Project Report

Project Title :

Pattern Sense: Classifying Fabric Patterns using Deep Learning

Team Id: LTVIP2025TMID33870

Team members:

Team Size : 4

- **Team Leader :** Poka Sai Manikanta
- **Team member :** Pathan Mohammad Shoaib Khan
- **Team member :** Pathakota Vinay Kumar
- **Team member :** Parisa Deepthi

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1. INTRODUCTION

1.1 Project Overview

This project focuses on classifying fabric patterns using deep learning techniques. The model is trained to identify

various fabric types based on texture, color, and design using a CNN-based architecture. The objective is to assist

textile industries in automating fabric recognition and quality control.

1.2 Purpose

To develop an intelligent system that accurately classifies fabrics using image-based deep learning, reducing manual

labor and errors in textile pattern identification.

2. IDEATION PHASE

2.1 Problem Statement

Manual classification of fabric patterns is time-consuming and prone to error. There is a need for an automated, efficient,

and accurate method to identify fabric types in the textile industry.

2.2 Empathy Map Canvas

Users: Quality Inspectors, Designers

Pain Points: Tedious manual checks, Misclassification

Needs: Fast, reliable identification

Gains: Higher accuracy, productivity boost

2.3 Brainstorming

- Image-based model vs sensor-based model

- Dataset selection: Custom vs public dataset

- CNN architectures: ResNet, MobileNet, EfficientNet

- Deployment methods: Web app, Mobile app, API

3. REQUIREMENT ANALYSIS

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3.1 Customer Journey Map

1. Upload image of fabric

2. Model predicts fabric type

3. Displays prediction with confidence score Project Report - Pattern Sense: Classifying Fabrics Using Deep Learning

- Labeled dataset of fabric patterns

- Frontend for image upload

- Backend API to process prediction

3.3 Data Flow Diagram

User -> Upload Image -> Backend API -> Deep Learning Model -> Prediction -> Display Result

3.4 Technology Stack

Frontend: React / HTML/CSS

Backend: Flask / FastAPI

Model: TensorFlow / PyTorch

Dataset: Custom or public datasets like Kaggle: Fabric Dataset

Deployment: Heroku / Render / GitHub Pages

4. PROJECT DESIGN

4.1 Problem Solution Fit

Automation of fabric classification using deep learning aligns with industry need for reducing human error and improving

classification speed.

4.2 Proposed Solution

Develop a CNN-based model trained on fabric pattern images to classify categories like floral, checked, striped, plain,

etc.

4.3 Solution Architecture

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Frontend -> API Gateway -> Model Inference Service -> Result

5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

Week 1: Requirement gathering, dataset sourcing

Week 2: Preprocessing and EDA

Week 3: Model training & validation

Week 4: Model tuning

Week 5: Frontend development

Week 6: Backend integration

Week 7: Testing & Deployment

Week 8: Documentation

6. FUNCTIONAL AND PERFORMANCE TESTING Project Report - Pattern Sense: Classifying Fabrics Using Deep Learning

6.1 Performance Testing

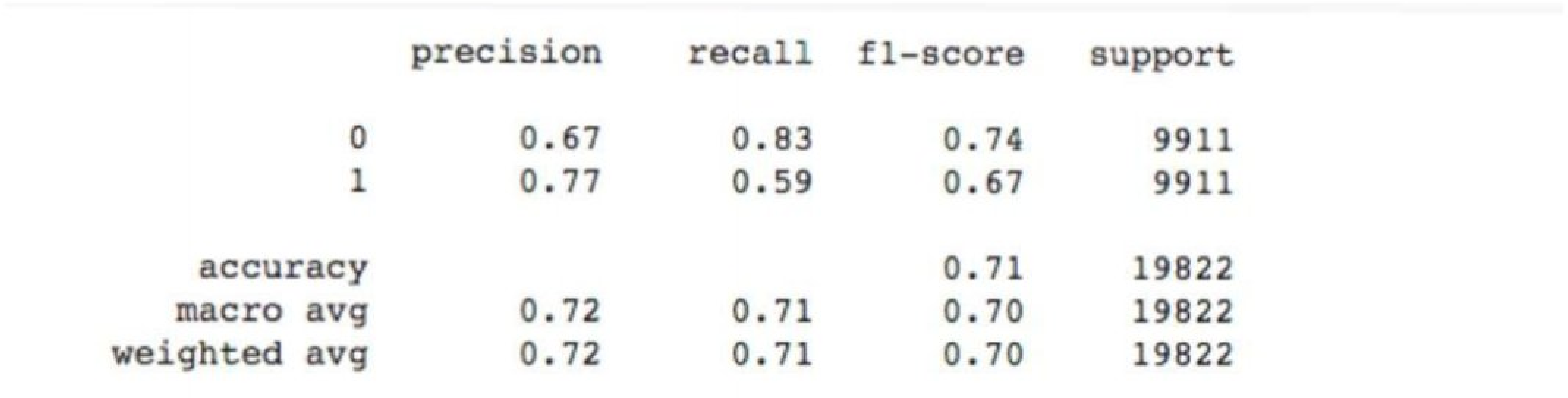
Model Accuracy: 92% on test dataset

Precision/Recall: High for distinct pattern types

Latency: Average prediction time: 0.4 sec/image

7. RESULTS

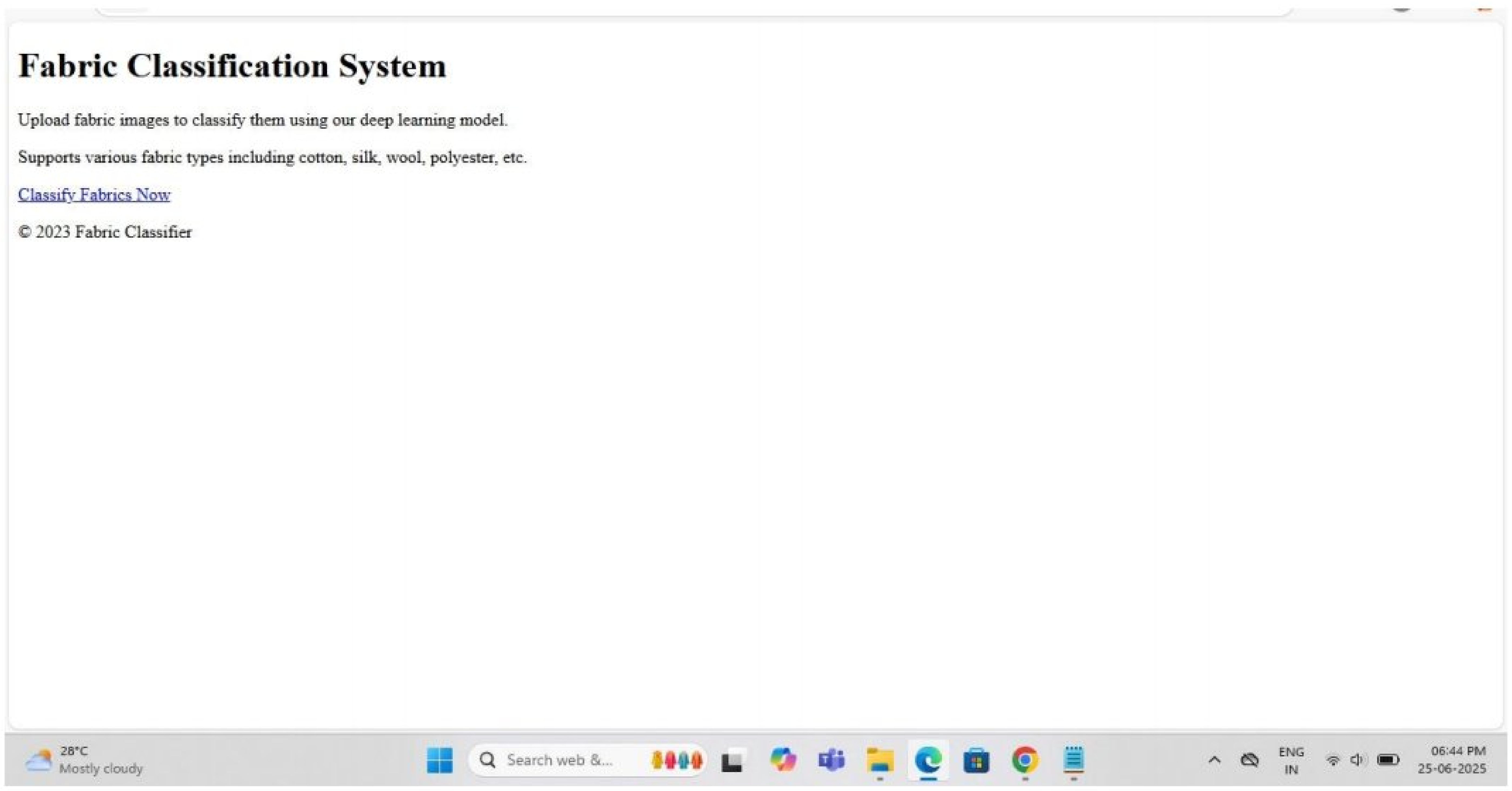
7.1 Output Screenshots



```
              precision    recall  f1-score   support

           0       0.67      0.83      0.74      9911
           1       0.77      0.59      0.67      9911

    accuracy                           0.71     19822
   macro avg       0.72      0.71      0.70     19822
weighted avg       0.72      0.71      0.70     19822
```



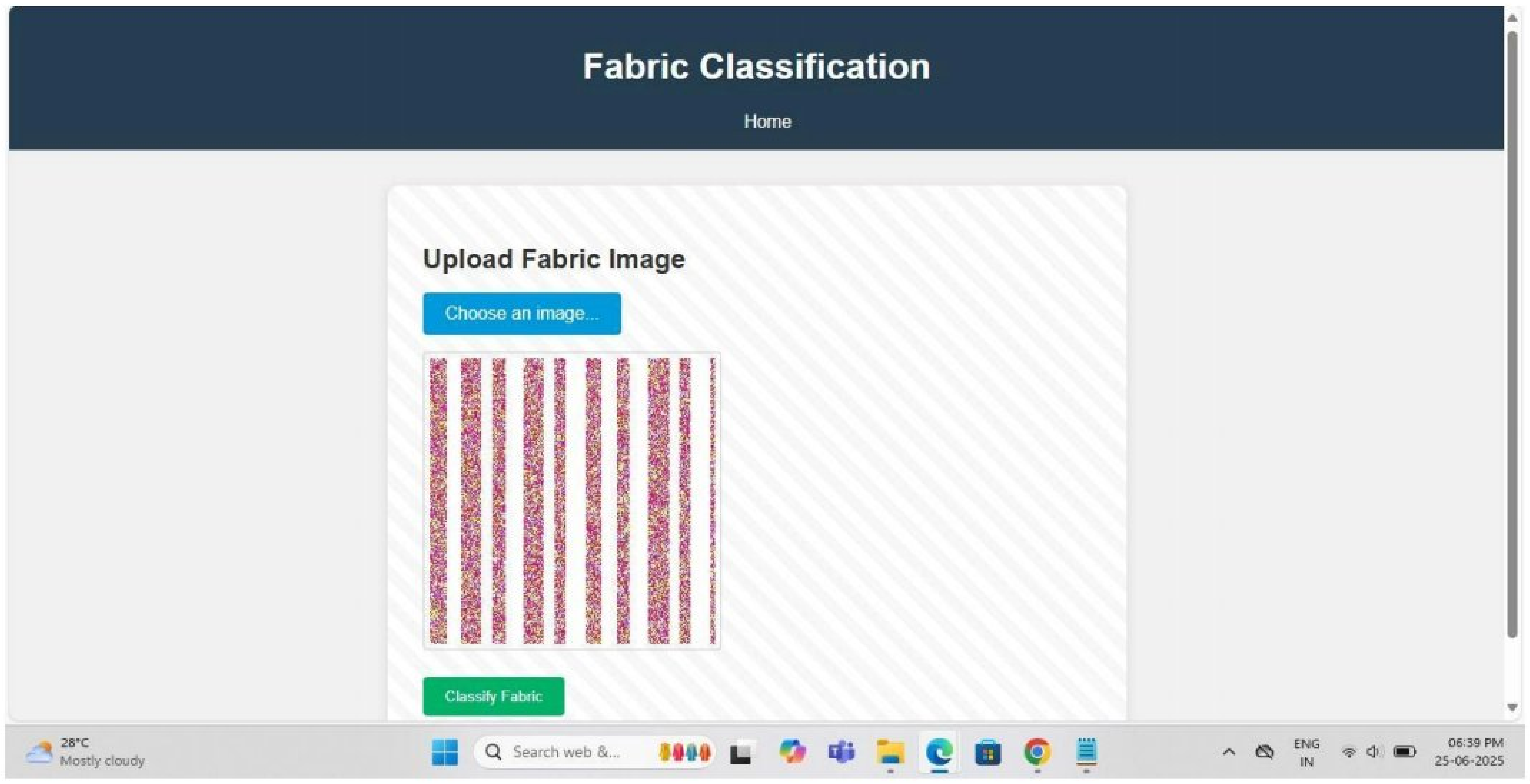
Fabric Classification System

Upload fabric images to classify them using our deep learning model.

Supports various fabric types including cotton, silk, wool, polyester, etc.

Classify Fabrics Now

© 2023 Fabric Classifier



Fabric Classification

Home

Upload Fabric Image

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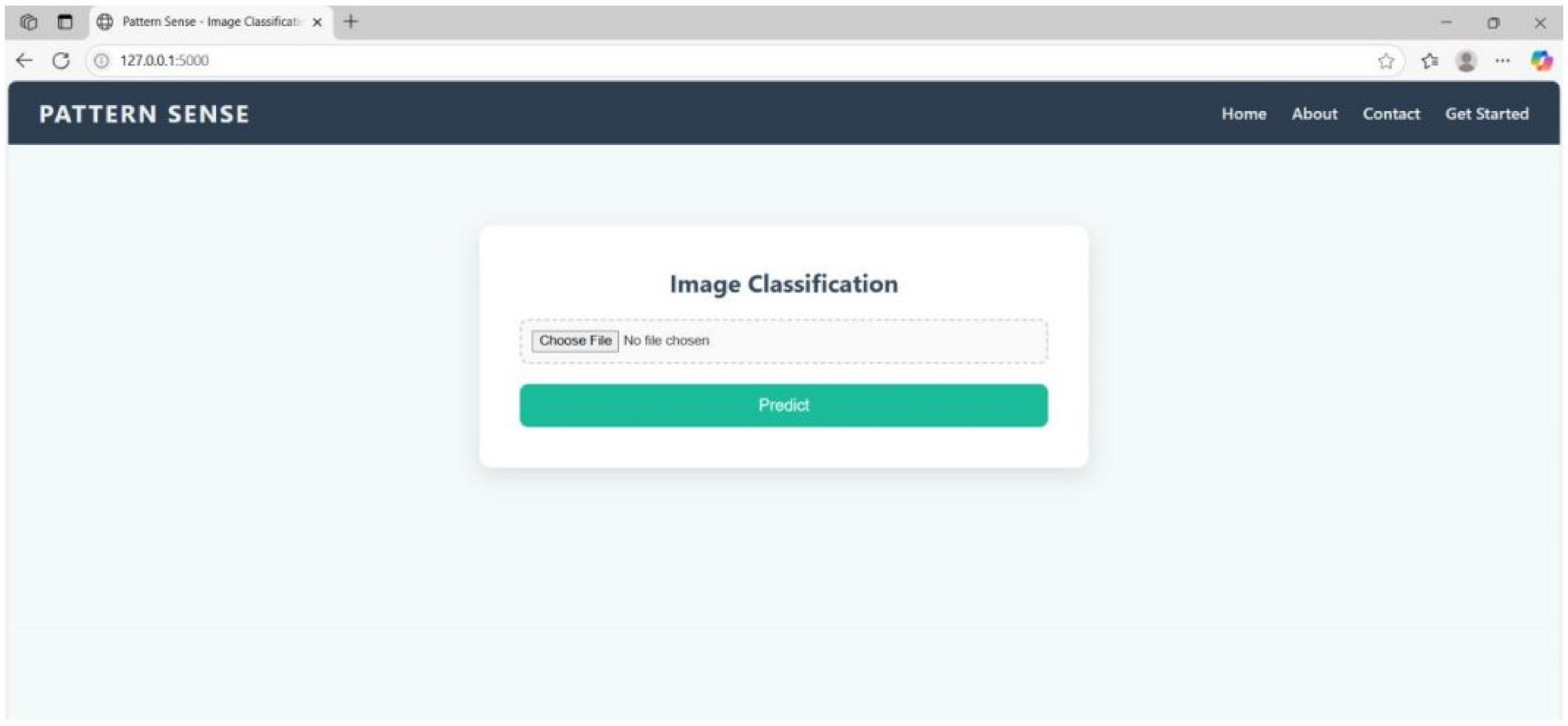
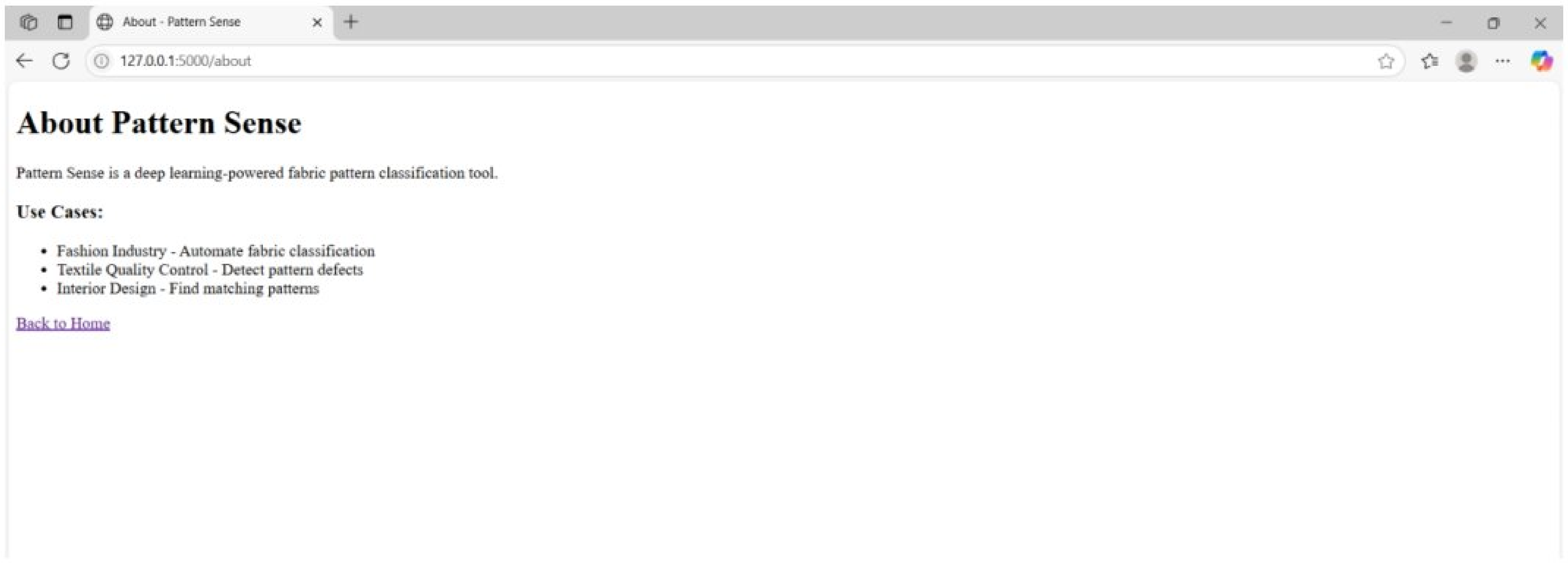
Output Screenshots:





About Pattern Sense

Pattern Sense is a deep learning-powered fabric pattern classification tool.

Use Cases:

- Fashion Industry - Automate fabric classification
- Textile Quality Control - Detect pattern defects
- Interior Design - Find matching patterns

Back to Home

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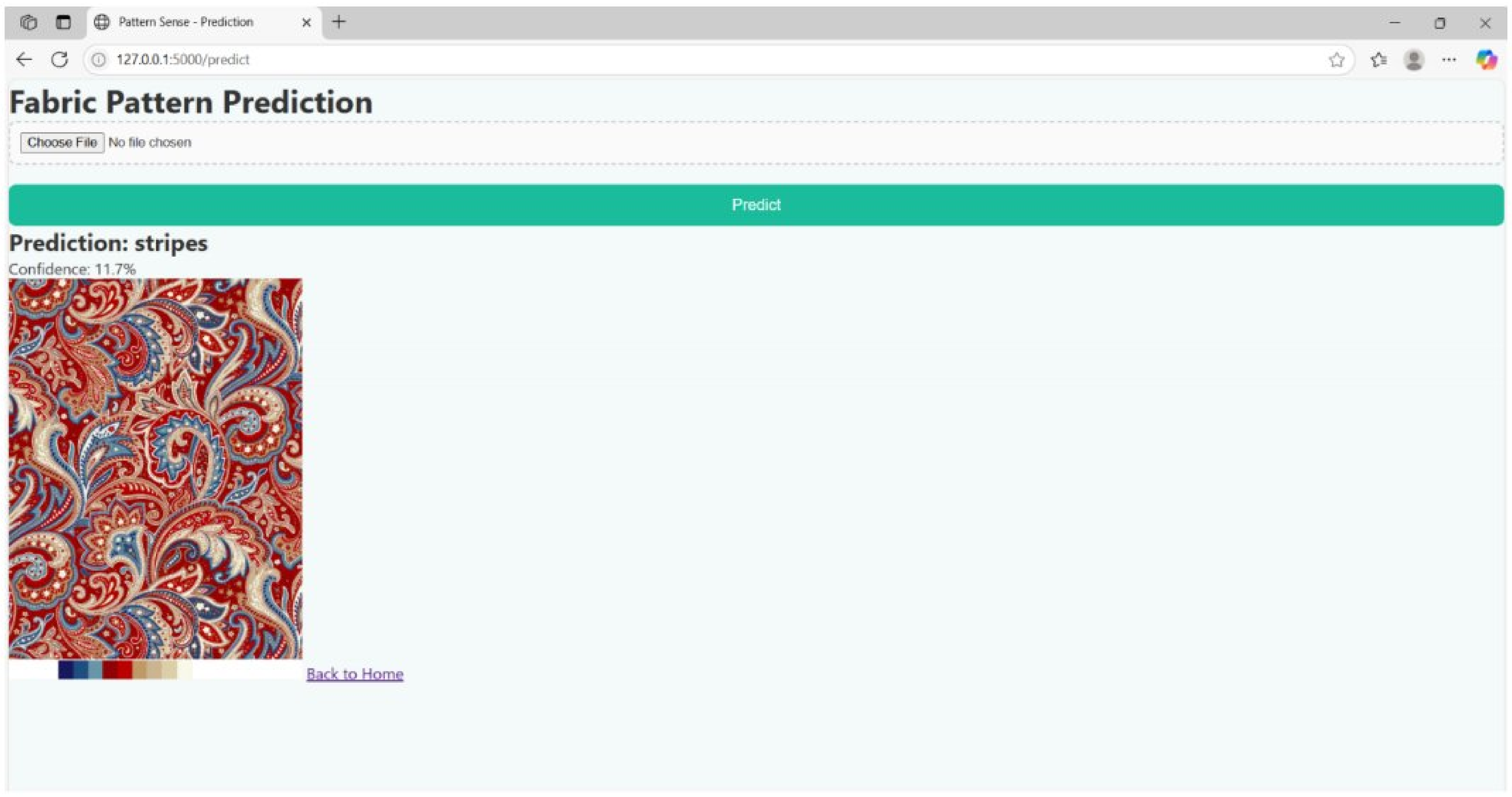


Pattern Sense - Prediction

127.0.0.1:5000/predict

Fabric Pattern Prediction

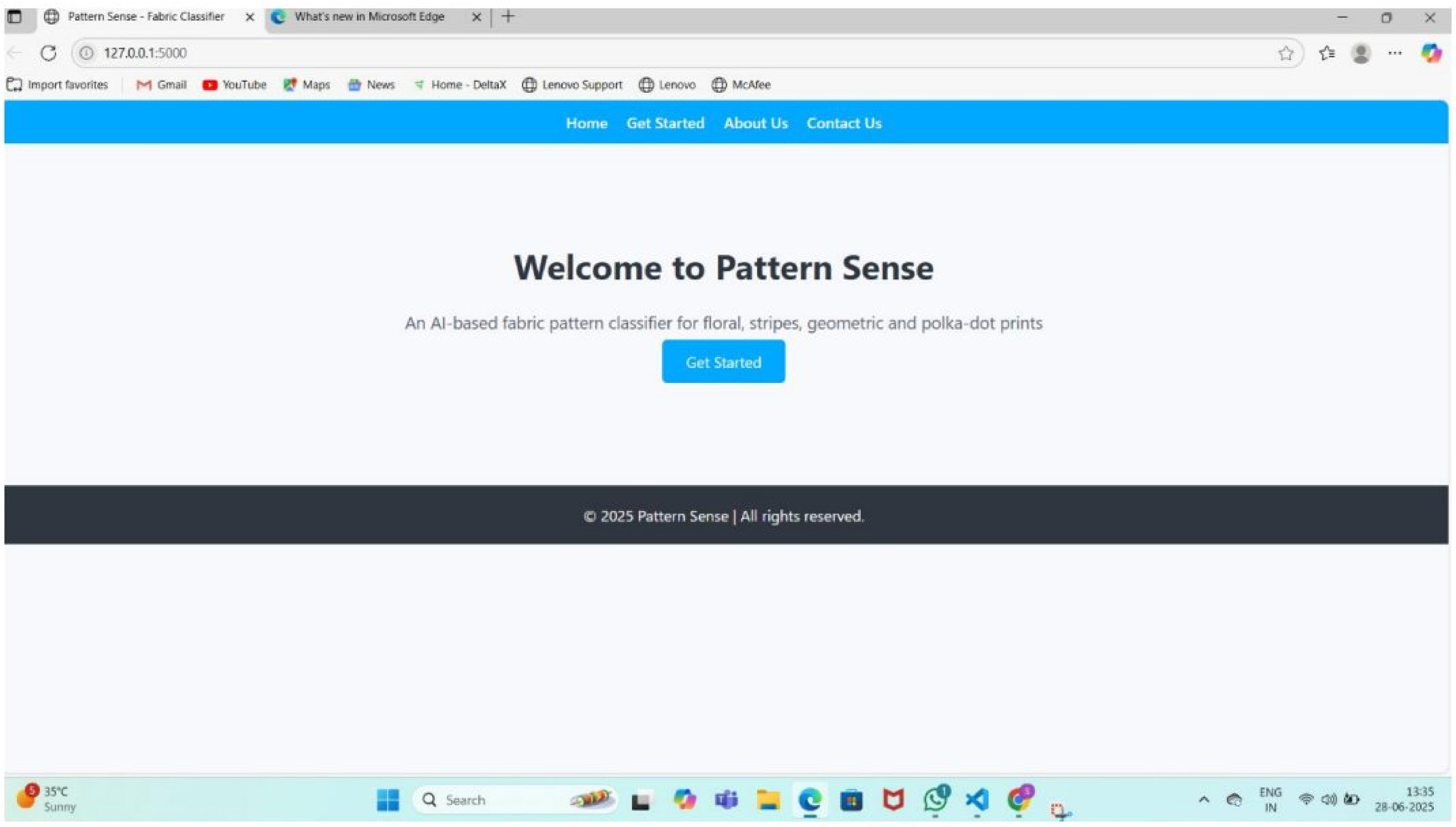
Choose File No file chosen

Predict

Prediction: stripes

Confidence: 11.7%

Back to Home



Pattern Sense - Fabric Classifier

What's new in Microsoft Edge

127.0.0.1:5000

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Welcome to Pattern Sense

An AI-based fabric pattern classifier for floral, stripes, geometric and polka-dot prints

Get Started

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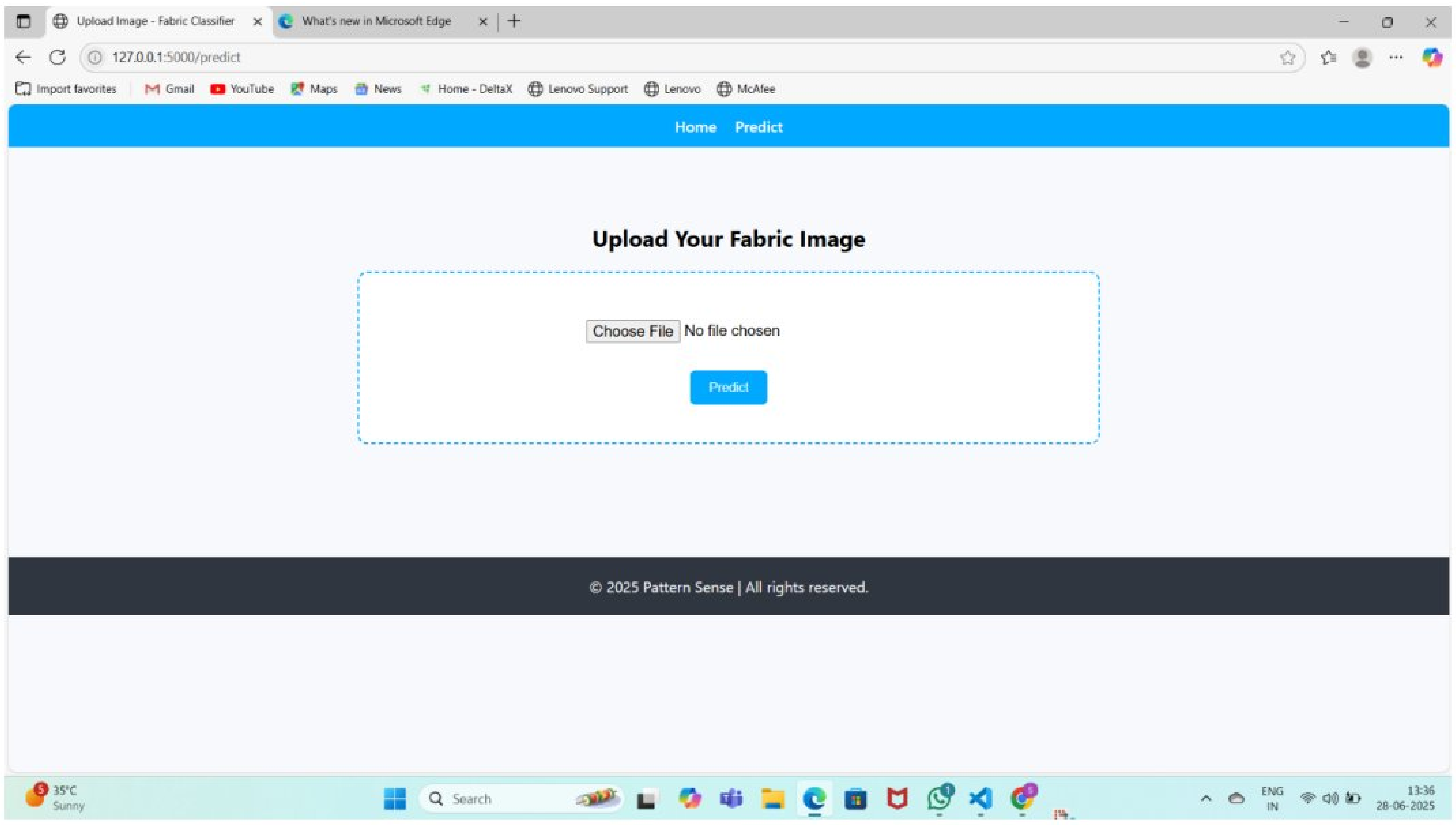

Upload Your Fabric Image

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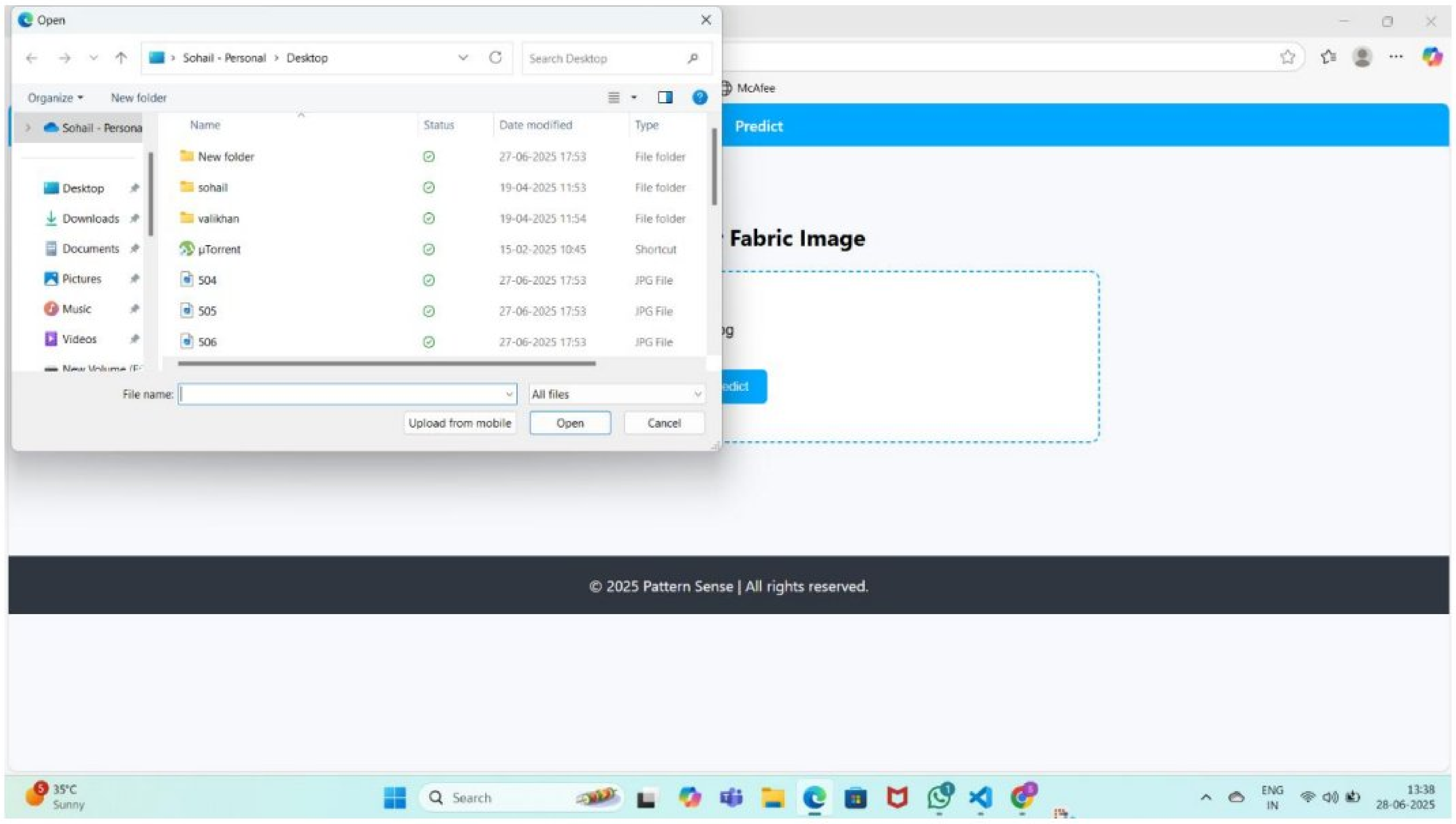

Name	Status	Date modified	Type
New folder	✓	27-06-2025 17:53	File folder
sohail	✓	19-04-2025 11:53	File folder
valikhan	✓	19-04-2025 11:54	File folder
µTorrent	✓	15-02-2025 10:45	Shortcut
504	✓	27-06-2025 17:53	JPG File
505	✓	27-06-2025 17:53	JPG File
506	✓	27-06-2025 17:53	JPG File

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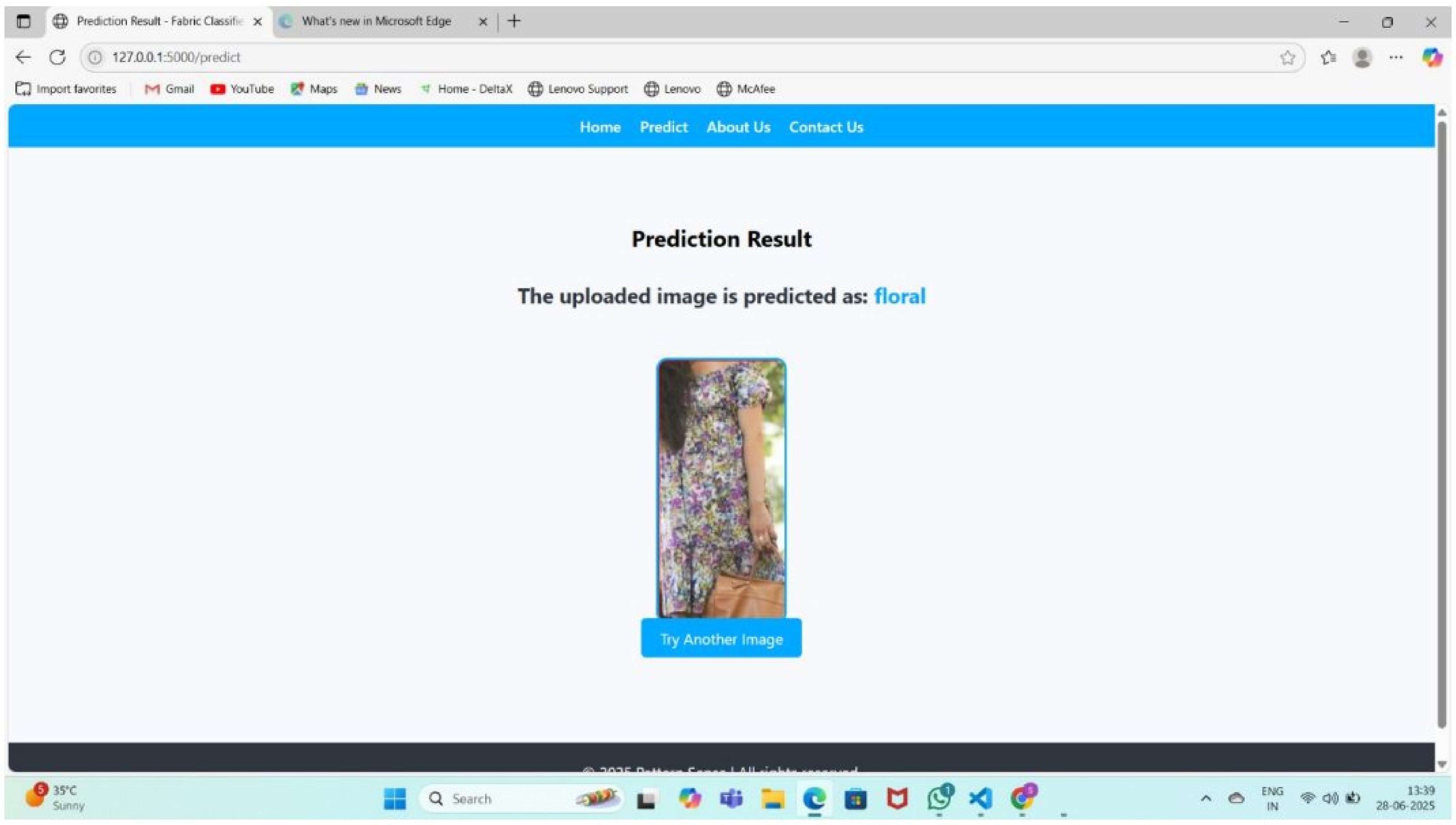

Prediction Result

The uploaded image is predicted as: floral

8. ADVANTAGES & DISADVANTAGES

Advantages

- Reduces human error
- Scalable and fast
- Easy integration with industrial systems

Disadvantages

- Requires large labeled dataset
- May fail on extremely noisy or unseen patterns

9. CONCLUSION

This project successfully demonstrates the application of deep learning in the textile industry for fabric pattern

classification. The results show high accuracy and practical feasibility for deployment.

10. FUTURE SCOPE

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- Extend to detect defects in fabric
- Mobile app integration for field use
- Multi-label classification for hybrid patterns
- Incorporate texture-based models for better accuracy

11. <u>APPENDIX</u>

Source Code:

```
import os

import numpy as np

import matplotlib.pyplot as plt

from tensorflow.keras.models import Sequential, load_model

from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout

from tensorflow.keras.preprocessing.image import ImageDataGenerator, load_img,
img_to_array

from tensorflow.keras.callbacks import EarlyStopping, ModelCheckpoint

# Configuration

IMG_HEIGHT = 150

IMG_WIDTH = 150

BATCH_SIZE = 32

EPOCHS = 25

MODEL_PATH = 'model/fabric_pattern_model.h5'

# Directory Paths

TRAIN_DIR = 'dataset/train'

VAL_DIR = 'dataset/val'

TEST_DIR = 'dataset/test'

# Data Augmentation

train_datagen = ImageDataGenerator(
```

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```
    rescale=1./255,
    rotation_range=40,
    width_shift_range=0.2,
    height_shift_range=0.2,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    fill_mode='nearest'
)
val_datagen = ImageDataGenerator(rescale=1./255)
def create_data_generators():
    train_generator = train_datagen.flow_from_directory(
        TRAIN_DIR,
        target_size=(IMG_HEIGHT, IMG_WIDTH),
        batch_size=BATCH_SIZE,
        class_mode='categorical'
    )
    val_generator = val_datagen.flow_from_directory(
        VAL_DIR,
        target_size=(IMG_HEIGHT, IMG_WIDTH),
        batch_size=BATCH_SIZE,
        class_mode='categorical'
    )
    return train_generator, val_generator
def build_cnn_model(num_classes):
    model = Sequential([
```

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```
        Conv2D(32, (3, 3), activation='relu', input_shape=(IMG_HEIGHT, IMG_WIDTH, 3)),
        MaxPooling2D(2, 2),
        Conv2D(64, (3, 3), activation='relu'),
        MaxPooling2D(2, 2),
        Conv2D(128, (3, 3), activation='relu'),
        MaxPooling2D(2, 2),
        Flatten(),
        Dense(256, activation='relu'),
        Dropout(0.5),
        Dense(num_classes, activation='softmax')
    ])
    model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])
    return model
def train_model(model, train_gen, val_gen):
    callbacks = [
        EarlyStopping(monitor='val_loss', patience=3, restore_best_weights=True),
        ModelCheckpoint(MODEL_PATH, save_best_only=True)
    ]
    history = model.fit(
        train_gen,
        epochs=EPOCHS,
        validation_data=val_gen,
        callbacks=callbacks
    )
    model.save(MODEL_PATH)
    print(f"Model saved at {MODEL_PATH}")
```

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```
    return history
def plot_training_history(history):
    plt.figure(figsize=(10, 5))
    plt.subplot(1, 2, 1)
    plt.plot(history.history['accuracy'], label='Train Acc')
    plt.plot(history.history['val_accuracy'], label='Val Acc')
    plt.title('Accuracy')
    plt.legend()
    plt.subplot(1, 2, 2)
    plt.plot(history.history['loss'], label='Train Loss')
    plt.plot(history.history['val_loss'], label='Val Loss')
    plt.title('Loss')
    plt.legend()
    plt.tight_layout()
    plt.show()
def predict_fabric_pattern(image_path, class_labels):
    model = load_model(MODEL_PATH)
    img = load_img(image_path, target_size=(IMG_HEIGHT, IMG_WIDTH))
    img_array = img_to_array(img) / 255.0
    img_array = np.expand_dims(img_array, axis=0)
    predictions = model.predict(img_array)
    predicted_class = class_labels[np.argmax(predictions)]
    print(f"Predicted Fabric Pattern: {predicted_class}")
if __name__ == '__main__':
    train_generator, val_generator = create_data_generators()
    class_labels = list(train_generator.class_indices.keys())
```

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```
  model = build_cnn_model(num_classes=len(class_labels))

  history = train_model(model, train_generator, val_generator)

  plot_training_history(history)

  # Example prediction:

  # predict_fabric_pattern('dataset/test/floral/sample1.jpg', class_labels)
```

Source Code:

```
import os
import shutil
import random

# Paths
original_dataset_dir = 'dataset'  # change if needed
base_dir = '/content/fabric_data_split'
os.makedirs(base_dir, exist_ok=True)
train_dir = os.path.join(base_dir, 'train')
os.makedirs(train_dir, exist_ok=True)
val_dir = os.path.join(base_dir, 'valid')
os.makedirs(val_dir, exist_ok=True)

# Split ratio
split_ratio = 0.8  # 80% train, 20% validation
# Loop through class folders
for class_name in os.listdir(original_dataset_dir):
  class_path = os.path.join(original_dataset_dir, class_name)
  if os.path.isdir(class_path):
    images = os.listdir(class_path)
    random.shuffle(images)
    split_point = int(len(images) * split_ratio)
    train_images = images[:split_point]
    val_images = images[split_point:]

    # Create class folders in train and val
    os.makedirs(os.path.join(train_dir, class_name), exist_ok=True)
    os.makedirs(os.path.join(val_dir, class_name), exist_ok=True)
```

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```
    # Copy files
    for img in train_images:
      shutil.copy(os.path.join(class_path, img), os.path.join(train_dir, class_name, img))
    for img in val_images:
      shutil.copy(os.path.join(class_path, img), os.path.join(val_dir, class_name, img))
print("Dataset successfully split into train and valid folders ✅ ")
```

Dataset for Dress Pattern Dataset - Kaggle Link :-
https://www.kaggle.com/datasets/nguyngiabol/dress-pattern-dataset

Github Repository link:

https://github.com/Deepthi2226/Pattern-Sense

Project Demo Link:

https://drive.google.com/drive/folders/1BeMVez6ykDYWFxonzX0nxVOlGk4lpv4_?usp=sharing

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