Project Based Learning-II

(Guidelines and Work Book)

Course Code: 210258

(2019 Course)

Second Year Engineering

Year 2020 - 2021

Name of Student: K.Abhishek

Project Title : Face Mask Detector using Machine Learning

Name of Mentor: Archana Chaudhari

DEPARTMENT OF COMPUTER ENGINEERING

DR. D. Y. PATIL INSTITUTE OF TECHNOLOGY, PIMPRI, PUNE
SAVITRIBAI PHULE PUNE UNIVERSITY
2019 - 2020

Preamble

For better learning experience, along with traditional classroom teaching and laboratory learning; project based learning has been introduced with an objective to motivate students to learn by working in group cooperatively to solve a problem, Project-based Learning (PBL) is a student centric pedagogy that involves a dynamic classroom approach in which it is believed that students acquire a deeper knowledge through active exploration of real world challenges and problems. Students learn about a subject by working for an extended period of time to investigate and respond to a complex question, challenge or a problem. It is a style of active learning and inquiry-based learning.(Reference: Wikipedia). Problem based learning will also redefine the role of teacher as mentor in learning process. Along with communicating knowledge to students, often in a lecture setting, the teacher will also to act as an initiator and facilitator in the collaborative process of knowledge transfer and development.

This is a recommended workbook for PBL that will serve the purpose and facilitate the job of students, mentor and coordinator. This workbook will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken.

(For circulation at BoS Computer Engineering, Savitribai Phule Pune University only)

CERTIFICATE

This is to certify that **Mr. K.Abhishek** Group No.: **A4 - 2** Division **A** Branch **Computer Engineering** has successfully completed the work associated with **Project Based Learning II (210258**) titled as **Face Mask Detector using Machine Learning** and has submitted the workbook associated under my supervision, in the partial fulfillment of Second Year Bachelor of Engineering (Choice Based Credit System) (2019 course) of Savitribai Phule Pune University.

Date:
Place:

Guide	Head	Principal
(Name & Sign)	(Name & Sign)	(Name & Sign)

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1. Project Based Learning Syllabus:

Course Objectives:

1. To emphasize learning activities that is long-term, interdisciplinary and student-centric.
2. To inculcate independent learning by problem solving with social context.
3. To engages students in rich and authentic learning experiences.
4. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism

Course Outcomes:

CO1: Project based learning will increase their capacity and learning through shared cognition.
CO2: Students able to draw on lessons from several disciplines and apply them in a practical way.
CO3: Learning by doing approach in PBL will promote long-term retention of material and replicable skill, as well as improve teachers' and students' attitudes towards learning

Group Structure:

Working in supervisor/mentor – monitored groups. The students plan, manage and complete a task/project/activity which addresses the stated problem.

- There should be team/group of 5 -6students
- A supervisor/mentor teacher assigned to individual groups

Selection of Project/Problem:

The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem within an articulated interdisciplinary or subject frame. A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases .By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry. There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content and structure of the activity.

- A few hands-on activities that may or may not be multidisciplinary
- Use of technology in meaningful ways to help them investigate, collaborate, analyze, synthesize and present their learning.
- Activities may include-Solving real life problem, investigation /study and Writing reports of in depth study, field work.

Assessment:

The institution/head/mentor is committed to assessing and evaluating both student performance and program effectiveness. Progress of PBL is monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment AND evaluation the individual and team performance is to be measured. PBL is monitored and continuous assessment is done by supervisor/mentor and authorities. Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes.

Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

- Individual assessment for each student (Understanding individual capacity, role and involvement in the project)
- Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
- Documentation and presentation

Evaluation and Continuous Assessment:

It is recommended that the all activities are to be record and regularly, regular assessment of work to be done and proper documents are to be maintained at college end by both students as well as mentor (you may call it PBL work book).

Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department and institutes. Recommended parameters for assessment, evaluation and weightage:

- Idea Inception (5%)
- Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product (50%)(Individual assessment and team assessment)
- Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents) (25%)
- Demonstration (Presentation, User Interface, Usability etc) (10%)
- Contest Participation/ publication (5%)
- Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects (5%)

PBL workbook will serve the purpose and facilitate the job of students, mentor and project coordinator. This workbook will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken.

References:

- Project-Based Learning, Edutopia, March 14, 2016.
- What is PBL? Buck Institutes for Education
- www.schoology.com
- www.wikipedia.org
- www.howstuffworks.com

2. Recommended Guidelines and Phases:

PBL is learning through activity. One of the teachers can be appointed as coordinator for PBL. Following are the recommended guidelines that will work as an initiator and facilitator in process of completion of PBL.

1. In first week of commencement of 2nd semester or preferably at the end of first semester let the coordinator create awareness about PBL(what, why, and how) among the students. Convey students expected outcomes, assessment process and evaluation criteria.
2. Get groups of students registered preferably 4-6 students per group.
3. Assign mentor to each group.
4. Provide guidelines for title identification (Problem can be some real life situation that needs technology solutions. This situation can be identified by meeting people around, visiting various industries, society, and institutes. The solution can be prototype, model, convertible solutions, survey and analysis, simulation, and similar).
5. Let students submit the problem identified in prescribed format(Title, Problem statement, details of a problem undertaken, and what is need of solution to the problem)
6. Coordinator and mentor can approve the problem statements based on feasibility and learning outcomes expected for first year engineering students
7. Mentor is to monitor progress of the task during phases of project work. Broadly phases may include- requirements gathering, preparing a solution, technology design for the solution. (optional phases- implementation and testing)
8. Weekly monitoring and continuous assessment record is to be maintained by mentor.
9. Get the report submitted at the end of semester.

3. Project Information Sheet

Project ID	A4 - 2
Title	Face Mask Detector using Machine Learning
Problem Statement	Creating Face Mask Detector using Machine Learning for classification between person wearing a mask and not wearing a mask.
Name of Mentor	Archana Chaudhari

4. Continuous Assessment and Remarks Sheet

Problem Identification (Idea Inception) In public places, many people were not wearing a mask, so to identify them without any constant human supervision and making a beep sound, this software will help.
Problem Analysis (Requirement Gathering) A program is required for detecting faces with a mask and without a mask. Making beep sound whenever face with no mask is detected. Connecting program with a camera. Easy to use software for everyone. Solving minor dependency issues on its own, so that users won't have to tune it.
Proposed Solution Model/Design/Process/prototype TensorFlow (Python Library for Machine Learning) is used for detecting faces with a mask and without a mask. Making a beep sound whenever a face is detected without a mask. A software installer to make it easier for users to install and use the software.
Technology Solution Model Machine Learning, TensorFlow, Python, Advanced Installer, WordPress.
Expected Outcomes Software for detecting faces with and without a mask, which is easy to use.
Implementation and Testing Implemented using Python, TensorFlow. Testing was done for individual modules and then for integrated software in many different Windows 10 devices. Few dependency issues were identified and solved in an automated manner where the user won't have to deal with the issues.

5. Project Monitoring/ Progress Information Sheets

Week 1
Current Work phase of the project Initiating and Planning
Discussions Held The project title was decided. Features to be included in software were decided. The technology to be used in this project was decided. Software must be easy to use and correction of few minor issues should be automated.
Progress till Date The plan was made for making an easy to use software. The working of the software was roughly defined.

Week 2

Current Work phase of the project

Execution, Monitoring & Correcting

Discussions Held

It was decided that Python will be used for making Face Mask Detector Software. With the help of the TensorFlow Library, detection of faces became easier.
An automated checking will be done to know whether all dependencies were already installed or not. If not installed then the software will install it on its own. So that users won't have to deal with internal techy stuff.

Codes will be combined into one executable file using Advanced Installer Software.
Two versions will be made: Offline installer and Online Installer.
In Offline Installer, all dependent files are included.
In Online Installer, dependent files will be downloaded if not already installed.

Progress till Date

Software is user-friendly and easy to install.
Tested in various Windows 10 devices and all issues were resolved using an automated way so that if the issue arises in the future, it will be solved on its own.

Week 3
Current Work phase of the project Closure
Discussions Held Creating a website was decided for making software easy to access from anywhere, anytime. Few details about the software will be added to the website.
Progress till Date A website was created using WordPress. It is hosted on the internet for easy downloading of software anytime, anywhere. Details about the project are also shown on the website. Website Link: Face Mask Detector

7) Project Code

File: FMD_Runner.py [using pyinstaller library FMD_Runner.py is converted to FMD_Runner.exe, so that it can run without Python interpreter]

```
import os
os.system(".\Runner-Checker-Installer.bat")
```

File: Runner-Checker-Installer.bat

```
@echo off
TITLE "Face Mask Detector"

::for checking whether python is installed or not
reg query "hkcu\software\Python"
if ERRORLEVEL 1 (GOTO NOPYTHON) else (GOTO :YESPYTHON)

::installing python if python is not installed

:NOPYTHON

::checking architecture of device (32/64 bit)
echo "Python Not Insatlled.....Installing Python"
if %PROCESSOR_ARCHITECTURE%  == x86 (GOTO DownloadInstallPython32Bit) else (GOTO Downl
oadInstallPython64Bit)

:DownloadInstallPython32Bit
start python-32bit.exe

:LOOP
tasklist | find /i "PYTHON" >nul 2>&1
if ERRORLEVEL 1 (GOTO CONTINUE) else (
   echo "Installing Python"
   Timeout /T 5 /Nobreak
   GOTO LOOP
   )

:CONTINUE

echo n | copy /-y api-ms-win-core-path-l1-1-0.dll "C:/Windows/System32"
pip --version 2>NUL
if errorlevel 1 (python get-pip.py)
pip install -r requirements.txt
GOTO YESPYTHON

:DownloadInstallPython64Bit
start python-64bit.exe

:LOOP
tasklist | find /i "PYTHON" >nul 2>&1
if ERRORLEVEL 1 (GOTO CONTINUE) else (
   Timeout /T 5 /Nobreak
   GOTO LOOP
   )
```

```
:CONTINUE

echo n | copy /-y api-ms-win-core-path-l1-1-0.dll "C:/Windows/System32"
echo n | copy /-y api-ms-win-core-path-l1-1-0.dll "C:/Windows/SysWOW64"
pip --version 2>NUL
if errorlevel 1 (python get-pip.py)
pip install -r requirements.txt

GOTO YESPYTHON

:YESPYTHON
::Running FaceMaskDetector.py
pip --version 2>NUL
if errorlevel 1 (python get-pip.py)
pip install -r requirements.txt
cls
FaceMaskDetector.py
```

File: FaceMaskDetector.py

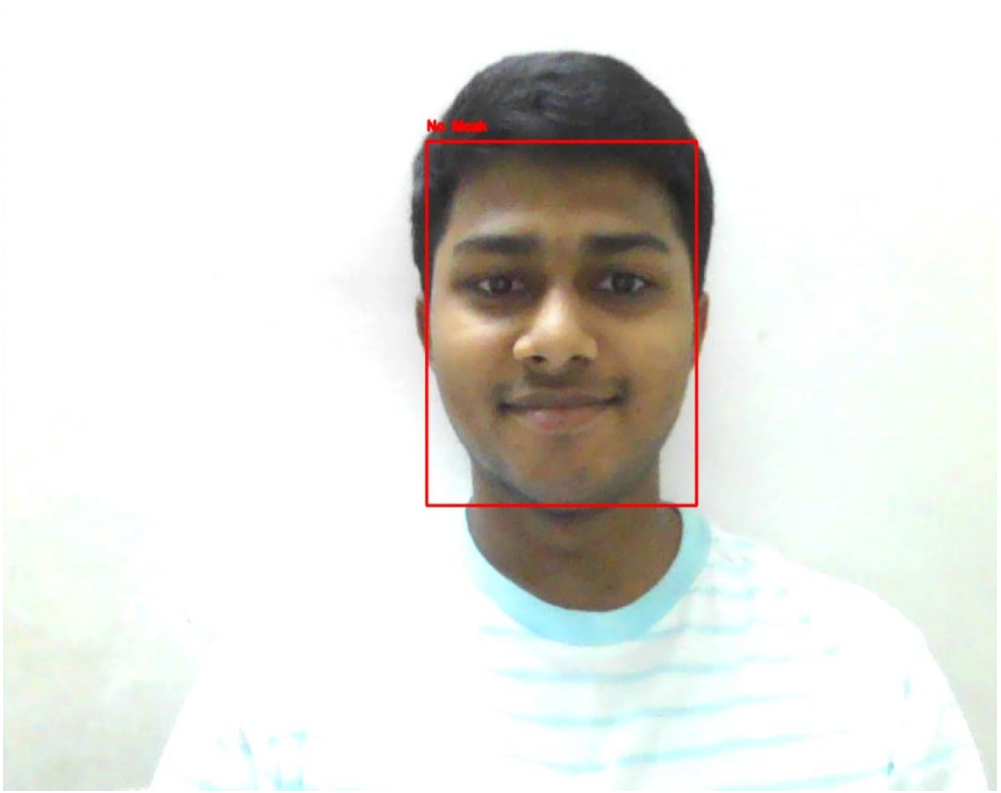
```
# importing necessary packages
from __future__ import print_function

import os
#for reducing unnecessary issue to those Devices which doesn't has GPU support
#hiding presence of GPU devices
os.environ["CUDA_VISIBLE_DEVICES"]="-1"

from tensorflow.keras.applications.mobilenet_v2 import preprocess_input
from tensorflow.keras.preprocessing.image import img_to_array
from tensorflow.keras.models import load_model
import tensorflow as tf
from imutils.video import VideoStream
import numpy as np
import imutils
import time
import cv2
import winsound
from PIL import Image
from PIL import ImageTk
import datetime
from win10toast import ToastNotifier

def detectAndPredictMask(frame, faceNet, maskNet):
    # grab the dimensions of the frame and then construct a blob from it
    (h, w) = frame.shape[:2]
    blob = cv2.dnn.blobFromImage(frame, 1.0, (224, 224),
        (104.0, 177.0, 123.0))

    # pass the blob through the network and obtain the face detections
    faceNet.setInput(blob)
    detections = faceNet.forward()
    print(detections.shape)
```

```
    # initialize our list of faces, their corresponding locations, and the list of predictions from our face mask n
etwork
    faces = []
    locs = []
    preds = []

    # loop over the detections
    for i in range(0, detections.shape[2]):
        # extract the confidence (i.e., probability) associated with the detection
        confidence = detections[0, 0, i, 2]

        # filter out weak detections by ensuring the confidence is greater than the minimum confidence
        if confidence > 0.5:
            # compute the (x, y)-coordinates of the bounding box for the object
            box = detections[0, 0, i, 3:7] * np.array([w, h, w, h])
            (startX, startY, endX, endY) = box.astype("int")

            # ensure the bounding boxes fall within the dimensions of the frame
            (startX, startY) = (max(0, startX), max(0, startY))
            (endX, endY) = (min(w - 1, endX), min(h - 1, endY))

            # extract the face ROI (Region Of Interest), convert it from BGR to RGB channel ordering, resize it t
o 224x224, and preprocess it
            face = frame[startY:endY, startX:endX]
            face = cv2.cvtColor(face, cv2.COLOR_BGR2RGB)
            face = cv2.resize(face, (224, 224))
            face = img_to_array(face)
            face = preprocess_input(face)

            # add the face and bounding boxes to their respective lists
            faces.append(face)
            locs.append((startX, startY, endX, endY))

    # only make a predictions if at least one face was detected
    if len(faces) > 0:
        # for faster inference we'll make batch predictions on *all* faces at the same time rather than one-by-
one predictions in the above `for` loop
        faces = np.array(faces, dtype="float32")
        preds = maskNet.predict(faces, batch_size=32)

    # return a 2-tuple of the face locations and their corresponding locations
    return (locs, preds)

# load our serialized face detector model from disk
prototxtPath = r"deploy.prototxt"
weightsPath = r"res10_300x300_ssd_iter_140000.caffemodel"
faceNet = cv2.dnn.readNet(prototxtPath, weightsPath)

# load the face mask detector model from disk
maskNet = load_model("mask_detector.model")

# initialize the video stream
print("[INFO] starting video stream...")
vs = VideoStream(src=0).start()

# display for Exit option
```

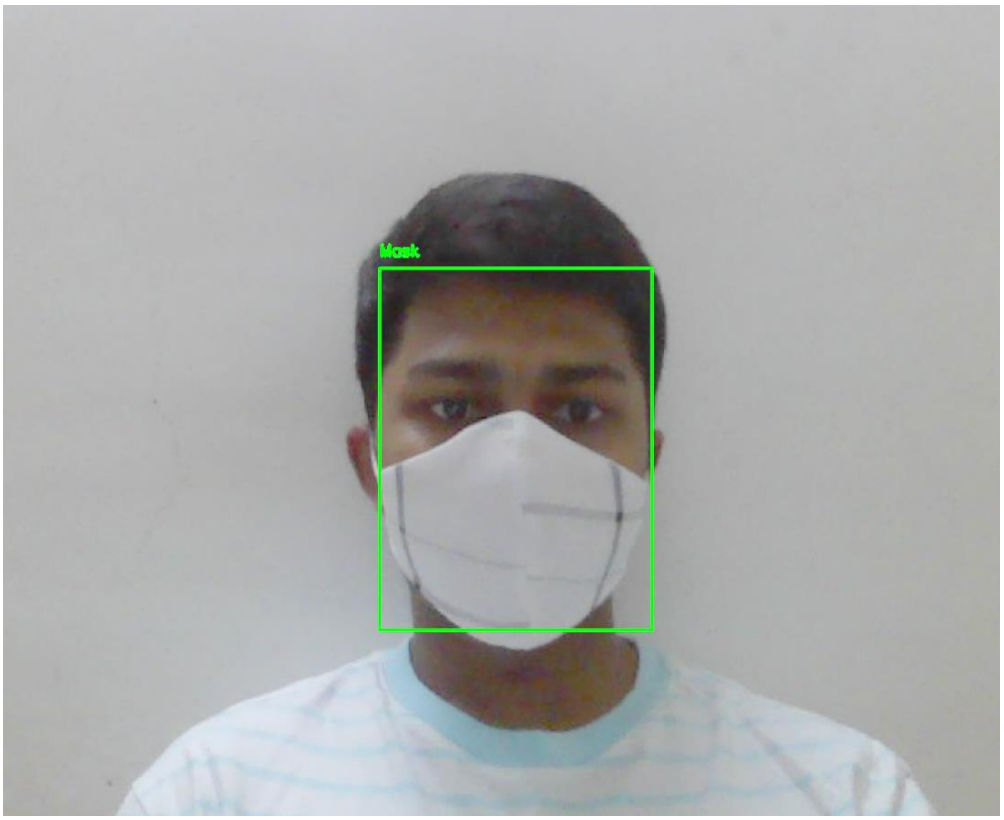
```
# create an object to ToastNotifier class
n = ToastNotifier()
n.show_toast("Face Mask Detector", "Press 'q' to Quit Application", duration = 1.5)

# loop over the frames from the video stream
while True:
    # grab the frame from the threaded video stream and resize it to have a maximum width of Max System
Width 1000
    frame = vs.read()
    frame = imutils.resize(frame, width=1000)

    # detect faces in the frame and determine if they are wearing a face mask or not
    (locs, preds) = detectAndPredictMask(frame, faceNet, maskNet)

    # loop over the detected face locations and their corresponding locations
    for (box, pred) in zip(locs, preds):
        # unpack the bounding box and predictions
        (startX, startY, endX, endY) = box
        (mask, withoutMask) = pred

        # determine the class label and color we'll use to draw the bounding box and text
        label = "Mask" if mask > withoutMask else "No Mask"
        color = (0, 255, 0) if label == "Mask" else (0, 0, 255)

        # display the label and bounding box rectangle on the output frame
        # in few devices winsound.Beep was not working properly and raising errors, to avoid that try-
except is used
        try:
            if label=="No Mask": winsound.Beep(2000,50)
        except :
            pass

        cv2.putText(frame, label, (startX, startY - 10),cv2.FONT_HERSHEY_SIMPLEX, 0.45, color, 2)
        cv2.rectangle(frame, (startX, startY), (endX, endY), color, 2)

    # show the output frame
    cv2.imshow("Face Mask Detector     : Press 'q' to Quit Application", frame)

    #cv2.waitKey(1) waits for up to 1 ms for a keypress and then checks if 'q' was pressed or not
    key = cv2.waitKey(1) & 0xFF

    # if the `q` key was pressed, break from the loop
    if key == ord("q"):
        break

# do a bit of cleanup
cv2.destroyAllWindows()
vs.stop()
```

Result

Website : [Face Mask Detector](www.facemaskdetector.ml) (www.facemaskdetector.ml)



No Mask



Mask