PROJECT

INTELLIGENT GARBAGE CLASSIFICATION

MITHIL DAMULURI – TEAM LEADER

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Team Id: **LTVIP2023TMID03279**

Category: Artificial Intelligence

INTRODUCTION

Project Overview

- Problem: The problem of garbage classification is a challenging one, as there are many different types of garbage, and they can often be difficult to distinguish from one another. This can lead to problems in waste management, as garbage that is not properly sorted can contaminate other types of garbage, making it difficult to recycle or compost.
- Solution: Deep learning can be used to solve the problem of garbage classification. Deep learning models can be trained to identify different types of garbage based on their visual appearance. This can be done by feeding the model a large dataset of images of garbage, along with the labels for each type of garbage. Once the model is trained, it can be used to classify new images of garbage with high accuracy.
- Implementation: The project would be implemented using the following steps:
    - Collect a dataset of images of garbage. The dataset should include images of all of the different types of garbage that the model will be expected to classify.
    - Label the images in the dataset. The labels for each image should indicate the type of garbage that is shown in the image.

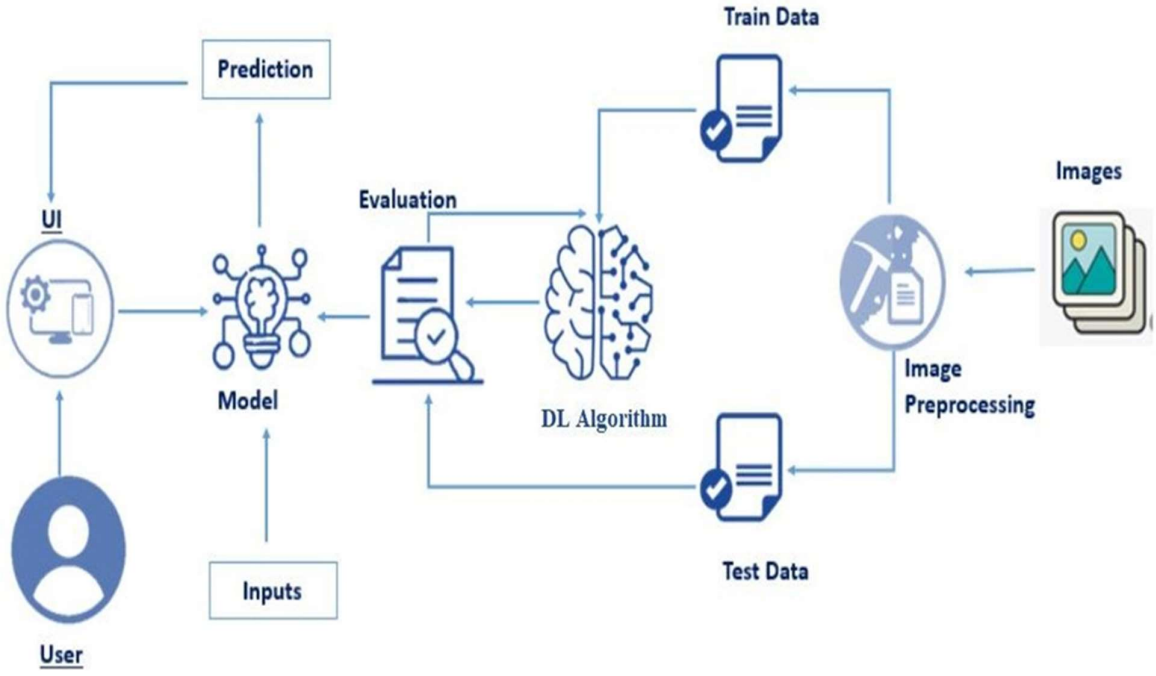
    - Train a deep learning model on the dataset. The model can be trained using a variety of deep learning frameworks, such as TensorFlow or PyTorch.
    - Test the model on a held-out test set. The test set should be a set of images that were not used to train the model. This will allow the model to be evaluated on its ability to classify new images of garbage.
- Evaluation: The model can be evaluated using a variety of metrics, such as accuracy, precision, and recall. Accuracy measures the percentage of images that the model correctly classifies. Precision measures the percentage of images that are classified as a particular type of garbage that are actually that type of garbage. Recall measures the percentage of images that are actually a particular type of garbage that are classified as that type of garbage.
- Deployment: The model can be deployed in a variety of ways. It can be used to power a web application that allows users to classify their own garbage. It can also be used to power a mobile app that allows users to scan images of garbage and have the app identify the type of garbage.

Purpose

The purpose of this project is to develop a deep learning model that can be used to classify garbage. This model could be used to improve waste management by helping to ensure that garbage is properly sorted. This would help to reduce contamination of recyclable materials and make it easier to recycle and compost garbage.

In addition, the model could be used to educate people about the different types of garbage and how to properly dispose of them. This could help to reduce the amount of garbage that ends up in landfills and incinerators.

The project would also contribute to the development of deep learning technology. The model would be trained on a large dataset of images of garbage, which would help to improve the accuracy of deep learning models for other image classification tasks.



CODING AND SOLUTION:

jupyter index.html Yesterday at 7:22 PM

Logout

File Edit View Language HTML

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">

    <!--Bootstrap -->
    <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/css/bootstrap.min.css" integrity="sha384-
Gn5384xqQ1aoWXA+058RXPxPg6fy4IWvTNh0E263XmFcJlSAwiGgFAW/dAiS6JXm" crossorigin="anonymous">
    <script src="https://code.jquery.com/jquery-3.2.1.slim.min.js" integrity="sha384-
KJ3o2DKtIkvYIK3UENzmM7KCkRr/rE9/Qpg6aAZGJwFDMVNA/GpGFF93hXpG5KkN" crossorigin="anonymous"></script>
    <script src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.12.9/umd/popper.min.js" integrity="sha384-
ApNbgh9B+Y1QKtv3Rn7W3mgPxhU9K/ScQsAP7hUibX39j7fakFPskvXusvfa0b4Q" crossorigin="anonymous"></script>
    <script src="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/js/bootstrap.min.js" integrity="sha384-
JZR6Spejh4U02d8jOt6vLEHfe/JQGiRRSQQxSfFWpi1MquVdAyjUar5+76PVCmYl" crossorigin="anonymous"></script>


    <script src="https://kit.fontawesome.com/8b9cdc2059.js" crossorigin="anonymous"></script>
    <link href="https://fonts.googleapis.com/css2?family=Akronim&family=Roboto&display=swap" rel="stylesheet">
    <link rel="stylesheet" href="../static/style.css">
    <!-- <script defer src="../static/js/main.js"></script> -->
    <title>Garbage Classification</title>
</head>
<body>
    <header id="head" class="header">
   <section  id="navbar">
          <h1 class="nav-heading"><i class="fas fa-recycle m2"></i>Garbage Classification</h1>
       <div class="nav--items">
           <ul>
               <li><a href="#about">About</a></li>
               <li><a href="#services">Services</a></li>
               <li><a href="#contact">Contact</a></li>
```

```
            <li><a href="prediction.html">Prediction</a></li>
        </ul>
    </div>
</section>
<section id="slider">
 <div id="carouselExampleIndicators" class="carousel" data-ride="carousel">
    <ol class="carousel-indicators ">
        <li data-target="#carouselExampleIndicators" data-slide-to="0" class="active "></li>
        <li data-target="#carouselExampleIndicators" data-slide-to="1"></li>
        <li data-target="#carouselExampleIndicators" data-slide-to="2"></li>
        <li data-target="#carouselExampleIndicators" data-slide-to="3"></li>
        <li data-target="#carouselExampleIndicators" data-slide-to="4"></li>
    </ol>
    <div class="carousel-inner">
        <div class="carousel-caption d-none d-md-block">
            <h2 class="font">Welcome to Garbage Classification</h2>
            <p class="text-light">Reuse the past, Recycle the present, Save the future.</p>
        </div>
        <div class="carousel-item active">
            <img class="d-block w-100" src="../static/img/first.jpg" alt="First slide">
        </div>
        <div class="carousel-item">
            <img class="d-block w-100" src="../static/img/second.jpg" alt="Second slide">
        </div>
        <div class="carousel-item">
            <img class="d-block w-100" src="../static/img/third.jpg" alt="Third slide">
        </div>
        <div class="carousel-item">
            <img class="d-block w-100" src="../static/img/fourth.jpg" alt="fourth slide">
        </div>
        <div class="carousel-item">
            <img class="d-block w-100" src="../static/img/fifth.jpg" alt="fifth slide">
        </div>
```

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">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    <script src="https://code.jquery.com/jquery-3.2.1.slim.min.js" integrity="sha384-KJ3o2DKtIkvYIK3UENzmM7KCkRr/rE9/Qpg6aAZGJwFDMVNA
```

```
/GpGFF93hXpG5KkN"
crossorigin="anonymous"></script>
    <script
src="https://cdnjs.cloudflare.com/ajax/libs/popp
er.js/1.12.9/umd/popper.min.js"
integrity="sha384-
ApNbgh9B+Y1QKtv3Rn7W3mgPxhU9K/ScQsAP7hUibX39j7fa
kFPskvXusvfa0b4Q"
crossorigin="anonymous"></script>
    <script
src="https://maxcdn.bootstrapcdn.com/bootstrap/4
.0.0/js/bootstrap.min.js" integrity="sha384-
JZR6Spejh4U02d8jOt6vLEHfe/JQGiRRSQQxSfFWpi1MquVd
AyjUar5+76PVCmYl"
crossorigin="anonymous"></script>



    <script
src="https://kit.fontawesome.com/8b9cdc2059.js"
crossorigin="anonymous"></script>
    <link
href="https://fonts.googleapis.com/css2?family=A
kronim&family=Roboto&display=swap"
rel="stylesheet">
    <link rel="stylesheet"
href="../static/style.css">
    <!-- <script defer
src="../static/js/main.js"></script> -->
    <title>Garbage Classification</title>
</head>
<body>
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```

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   <section  id="navbar">
            <h1 class="nav-heading"><i class="fas
fa-recycle m2"></i>Garbage Classification</h1>
          <div class="nav--items">
              <ul>
                  <li><a
href="#about">About</a></li>
                  <li><a
href="#services">Services</a></li>
                  <li><a
href="#contact">Contact</a></li>
                  <li><a
href="prediction.html">Prediction</a></li>
              </ul>
          </div>
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target="#carouselExampleIndicators" data-slide-
to="0" class="active "></li>
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target="#carouselExampleIndicators" data-slide-
to="1"></li>
            <li data-
target="#carouselExampleIndicators" data-slide-
to="2"></li>
```

```
            <li data-
target="#carouselExampleIndicators" data-slide-
to="3"></li>
            <li data-
target="#carouselExampleIndicators" data-slide-
to="4"></li>
        </ol>
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            <div class="carousel-caption d-none
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                <p class="text-light">Reuse the
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            </div>
            <div class="carousel-item">
                <img class="d-block w-100"
src="../static/img/second.jpg" alt="Second
slide">
            </div>
            <div class="carousel-item">
                <img class="d-block w-100"
src="../static/img/third.jpg" alt="Third slide">
            </div>
            <div class="carousel-item">
```

```
                <img class="d-block w-100"
src="../static/img/fourth.jpg" alt="fourth
slide">
            </div>
            <div class="carousel-item">
                <img class="d-block w-100"
src="../static/img/fifth.jpg" alt="fifth slide">
            </div>
        </div>
        <a class="carousel-control-prev"
href="#carouselExampleIndicators" role="button"
data-slide="prev">
            <span class="carousel-control-prev-
icon" aria-hidden="true"></span>
            <span class="sr-
only">Previous</span>
        </a>
        <a class="carousel-control-next"
href="#carouselExampleIndicators" role="button"
data-slide="next">
            <span class="carousel-control-next-
icon" aria-hidden="true"></span>
            <span class="sr-only">Next</span>
        </a>
    </div>


   </section>
</header>
<section id="about">
```

```
    <div class="top">
        <h3 class="title text-muted">
            ABOUT PROJECT
        </h3>
        <div class="line"></div>
    </div>
<div class="body">
<div class="left">
    <h2>Problem:</h2>
    <p>
```

The accumulation of solid waste in the urban area is becoming a great concern, and

it would result in environmental pollution and may be hazardous to human health if

itis not properly managed. It is important to have an advanced/intelligent waste

management system to manage a variety of waste materials. One of the most

important steps of waste management is the separation of the waste into the.

different components and this process is normally done manually by hand-picking.

To simplify the process, we propose an intelligent waste material classification

system, which is developed by using the 50-layer residual net pre-train (ResNet-50)

Convolutional Neural Network model which is a machine learning tool and serves as

the extractor, and Support Vector Machine (SVM) which is used to classify the waste

into different groups/types such as glass, metal, paper, and plastic etc. The proposed

system is tested on the trash image dataset which was developed by Gary Thung and

Mindy Yang, and is able to achieve an accuracy of 87% on the dataset. The separation

process of the waste will be faster and intelligent using the proposed waste material

classification system without or reducing human involvement.

    <h2>Solution:</h2>

        The present way of separating waste/garbage is the hand-picking method, whereby

someone is employed to separate out the different objects/materials. The person,

who separate waste, is prone to diseases due to the harmful substances in the

garbage. With this in mind, it motivated us to develop an automated system which is

able to sort the waste. and this system can take short time to sort the waste, and it

will be more accurate in sorting than the manual way. With the system in place, the

beneficial separated waste can still be recycled and converted to energy and fuel for

the growth of the economy. The system that is developed for the separation of the

accumulated waste is based on the combination of Convolutional Neural Network.

```
    </p>
</div>
</div>
</section>
<section id="services">
<h3 class="title text-muted">WE CLASSIFY</h3>
<div class="line"></div>
<div class="testimonials">
    <div class="card" style="width: 25rem;">
        <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\tesimonials\cardboard.
jpg" class="card-img-top" alt="cardboard">
        <div class="card-body">
          <h5 class="card-title text-
muted">CardBoard</h5>
          <p class="card-text">Waste cardboard
is a major source of pollution, but it can also
be a valuable resource. Here are some of the
things that can be done with waste cardboard:
```

Recycled. Waste cardboard can be recycled into new paper products, such as paper towels, tissues, and cardboard boxes. Recycling cardboard helps to reduce the amount of waste that goes to landfills and incinerators.

Composted. Waste cardboard can be composted, which means it can be broken down into organic matter that can be used to enrich soil. Composting helps to reduce the amount of waste that goes to landfills and incinerators, and it also helps to improve soil quality.

Upcycled. Waste cardboard can be upcycled, which means it can be reused to create new products. There are many creative ways to upcycle waste cardboard, such as making storage boxes, art projects, and even furniture. Upcycling helps to reduce the amount of waste that goes to landfills and incinerators, and it also helps to reduce the need for new materials.</p>

```
        </div>
      </div>
    <div class="card" style="width: 25rem;">
        <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\tesimonials\bottle.jpg
" class="card-img-top" alt="bottle">
        <div class="card-body">
          <h5 class="card-title text-
muted">Glass</h5>
```

Waste glass is a type of solid waste that is made up of glass that has been discarded.

Glass is a 100% recyclable material, which means that it can be recycled indefinitely without losing its quality.

When glass is recycled, it is melted down and used to make new glass products.

Recycling glass helps to reduce the amount of waste that goes to landfills and incinerators.

Recycling glass also helps to conserve natural resources, such as sand and limestone.

<img src="C:\Users\Mithi\OneDrive\Desktop\Mithil's Version\Garbage classification\static\img\tesimonials\metal.jpg" class="card-img-top" alt="metal">

<h5 class="card-title">Metal</h5>

Waste metal is a type of solid waste that is made up of metal that has been discarded. It is a valuable resource that can be recycled into new products.

Metals are a versatile material that can be used to make a wide variety of products, including cars, appliances, and construction materials. They are also a valuable resource that can be

recycled over and over again without losing their properties.

Waste metal can be recycled into new products through a process called smelting. In smelting, the metal is melted down and then cast into new shapes. This process can be used to recycle a wide variety of metals, including steel, aluminum, copper, and zinc.</p>

```
        </div>
      </div>
    <div class="card" style="width: 25rem;">
        <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\tesimonials\page.jpg"
class="card-img-top" alt="page">
        <div class="card-body text-muted">
          <h5 class="card-title">Paper</h5>
          <p class="card-text">Waste paper is a
type of solid waste that is made up of paper
that has been discarded. It is the most common
type of waste in the world, accounting for about
40% of municipal solid waste (MSW).
```

Waste paper can be recycled into new paper products, such as paper towels, tissues, and cardboard boxes. Recycling waste paper helps to reduce the amount of waste that goes to landfills and incinerators. It also helps to

conserve natural resources, such as trees and water.

<img src="C:\Users\Mithi\OneDrive\Desktop\Mithil's Version\Garbage classification\static\img\tesimonials\plastic.jpg" class="card-img-top" alt="plastic">

<h5 class="card-title">Plastic</h5>
Waste plastic is a type of solid waste that is made up of plastic that has been discarded.

Plastic is a non-renewable resource, which means that it cannot be replaced once it has been used.

Plastic takes hundreds of years to decompose in landfills.

Plastic pollution is a major environmental problem, as it can harm wildlife and pollute waterways.

There are a number of ways to reduce waste plastic, such as using reusable bags, recycling plastic, and avoiding single-use plastics.

```
    <div class="card" style="width: 25rem;">
        <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\tesimonials\trash.jpg"
class="card-img-top" alt="trash">
        <div class="card-body text-muted">
          <h5 class="card-title">Trash</h5>
          <p class="card-text">India is the
world's second-largest producer of trash,
generating about 2.56 million tons of trash
every day.
Only about 12% of India's trash is recycled,
while the rest is either landfilled or burned.
Landfills in India are often poorly managed,
leading to pollution of groundwater and soil.
Burning trash releases harmful pollutants into
the air, contributing to climate change and
respiratory problems.
India's trash problem is a major environmental
and public health challenge.</p>


        </div>
      </div>
</div>
</section>


<!-- Contact  -->
<setion id="contact">
```

```
    <h3 class=" text-muted title">CONTACT
US</h3>
    <div class="line"></div>
    <div class="contact-container">
    <div class="conatct-left">
        <div class="items">
            <i class="fas fa-map-pin fa-2x"></i>
            <h3 class=" text-muted">
                 Address
            </h3>
            <p>Plot No 132, 2nd Floor, Above DCB
Bank, HMT Nagar, Nacharam Main
Road, Hyderabad - 500076</p>
        </div>
        <div class="items">
            <i class="fas fa-envelope fa-
2x"></i>
            <h3 class="text-muted">
                 Enquiries
            </h3>
            <p>info@thesmartbridge.com </p>
        </div>
        <div class="items">
            <i class="fas fa-phone fa-2x"></i>
            <h3 class=" text-muted">
                 Call Us
```

```
            </h3>
            <p>+91403511 2535</p>
        </div>


    </div>
    <div class="contact-right">
        <h3 class=" text-muted">ENROLL TO OUR
SERVICES</h3>
        <form>
            <input type="text"
placeholder="Your Name"
                name="name">
                <input type="email"
placeholder="Email Adress"
                name="email">
                <input type="text"
placeholder="Phone Number"
                name="phone">
            <button type="submit" class="btn-
warning btn">Submit</button>
        </form>
    </div>
</div>
</setion>
<section id="footer">
    <p>Copyright © 2023. All Rights Reserved
</p>
```

```
    <div class="social">
      <a href="#" target="_blank"><i class="fab
fa-2x fa-twitter-square"></i></a>
       <a href="#" target="_blank">
        <i class="fab fa-2x  fa-
linkedin"></i></a>
        <a href="#">
            <i class="#"></i>
        </a>
    </div>
</section>
</body>
</html>
```

Prediction.html

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible"
content="IE=edge">
    <meta name="viewport" content="width=device-
width, initial-scale=1.0">
    <!--Bootstrap -->
    <link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/
```

```
4.0.0/css/bootstrap.min.css" integrity="sha384-
Gn5384xqQ1aoWXA+058RXPxPg6fy4IWvTNh0E263XmFcJlSA
wiGgFAW/dAiS6JXm" crossorigin="anonymous">

    <script src="https://code.jquery.com/jquery-
3.2.1.slim.min.js" integrity="sha384-
KJ3o2DKtIkvYIK3UENzmM7KCkRr/rE9/Qpg6aAZGJwFDMVNA
/GpGFF93hXpG5KkN"
crossorigin="anonymous"></script>

    <script
src="https://cdnjs.cloudflare.com/ajax/libs/popp
er.js/1.12.9/umd/popper.min.js"
integrity="sha384-
ApNbgh9B+Y1QKtv3Rn7W3mgPxhU9K/ScQsAP7hUibX39j7fa
kFPskvXusvfa0b4Q"
crossorigin="anonymous"></script>

    <script
src="https://maxcdn.bootstrapcdn.com/bootstrap/4
.0.0/js/bootstrap.min.js" integrity="sha384-
JZR6Spejh4U02d8jOt6vLEHfe/JQGiRRSQQxSfFWpi1MquVd
AyjUar5+76PVCmYl"
crossorigin="anonymous"></script>



    <script
src="https://kit.fontawesome.com/8b9cdc2059.js"
crossorigin="anonymous"></script>

    <link
href="https://fonts.googleapis.com/css2?family=A
kronim&family=Roboto&display=swap"
rel="stylesheet">

    <link rel="stylesheet"
href="../static/style.css">
```

```
    <script defer
src="../static/js/JScript.js"></script>
    <title>Prediction</title>
</head>
<body>
    <header id="head" class="header">
        <section  id="navbar">
          <h1 class="nav-heading">
            <i class="fas fa-recycle m2"></i>
            Garbage Classification
          </h1>
            <div class="nav--items">
                <ul>
                    <li><a
href="index.html#about">About</a></li>
                    <li><a
href="index.html#services">Services</a></li>
                    <li><a
href="index.html#contact">Contact</a></li>
                    <li><a
href="prediction.html">Prediction</a></li>
                </ul>
            </div>
        </section>
    </header>
    <!-- dataset/Training/metal/metal326.jpg -->
    <section id="prediction">
```

```
        <div class="prediction-input">
        <div class="circle">
            <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\dummy\sample.png"
alt="Demo" id="demo" class="circle">
        </div>
                <form id="form" action="/result"
method="post"  enctype="multipart/form-data">
                    <input type="file"
id="imageupload"  name="image" accept="image/*"
class="input-image">
                    <input type="submit"
class="submitbtn">
                </form>
            </div>
            <h3 class="title text-muted">
            THE PREDICTION IS
          </h3>
          <div class="line"></div>
              <div class="output-container">
                  <div data-type="cardboard"
class="output img1">
                    <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\tesimonials\cardboard.
jpg" alt="" class="circle">
```

```
                    <h3 class="text-
muted">CARDBOARD</h3>
                </div>
                  <div data-type="glass"
class="output img2">
                    <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\tesimonials\bottle.jpg
" alt="" class="circle">
                    <h3 class="text-
muted">GLASS</h3>
                </div>
                  <div data-type="metal"
class="output img3">
                    <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\tesimonials\metal.jpg"
alt="" class="circle">
                    <h3 class="text-
muted">METAL</h3>
                </div>
                  <div data-type="paper"
class="output img4">
                    <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\tesimonials\page.jpg"
alt="" class="circle">
                    <h3 class="text-
muted">PAPER</h3>
```

```
                </div>
                  <div data-type="plastic"
class="output img5">
                    <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\tesimonials\plastic.jp
g" alt="" class="circle">
                    <h3 class="text-
muted">PLASTIC</h3>
                </div>
                  <div data-type="trash"
class="output img6">
                    <img
src="C:\Users\Mithi\OneDrive\Desktop\Mithil's
Version\Garbage
classification\static\img\tesimonials\trash.jpg"
alt="" class="circle">
                    <h3 class="text-
muted">TRASH</h3>
                </div>


              </div>


              <div class="hide" id="result">
                {{prediction}}
              </div>
    </section>
    <section id="footer">
```

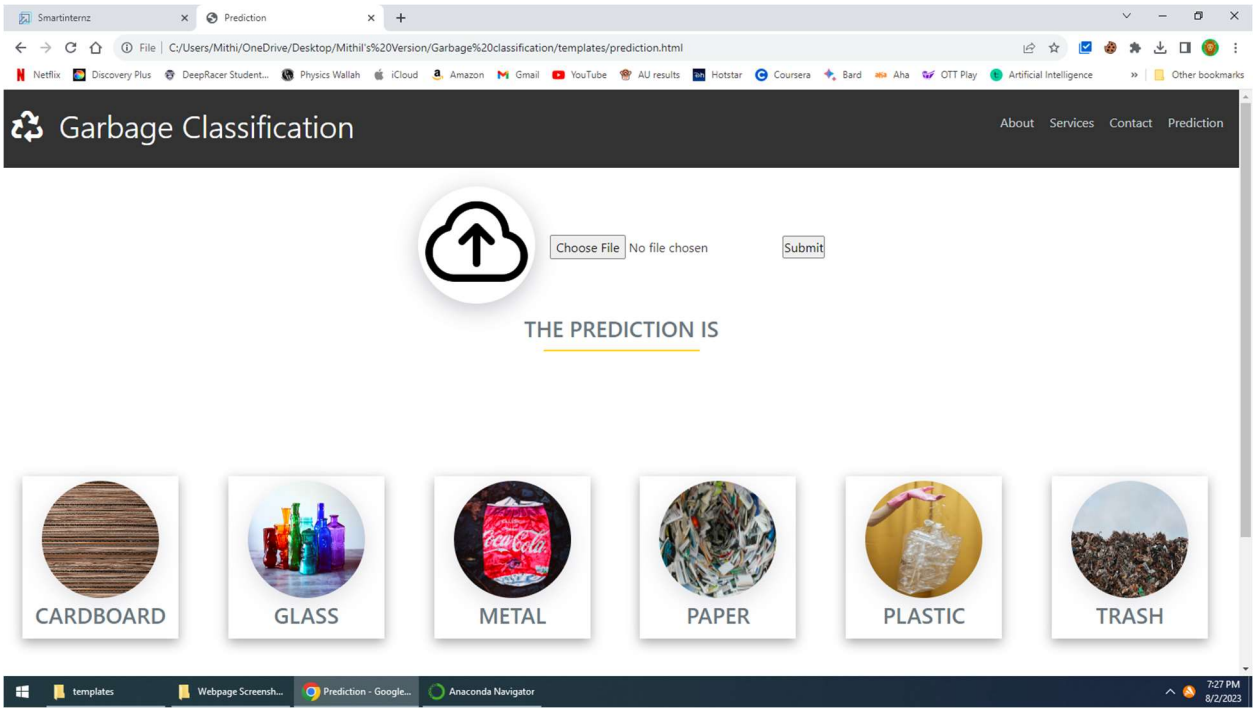
```
        <p>Copyright © 2023. All Rights
Reserved</p>
        <div class="social">
          <a href="#"_blank"><i class="fab fa-2x
fa-twitter-square"></i></a>
           <a href="#" target="_blank">
            <i class="fab fa-2x  fa-
linkedin"></i></a>
            <a href="#">
                <i class="fab fa-instagram-
square fa-2x "></i>
            </a>
        </div>
    </section>
</body>

</html>
```

Results

Performance Metrics

Training Accuracy – 0.8994 Validation Accuracy – 0.8488



Back end

```
import re
import numpy as np
import os
from flask import Flask,
app,request,render_template
from tensorflow.keras import models
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
from tensorflow.python.ops.gen_array_ops import
concat
#Loading the model
```

```
model=load_model(r"Garbage1.h5")

app=Flask(__name__)



#default home page or route
@app.route('/')
def index():
    return render_template('index.html')

@app.route('/prediction.html')
def prediction():
    return render_template('prediction.html')

@app.route('/index.html')
def home():
    return render_template("index.html")

@app.route('/result',methods=["GET","POST"])
def res():
    if request.method=="POST":
        f=request.files['image']
        basepath=os.path.dirname(__file__) #getting
the current path i.e where app.py is present
        #print("current path",basepath)
        filepath=os.path.join(basepath,'Garbage
classification',f.filename) #from anywhere in the
system we can give image but we want that image later
to process so we are saving it to uploads folder for
reusing
```

```
            #print("upload folder is",filepath)
            f.save(filepath)


img=image.load_img(filepath,target_size=(128,128))
            x=image.img_to_array(img)#img to array
            x=np.expand_dims(x,axis=0)#used for adding
one more dimension
            #print(x)
            prediction=np.argmax(model.predict(x), axis
=1) #instead of predict_classes(x) we can use
predict(X) ---->predict_classes(x) gave error
            #print("prediction is ",prediction)

index=["cardboard","glass","metal","paper","plastic","t
rash"]
            result = str(index[int(prediction)])


            result
            return
render_template('prediction.html',prediction=result)




    """ Running our application """
    if __name__ == "__main__":
        app.run(debug=False,port=8000)
```

Advantages:

- High accuracy: Deep learning models can be trained to achieve high accuracy in garbage classification. This is because deep learning models can learn to identify subtle features in images that can be used to distinguish between different types of garbage.
- Scalability: Deep learning models can be scaled to handle large datasets of images. This means that the model can be trained on a large dataset of images, which will improve its accuracy.
- Robustness: Deep learning models are robust to noise and variations in the appearance of garbage. This means that the model can still classify garbage accurately even if the images are blurry or the garbage is not well-lit.

Disadvantages:

- Data requirements: Deep learning models require a large dataset of images to train. This can be a challenge to collect, especially if the model is being trained to classify a wide variety of garbage.
- Computational resources: Training deep learning models requires a significant amount of computational resources. This can be a barrier to entry for some projects.
- Interpretability: Deep learning models are often difficult to interpret. This means that it can be difficult to understand why the model makes the predictions that it does. This can be a challenge for debugging and improving the model.

Conclusion

In conclusion, deep learning has the potential to revolutionize garbage classification. By using deep

learning, we can develop models that can classify garbage with high accuracy, even in the presence of noise and variations in the appearance of garbage. This would have a number of benefits, including improved waste management, increased recycling and composting, and increased public education about garbage disposal.

However, there are some challenges that need to be addressed before deep learning can be widely adopted for garbage classification. These challenges include the need for large datasets of images, the need for significant computational resources, and the difficulty of interpreting deep learning models.

Despite these challenges, I believe that deep learning is a promising technology for garbage classification. With continued research and development, I believe that we can develop deep learning models that can significantly improve the way we manage our garbage.