input image")
plt.show()
```

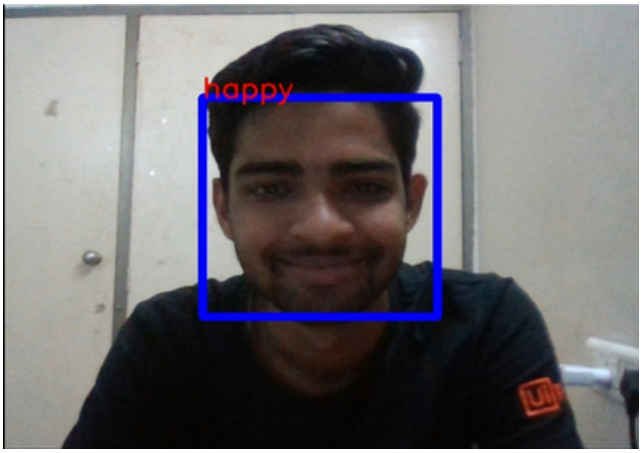
## Output

```
the image is of fear
```

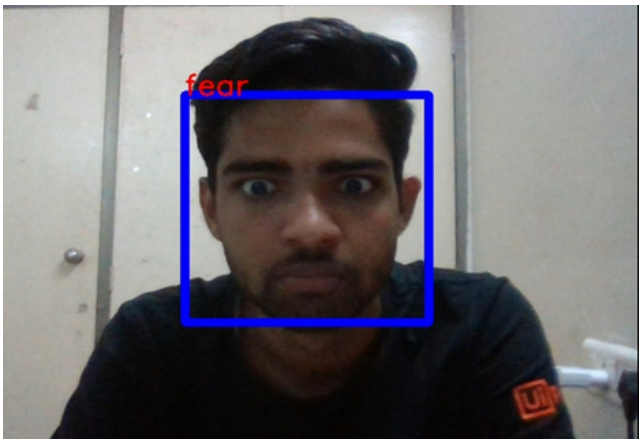


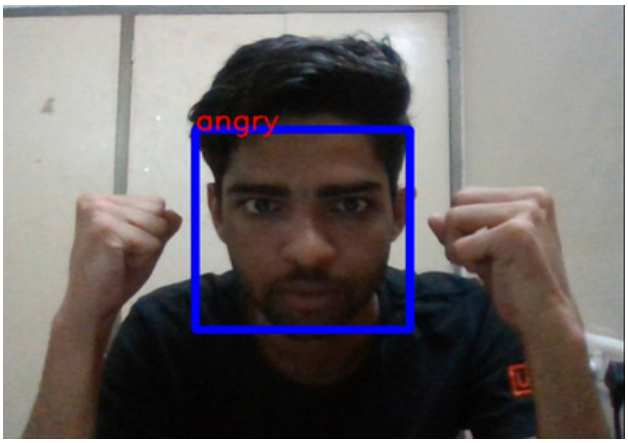
## DETECTING FACIAL EMOTIONS THROUGH WEBCAM

THE MODEL CREATED IS ABLE TO DETECT FACIAL EMOTIONS THROUGH WEBCAM WITH AN APPRECIABLE ACCURACY.







# 4.CONCLUSION

IN THIS PROJECT, WE SUCCESSFULLY IMPLEMENTED MODEL ON "EMOTION DETECTION USING OPENCV & PYTHON" FOR IDENTIFYING SEVEN FACIAL EMOTIONS - NEUTRAL, HAPPY, SAD, SURPRISE, FEAR AND ANGRY.

IN THE END, WE CONDUCTED A THOROUGH INVESTIGATION INTO THE EFFICACY OF THE TEST MODEL IN PREDICTING EMOTIONAL EXPRESSIONS AS DEPICTED IN FACIAL IMAGES. OUR RESULTS SUGGEST THAT THIS TEST MODEL CAN BE SUCCESSFUL IN RECOGNIZING HUMAN EMOTIONS IN FACIAL IMAGES.

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