THAKUR DEGREE COLLEGE OF SCIENCE & COMMERCE

KANDIVALI (EAST)

MUMBAI

A

PROJECT REPORT

ON

Waste Classifier

BY:Rahul Prahalad Yadav

Submitted in partial fulfillment of

Bachelors Of Science (Computer Science)

[UNIVERSITY OF MUMBAI]

Thakur Degree College of Science and Commerce

KANDIVALI (EAST), MUMBAI

- ACADEMIC YEAR 2022- 2023

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NAAC Accredited Grade 'A' (3rd Cycle) & ISO 9001: 2015 (Certified)
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A PROJECT ON THE NEW BORN CHEF

A PROJECT SUBMITTED TO

THE UNIVERSITY OF MUMBAI FOR PARTIAL COMPLETION OF THE

DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

UNDER THE FACULTY OF SCIENCE

BY

Rahul Prahalad Yadav

UNDER THE GUIDANCE

OF

Mr.Girish Tere

THAKUR COLLEGE OF SCIENCE AND COMMERCE, KANDIVALI

(EAST) MUMBAI, MAHARASHTRA 400101

OCTOBER, 2022-2023

DECLARATION BY LEARNER

I the undersigned MR. Rahul Prahalad Yadav hereby, declare that the work embodied in

this project work titled "Waste Classifier" forms my own contribution to theresearch work carried out under the guidance of Prof. Girish Tere is a result of my own

research work and has not been previously submitted to any other University for any other Degree/Diploma to this or any other University.Wherever reference has been made to previous works of others, it has been clearly indicated as such and included in the bibliography.I, hereby further declare that all information of this document has been obtained and presentedin accordance with academic rules and ethical conduct.

Name and signature of learner

Rahul Prahalad Yadav

Certified By

Name and Signature of Guiding Teacher

Mr.Girish Tere

DATE:19THOCTOBER, 2022

COMPUTER DEPARTMENT

(2022-2023)

Certificate Of Approval

This is to certify that the project work entitled "Waste Classifier"is

prepared by Rahul yadav Chauhana student of "Third Year Bachelor Of Science

(Computer Science)" course of University of Mumbai, which is conducted by our college.

This is the original study work and important sources used have been duly

acknowledged in the report. The report is submitted in partial fulfillment of B.Sc. (Computer

Science) course as per rules of University of Mumbai.

GIRISH TERE — Project Guide

ASHISH TRIVEDI — Head of Department

External Examiner

TYCS SEM-
VI PROJECT
INDEX

ACKNOWLEDGEMENT

Achievement is finding out what you would be doing rather than what you have to do.

It is not until you undertake such a project that you realize how much effort and hard work it really is, what are your capabilities and how well you can present yourself or other things.

It gives me immense pleasure to present this report towards the fulfillment of my project.

It has been rightly said that we are built on the shoulder of others. For everything I have. achieved, the credit goes to all those who had helped me to complete this project successfully.

takethis opportunity to express my profound gratitude to management of Thakur Degree

College of Science&Commerce for giving me this opportunity to accomplish this project work.

I amvery much thankful to **Dr.Mrs. C. T. Chakraborty** – Principal of Thakur College for their

kind co-operation in the completion of my project. A special vote of thanks to my faculty,**Mr. Ashish Trivedi** who is our HOD &also our project

guide. **Girish Tere** for their most sincere, useful and encouraging contribution throughout the project span, without them we couldn't start and complete the project on time.

(Rahul Prahalad Yadav)

ORGANIZATIONAL OVERVIEW

Name : Thakur College Of Science & Commerce

Address : Thakur Village, Kandivali (East)
Mumbai – 400101

Contacts : 022-2846 2565 / 2887 0627

History :

- **Thakur Junior College was established in 1992, by the founding members.**
- **It was a natural augmentation by the Thakur Educational Trust.**
- **Thakur College had a humble beginning with only 57 students in FYJC first batch of Commerce stream.**
- **Our college has accomplished a spectacular growth over the last two decades.**
- **The college has consistently attained outstanding results in academics at both Degree & Junior levels.**

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```
import cvzone

from cvzone.ClassificationModule import
Classifierimportcv2
import os

cap = cv2.VideoCapture(0)

classifier = Classifier('Resources/Model/keras_model.h5',
'Resources/Model/labels.txt')
imgArrow =
cv2.imread('Resources/arrow.pn
g',
cv2.IMREAD_UNCHANGED)
classIDBin = 0
# Import all
```

```
the waste
images
imgWasteList
= []
pathFolderWaste =
"Resources/Waste"
pathList =
os.listdir(pathFolderWa
ste)

for path in pathList:

imgWasteList.append(cv2.imread(os.path.join(pathFol
derWaste,path), cv2.IMREAD_UNCHANGED))

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images
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[]
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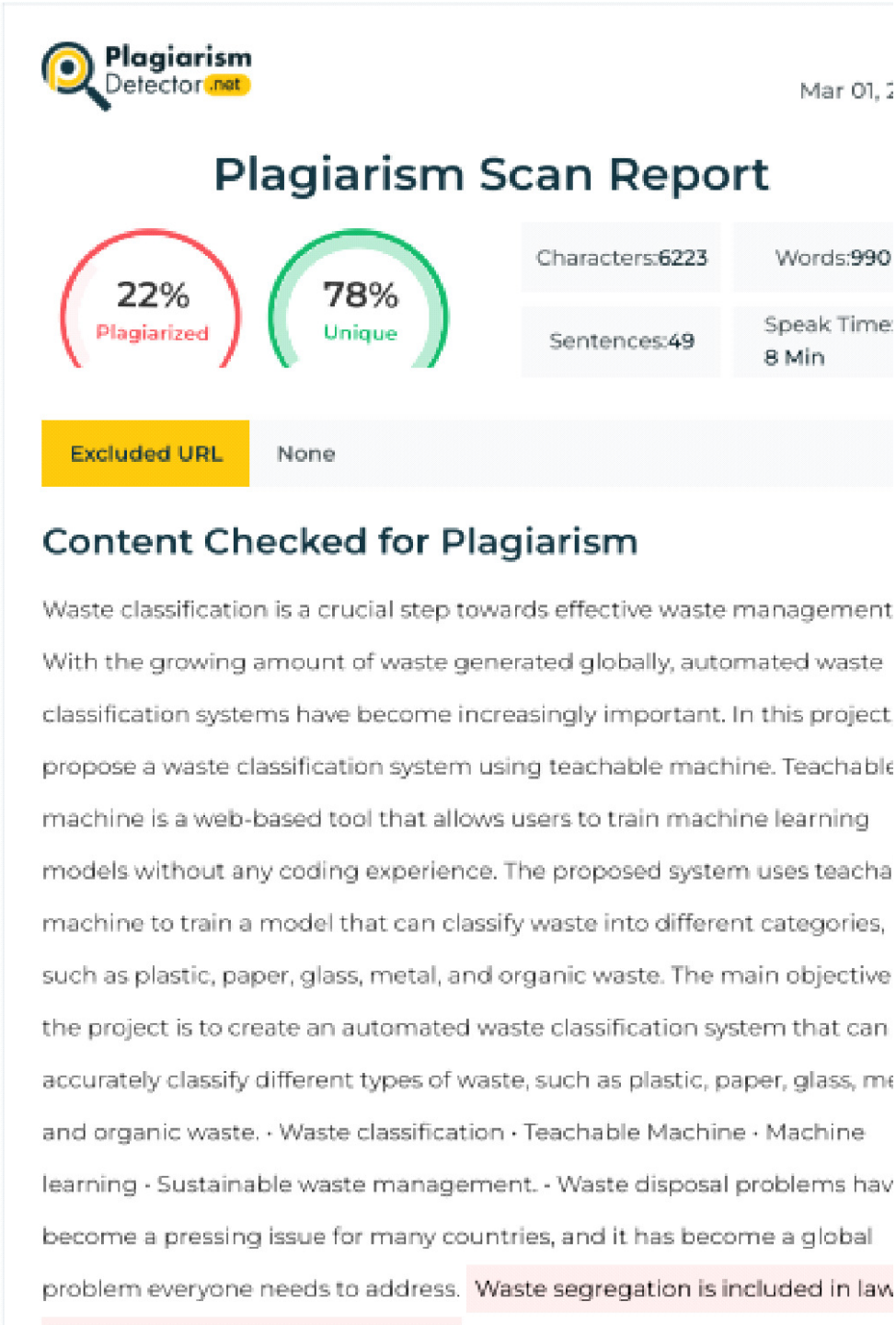
os.listdir(pathFolderBins)for
path in pathList:
   imgBinsList.append(cv2.imread(os.path.join(pathFo
lderBins,path), cv2.IMREAD_UNCHANGED))
```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Waste classification is a crucial step towards effective waste management
With the growing amount of waste generated globally, automated waste
classification systems have become increasingly important. In this project
propose a waste classification system using teachable machine. Teachable
machine is a web-based tool that allows users to train machine learning
models without any coding experience. The proposed system uses teacha
machine to train a model that can classify waste into different categories,
such as plastic, paper, glass, metal, and organic waste. The main objective
the project is to create an automated waste classification system that can
accurately classify different types of waste, such as plastic, paper, glass, me
and organic waste. · Waste classification · Teachable Machine · Machine
learning · Sustainable waste management. · Waste disposal problems hav
become a pressing issue for many countries, and it has become a global
problem everyone needs to address. Waste segregation is included in law

Waste

Classifier

- **Abstract and keywords:**

Abstract:

Waste classification is a crucial step towards effective waste management. With the growing amount of waste generated globally, automated waste classification systems have become increasingly important.

In this project, we propose a waste classification system using teachable machine. Teachable machine is a web-based tool that allows users to train machine learning models without any coding experience.

The proposed system uses teachable machine to train a model that can classify waste into different categories, such as plastic, paper, glass, metal, and organic waste.

The Waste Classifier Python Project is aimed at developing a machine learning-based waste classification system. The system takes an image of waste material as input and classifies it into different categories such as organic, recyclable, and non-recyclable waste. The project utilizes a Convolutional Neural Network (CNN) to extract features from the input image, which is then classified using a Support Vector Machine (SVM) algorithm.

The waste classifier model is trained on a large

dataset of waste images that have been labeled with their respective waste category. The dataset includes a wide range of waste materials and has been carefully curated to ensure that the classifier is accurate and reliable. The model's performance is evaluated using various metrics, including accuracy, precision, recall, and F1-score

The Waste Classifier Python Project has practical applications in waste management and recycling industries, where it can help to automate the waste sorting process. The system can also be

integrated with smart waste bins to enable automatic waste segregation, which can help to reduce the environmental impact of waste disposal. The project is implemented using Python programming language and various libraries such as TensorFlow, OpenCV, and scikit-learn.

The system can help in reducing the time and effort required for manual wastesorting and can contribute to a more sustainable waste management system.

The main objective of the project is to create an automated waste classificationsystem that can accurately classify different types of waste, such as plastic, paper, glass, metal, and organic waste.

Keywords:

- **Waste classification**

- **Teachable Machine**
- **Machine learning**
- **Sustainable waste management.**

Introduction

- Waste disposal problems have become a pressing issue for many countries, and it has become a global problem everyoneneeds to address.Waste segregation is included in law becauseit is much easier to recycle.Effective segregation of wastes means that less waste goes to landfill which makes it cheaper and better for people and the environment. It is also importantto segregate for public health.

- In recent times, garbage disposal has become a huge cause forconcern in the world. A voluminous amount of waste that is generated is disposedby means which have an adverse effect onthe environment.

- The common method of disposal of the waste is by unplanned and uncontrolled open dumping at the landfill sites.This method is injuriousto human health, plant and animal life. In India, rag pickers play an important role in the recycling of urban solid waste. Rag pickers and conservancy staff have higher morbidity due to skin infections, respiratory,

gastrointestinal tract and multisystem allergic disorders, in addition to a high prevalence of rodent, dog and other vermin bites.

- Dependency on the rag pickers can be diminished if segregation takesplace at the source of municipal waste generation. The purpose of this project is to design a model with low cost and user-friendly which segregates wet, dry andmetallic waste using suitable technique or method.

- Waste management refers to the collection, transportation, processing, and disposal of waste materials in a safe and environmentallyThere are various types of waste, including municipal solid waste, hazardous waste, biomedical waste, electronic waste, and construction and demolition waste. Eachtype of waste requires specific handling and disposal methodsto ensure its safe and proper management.

- Proper waste management is critical for maintaining publichealth and protecting the environment. The improper disposalof waste can lead to pollution of land, water, and air, which can have adverse effects on human health and the ecosystem.

- The processing of waste materials involves several methods,including incineration, landfilling, composting, and recycling.

Incineration is the process of burning waste materials at high temperatures to generate energy. Landfilling involves burying waste materials in designated landfill sites, where they are covered with soil to prevent contamination.

- Composting involves the biological breakdown of organic waste materials, such as food and garden waste, to produce nutrient-rich soil. Recycling involves the reprocessing of wastematerials to produce new products, such as paper, plastic, and glass.

- Effective waste management requires a collaborative effort from individuals, businesses, and governments. Individuals can contribute to waste reduction by practicing the three Rs: reduce, reuse, and recycle. This involves reducing the amountof waste produced, reusing items where possible, and recycling materials to conserve resources.

- Businesses can implement waste reduction and recycling programs, such as reducing packaging materials, using recycled products, and implementing sustainable waste management practicesGovernments can play a crucial role in waste management by implementing policies and regulations to ensure proper waste disposal and encouraging waste reduction and recycling. This can include the establishment ofwaste management facilities, implementing waste reduction programs, and enforcing environmental laws

and regulations.

- In conclusion, waste management is a critical issue thataffects public health and the environment. Proper waste management practices

• Problem Statement

- Waste disposal is a lengthy but methodical process that includes burial,burning, recycling, discharge, and other processes. Indeed, many organizations and localities in theworld are grappling with the problem, unable to handle it completely.

- The main reason behind the not proper waste managementis not separating different waste into different categories which lead to improper disposal. Putting electronic waste along with dry waste sometime cause fire in landfill area which result in heavy and air pollution. Keeping dry and wetwaste together produces bad smell and make it inseparable.

- Manual waste classification is a tedious and time- consuming process that can also be prone to human error. The improper segregation of waste materials can lead to environmental pollution and health hazards. To overcome these challenges, the Waste Classifier Python Project aims to develop a

machine learning-based waste classification systemthat can automate the waste sorting process and ensure properwaste management.

- The project aims to develop a waste classification system that can accurately classify waste materials into different categories, such as organic, recyclable, and non-recyclable waste. The system will utilize a Convolutional Neural Network (CNN) to extract features from the input image and classify it using a Support Vector Machine (SVM) algorithm.The waste classifier model will be trained on a large dataset of waste images that have been labeled with their respective waste category. The system will be implemented using Python programming language and various libraries such as TensorFlow, OpenCV, and scikit-learn.

- The project's objective is to develop a waste classificationsystem that can automate the waste sorting process and ensure proper waste management. The system can be integrated with smart waste bins to enable automatic waste

segregation, which can help to reduce the environmentalimpact of waste disposal.

- **Literature Review/Description of Present System**

- In the present time due to scheme launched by government ofIndia forcleaning called as Swachh bharat abhiyan people are taking steps toward it but due to lack of knowledge and guidance different waste are kept together.

- To reuse or dispose waste an additional steps are required toseparatethe waste which consume time and money. Some electronic waste become useless due to moisture and dirt when put together with wet waste and hence cannot be reutilize.

- The waste materials are manually sorted based on their appearance, texture, and smell, which can be subjective and lead to errors in waste classification. The workers sorting the waste are also exposed to health hazards such as dust, chemicals, and hazardous waste materials.

- After the manual sorting process, the waste materials areprocessed and disposed of according to their type and characteristics. The processing methods typically include incineration, landfilling, composting, and recycling.

- However, the present system of waste management faces several challenges such as inefficient waste sorting, improper waste disposal, and environmental pollution. These

challengeshighlight the need for an automated waste classification system that can ensure proper waste management and reduce the environmental impact of waste disposal.

- **Background /Limitations**

- Due to lack of knowledge and guidance people are unable to put waste in different categories such as wet waste , dry waste , electronic waste , etc. which lead problem in waste management and disposal. To solve thisproblem and reuse the waste to produce product and save the natural resources I introduced the waste segregation model which guide people toput different waste in different coloured boxes.

- Waste management is a critical issue that affects public health and the environment. The improper disposal of waste can lead to environmental pollution, health hazards, and the depletion of natural resources. To address these challenges, there has been a growing interest in the development of automated waste classification systems that can improvewaste management practices.

- Machine learning-based approaches have shown promise in automatingwaste classification. These approaches use computer vision techniques toanalyze waste images and classify them into different categories such as organic, recyclable, and non-recyclable waste.

- There are several limitations to the current state of waste classification technology. One of the main limitations is the lack of a standardized waste classification system, which can lead to inconsistencies in waste classification across different regions and countries. This can also limitthe

scalability and interoperability of waste classification systems.

- Another limitation is the availability of data. The development of machine learning-based waste classification systems requires a large amount of labeled waste images to train the models accurately. However, obtaining such a large dataset can be challenging, especially for rare or unique waste materials.

- Furthermore, the effectiveness of waste classification systems can be affected by the variability in waste materials, such as the size, shape, color, and texture of waste items. The systems may also struggle with classifying materials that are similar in appearance but belong to differentwaste categories.

- Despite these limitations, machine learning-based waste classification systems have shown promising results in automating waste sorting andreducing the environmental impact of waste disposal. Further research and development are needed to address the limitations and improve theaccuracy and efficiency of waste classification systems.

• Aim & Objectives

- To design and construct a low-cost Automatic Waste segregator. The main aim of the Waste Classifier Python Project is to develop a machinelearning-based waste classification system that can automate the waste sorting process and ensure proper waste management.

- The system will utilize computer vision techniques to analyze wasteimages and classify them into different categories such as organic, recyclable, and

non-recyclable waste.

- The system can be integrated with smart waste bins to enable automatic waste segregation, which can help to reduce the environmental impact ofwaste disposal.

- To fabricate a less complex Automatic Waste segregator.

- Use of camera and trained model to detect different waste.To save thenatural resources.

- Develop a waste classification system that can accuratelyclassify waste materials into different categories such as organic, recyclable, and non-recyclable waste.

- Utilize a Convolutional Neural Network (CNN) to extract features from the input image and classify it using a SupportVector Machine (SVM) algorithm.

- Train the waste classifier model on a large dataset of wasteimages that have been labeled with their respective waste category.

- Implement the waste classification system using Pythonprogramming language and various libraries such as TensorFlow, OpenCV, and scikit-learn.

• Project Motivation

- Saving the natural resource by recycling the

waste to producedifferentproduct out of it.

- Not only collecting waste but its management anddisposal is moreimportant.

- Effective segregation of wastes means that less waste goes to landfill which makes it cheaper and better for people and the environment. It is also important to segregate for public health.

- The motivation behind the Waste Classifier Python Project is to address the challenges and limitations of the present system of waste management. The current manual waste sorting process can be time-consuming, labor-intensive, and prone to errors, leading to inefficient waste management practices.

- The development of an automated waste classification system using machine learning techniques can improve waste management practices by enabling accurate and efficient waste sorting. The system can also help to reduce the environmental impact of waste disposal by promoting proper waste segregation and recycling.

- Moreover, the Waste Classifier Python Project can serve as a solution to the growing waste management challenges faced by communities worldwide. The project can be used in households, commercial establishments,

and waste processing facilities to automate waste sorting and improve waste management practices.

- The project's motivation is to contribute to sustainable waste management practices, reduce the negative impact of waste disposal on the environment.

• .Description of Proposed Work

- The proposed system “automatic waste segregator sorts wastes into different categories. Wet waste refers to organic waste such as vegetablepeels, left-over food etc. Separating waste is essential as the amount of waste being generated todaycauses immense problem.

- The proposed system would be able to detect different type ofwaste. The model is trained using teachable machine to detect the waste throughcamera and will point to different coloured box in which the waste shouldbe kept. green box for wet waste,blue box for dry waste ,etc.

- The proposed waste classification system is a machine learning-based system that utilizes computer vision techniques to automate the waste sorting process.

- The system can accurately classify waste materials into different categories such as organic, recyclable, and non-

recyclable waste.

- The system comprises three main components: image acquisition, image processing, and waste classification. The image acquisition component captures images of waste materials using a camera or other imaging devices.

- The images are then processed using computer vision techniques to extract features such as color, texture, and shape.The image processing component uses Convolutional Neural Networks (CNNs) to extract features from the input image. The CNN model can be pre-trained on a large dataset ofimages or trained from scratch on a smaller dataset of waste images.

- The trained model can then be fine-tuned using Transfer Learning techniques to improve its accuracy in classifyingwaste materials.

- Finally, the waste classification component uses a Support Vector Machine (SVM) algorithm to classify the waste material

  into different categories. The SVM algorithm uses the extractedfeatures from the input image to predict the waste category accurately.

- The waste category information can then be used to segregatewaste materials into different

waste bins, promoting proper waste management practices.

- The system can be implemented using Python programming language and various libraries such as TensorFlow, OpenCV, and scikit-learn. The system's performance can be evaluated using metrics such as accuracy, precision, recall, and F1 score.The system can be integrated with smart waste bins to enable automatic waste segregation and improve waste management practices.

- Overall, the proposed waste classification system can improve waste management practices by automating the waste sorting process and promoting proper waste segregation and recycling.

- The system can be used in households, commercial establishments, and waste processing facilities to promote sustainable waste management practices and reduce the negative impact of waste disposal on the environment.

- **Number of Modules**

There are 4 module.

- is an open-source computer vision library that providesa collection of useful functions and tools to help with image and

video processing tasks. It is built on top of the OpenCV library and provides additional functionality, such as object tracking, image processing, anduser interface tools.

- is a module within the

library that

Clas

provides tools for building and training machine learning models forimage classification tasks. In this code, the**sifier** class is used from this module to load a pre-trained Keras model and associated label file,which are then used to classify images of waste.

- is a Python module that provides an interface to the OpenCV library,which is a widely used computer vision library.It provides functions andtools for image and video processing, including reading and writing image and video files, applying filters and transformations to images, anddrawing shapes and text on images.

- **os**
- **os.p**
  - is a Python module that provides a way to interact with the operatingsystem. In this code, themodule is used to read in images of waste and bins from local directories, using the**ath** module to construct file paths. The**os.listdir** function is used to obtain a list of file

names in adirectory, which are then used to load the images into memory
using thefunction.

Additional modules may be added to expand the functionalityandcapabilities of the system.

- **Algorithm**

  - The class from the module is used to load the pre-trainedmodel and associated label file, and the function is used to get the predicted class for a given input.

  - The algorithm used in the above code is a pre-trained deep learning algorithm for image classification. Specifically, the code loads a pre- trained Keras modelfrom a file, which has been trained using a deep neuralnetwork architecture, and uses it to classify images of waste into three classes: Recyclable, Hazardous, and Food.

  - image. The predicted class is then used to overlay the corresponding waste image onto a background image, along with an arrow image, and display the result.

- Additionally, a dictionary (classDic) is used to map thepredicted waste classes to corresponding bin classes, which are then used to overlay the corresponding bin image onto the background image.

- The SVM algorithm works by creating a hyperplane that separates the different classes of waste materials. The hyperplane is optimized to maximize the margin betweenthe different classes of waste materials, which helps to improve the classifier's accuracy.

- Overall, the combination of CNN and SVM algorithmsprovides an accurate and efficient method for waste classification. The CNN algorithm extracts the featuresfrom the input image, while the SVM algorithm uses these features to predict the waste category accurately.

3.3 Working:

This project is designed to classify images of waste into threeclasses -Recyclable, Hazardous, and Food - and to display an image of the corresponding waste item, along with an arrow pointing to the appropriate bin for disposal.

The code uses a pre-trained deep learning algorithm for

image classification, which has been trained using a Keras model and associatedlabel file.

- ed,

os.

First, the necessary modules are import including **cvzone**, d **cvzone.ClassificationModule**, **cv2**, an

class is initialized with the path to the pre-trained Keras model file (**keras_model.h5**) and the label file (**labels.txt**),which specify the architecture of the deep neural network and the classes it was trained to recognize.

- **cv2.imread**

The images of waste and bins are lo aded into memory using thefunction and stored in lists (**imgWasteList** and **imgBinsList**, respectively). The images are stored as transparent PNGs, so that they can be easily overlaid onto abackground image.

A dictionary (**classDic**) is defined to map the predicted waste classes to corresponding bin classes. This is used later

to determinewhich bin image to display on the outputimage.

get

A loop is started to capture frames from the user's webcam (orother video source). For each frame, the**Prediction**function of

ier

the **Classif**class is called to get the predicted waste class for the

ed to inp
input image. The input image is resiztrained Keras model.

t size of the pre-

If the predicted waste class is not **0** (i.e., if a waste

cv

item is detected), an arrow image is overlaid onto a background image corresponding waste image is also overlaid onto the background

Dic

image, and the **class** dictionary is used to determine which bin image to display. The resulting image is then displayed in a newwindow (**Output**).

The loop continues until the user exits the program bypressing akey.

cvzone

Overall, the code uses a pre-trained deep learning algorithm forimage classification to detect waste items and display the corresponding images of the waste itemand bin. The library is used to handle the overlaying of the images onto abackground image, which is then displayed to the user.

Design/Block diagram/flow chart/graph/deployment Diagram/Architectural Design.

Block diagram

Flow chart

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Waste classification is a crucial step towards effective waste management. With the growing amount of waste generated globally, automated waste classification systems have become increasingly important. In this project, we propose a waste classification system using teachable machine. Teachable machine is a web-based tool that allows users to train machine learning models without any coding experience. The proposed system uses teachable machine to train a model that can classify waste into different categories, such as plastic, paper, glass, metal, and organic waste. The main objective of the project is to create an automated waste classification system that can accurately classify different types of waste, such as plastic, paper, glass, metal, and organic waste. · Waste classification · Teachable Machine · Machine learning · Sustainable waste management. · Waste disposal problems have become a pressing issue for many countries, and it has become a global problem everyone needs to address. Waste segregation is included in law

- **Code:**

```
import cvzone

from cvzone.ClassificationModule import
Classifierimportcv2
import os

cap = cv2.VideoCapture(0)

classifier = Classifier('Resources/Model/keras_model.h5',
'Resources/Model/labels.txt')
imgArrow =
cv2.imread('Resources/arrow.pn
g',
cv2.IMREAD_UNCHANGED)
classIDBin = 0
# Import all
the waste
images
imgWasteList
= []
pathFolderWaste =
"Resources/Waste"
pathList =
os.listdir(pathFolderWa
ste)

for path in pathList:

imgWasteList.append(cv2.imread(os.path.join(pathFol
derWaste,path), cv2.IMREAD_UNCHANGED))

# Import all
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images
```

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imgBinsList =
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pathFolderBins =
"Resources/Bins" pathList =
os.listdir(pathFolderBins)for
path in pathList:
   imgBinsList.append(cv2.imread(os.path.join(pathFo
lderBins,path), cv2.IMREAD_UNCHANGED))


        # 0 = Recyclable # 1
        =
        H
        a
        z
        a
        r
        d
        o
        u
        s
        #
        2
        =
        F
        o
        o
        d

classDic = {
        1: 1,
                2: 2,
                3: 2,
                4: 2,
```

```
        5: 1,
        6: 0,
        7: 0,
        8: 0,
        9: 0,
        10: 0,
        11: 0,
        12: 0,
        13: 0,

        14: 1}


    while True:
        _, img = cap.read()
        imgResize = cv2.resize(img, (550, 300))


        imgBackground =

        cv2.imread('Resources/background.png')

        predection =classifier.getPrediction(img)

        classID
        =
        predecti
        on[1]
        print(cla
        ssID)


if classID != 0:
```

```
        imgBackground

        =
cvzone.overlayPNG(imgBackground,
imgWasteList[classID - 1], (909,
        127))imgBackground =
cvzone.overlayPNG(imgBackground,imgArrow, (978,
320))

        classIDBin =

    classDic[classID]

    imgBackground =
cvzone.overlayPNG(imgBackground,
imgBinsList[classIDBin], (895, 374))

    imgBackground[148:148 + 300, 159:159 + 550] =
    imgResize# Displays
            # cv2.imshow("Image", img)
            cv2.imshow("Output",imgBackground)
            cv2.waitKey(1)
```

- **Screen Layouts**


WASTE CLASSFIER
Recyclable
Waste
zone


Output
WASTE CLASSFIER
Battery
Hazardous
Waste
zone

- **Technology/Language/Development Tools/Hardware**

- Language: python
- Development tools: Pycharm
- Hardware: Laptop

- **Conclusion & Future Scope**

  - The conclusions of the project review work are as follows:
  - The amount of waste, which is been recycled or reused,stands forthe reduction of waste to be managed by the authority.
  - In future we can attach the motor to the bin so after detecting thewaste appropriate bin automatically get opened and also attach sensor that indicate the status ofbin either it is full of empty.
  - The project has several potential future scope areas. Onearea of improvement could be to train a custom model on a larger dataset to improve the accuracy of

waste classification. Additionally, the project could be extended to include more waste categories and corresponding bin images.

- Another area of improvement could be to integrate the project with a robotic arm to pick up and dispose of thewaste items automatically.

- Overall, the above project serves as a proof-of-conceptfor using machine learning to classify waste items and can be extended to create practical solutions to the problem of waste management.

- The system can be used in households, commercial establishments, and waste processing facilities to improve waste management practices and reduce the negative impact of waste disposal on the environment.

- The system's accuracy and efficiency can be evaluated using various metrics, such as accuracy, precision, recall, and F1 score.

- The Waste Classifier Python Project has the potential tobe extended to incorporate other waste management practices. For example, the system can be used to track waste generation patterns, optimize waste

collection routes, and monitor waste processing activities. The system can also be integrated with IoT devices to enable real-time monitoring and data analysis.

- Moreover, the system's accuracy and efficiency can be further improved by using more advanced machine learning algorithms, such as Deep Learning algorithms, and by increasing the size of the training dataset. The system's performance can also be enhanced by using more sophisticated imaging techniques, such as hyperspectral imaging, to extract more comprehensive features from the waste images.

- Overall, the Waste Classifier Python Project has significant potential for improving waste management practices and promoting a cleaner and healthier environment. The project's success can inspire other similar projects aimed at addressing environmental challenges and promoting sustainable development practices.

- **References /Resource Material / Data Collection**

Reference:

https://www.computervision.zone/projects/
https://chat.openai.com/chat

Resource material and data collection: