AI&ML Project Documentation

Introduction

Project Title: Pattern Sense: Classifying Fabric Patterns Using Deep Learning

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Project Overview

Purpose: The purpose of this project is to build a deep learning-based image classification model that can accurately classify different types of fabric patterns. The tool aims to support industries in textile inspection, fashion technology, and inventory management by automating the process of pattern recognition.

Goals:

- Accurately classify fabric patterns such as checked, striped, floral, dotted, etc.
- Assist designers and quality inspectors in identifying pattern types.
- Build a scalable, reusable, and user-friendly system.

Key Features:

- Fabric pattern classification using a Convolutional Neural Network (CNN).
- Preprocessing pipeline for noise reduction and enhancement.
- Web-based interface for uploading fabric images.
- Real-time classification results with model confidence score.

Architecture

Frontend:

- **Framework Used:** HTML, CSS
- **Functionality:**
  - Users can upload fabric images.
  - Displays classification result and confidence score.
  - Intuitive and clean UI.

Backend:

- **Technology Used:** Python with Flask

- **Responsibilities:**
  - Handle image uploads from frontend.
  - Perform preprocessing and pass image to CNN model.
  - Return classification result to the frontend.
  - Manage exceptions and logging.
- **Model Integration:**
  - Trained CNN model (.h5) loaded during Flask app initialization.

Database:

- No persistent database implemented.
- Images are stored temporarily in static/uploads during session.

Setup Instructions

Prerequisites:

- Python 3.x
- Libraries: TensorFlow/Keras, Flask, NumPy, OpenCV, Pillow

STEP 1: Install Anaconda (optional)

- Visit https://www.anaconda.com/products/distribution

STEP 2: Create Virtual Environment

conda create -n pattern-sense python=3.9

conda activate pattern-sense

STEP 3: Install Required Packages

pip install tensorflow keras flask numpy opencv-python pillow

STEP 4: Run the Web Application

cd /path/to/project/files

python app.py

Visit http://127.0.0.1:5000 in your browser.

How to Use:

1. Launch the app.
2. Upload a fabric pattern image.
3. Click "Predict" to get classification result.
4. View image preview and model confidence.

Offline Usage

- Required files:
  - Trained model file (e.g., pattern_model.h5)
  - static/ and templates/ folders
- Ensure dependencies are pre-installed in the environment.

Folder Structure

PatternSense/

├── app.py

├── pattern_model.h5

├── static/

│ └── uploads/

├── templates/

│ ├── index.html

│ └── result.html

└── README.txt

Authentication

- No authentication currently implemented.
- Future enhancement: Add login with session tracking.

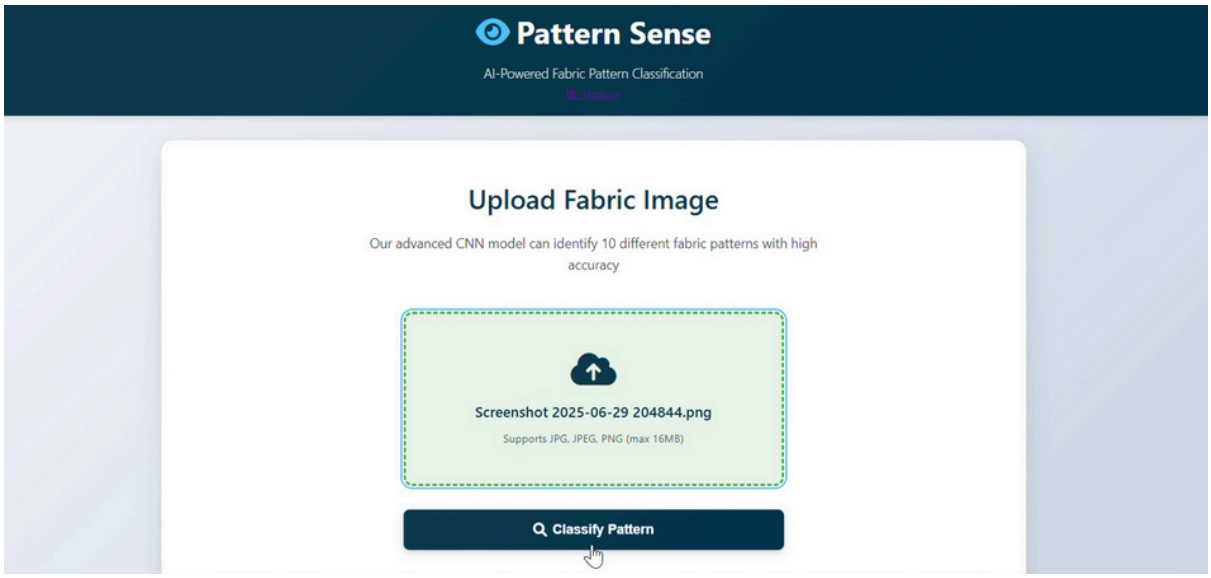
User Interface

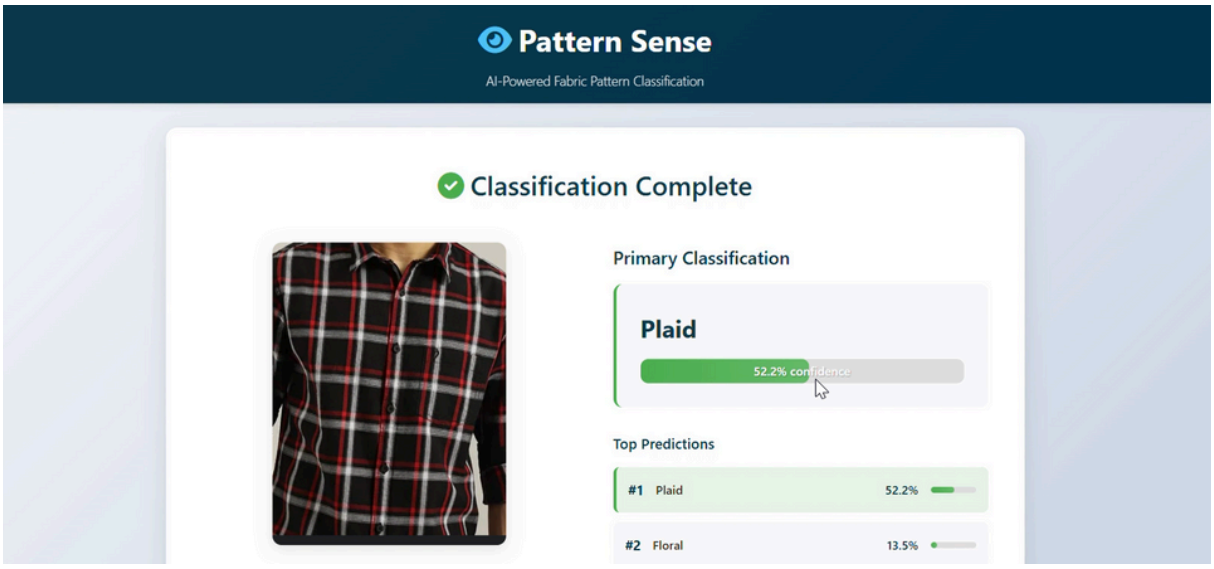
- Clean HTML form for image upload.
- Results displayed in an organized layout.
- Responsive and beginner-friendly.

Testing

- Manual testing with unseen fabric images.
- Checked model accuracy and confusion matrix.
- Validated frontend-backend communication.

Screenshots or Demo





Known Issues

- Lower accuracy for low-light or blurry images.
- Limited generalization to unseen pattern categories.

Future Enhancements

- Expand dataset with more pattern types.
- Implement login and result history.
- Deploy as cloud API.
- Add support for multi-pattern detection.

Conclusion Pattern Sense effectively demonstrates how deep learning can automate the fabric pattern recognition process. It provides a foundation for AI-assisted quality control in the textile industry.

References

- TensorFlow Documentation: https://www.tensorflow.org/

- Keras API: https://keras.io/
- Flask Documentation: https://flask.palletsprojects.com/
- OpenCV Library: https://opencv.org/