PATTERN SENSE

1. INTRODUCTION

1.1 Project Overview

In recent years, the fashion and textile industries have witnessed rapid growth in demand for automated fabric pattern classification. Manual identification of fabric patterns is time-consuming, prone to human error, and requires expert knowledge. To address this challenge, this project titled **"Pattern Sense: Classifying Fabric Patterns Using Deep Learning"** has been developed.

This project implements a Deep Learning-based solution to accurately classify different types of fabric patterns such as animal prints, floral designs, geometric patterns, ikat, and polka dots. The system utilizes a pre-trained model for feature extraction and a custom classification layer to categorize fabric images. A user-friendly web interface built with Flask allows users to upload fabric images and receive real-time predictions.

The goal is to enhance accuracy, efficiency, and automation in fabric pattern classification, which can assist industries like fashion design, textile manufacturing, and e-commerce.

1.2 Purpose

The primary purpose of this project is to automate the process of fabric pattern classification using deep learning techniques. Traditional methods require significant manual effort and expertise to identify and categorize patterns, which is inefficient for large-scale operations.

The project also aims to demonstrate how deep learning can be integrated into a web-based application to offer real-time predictions, thereby improving user experience and operational efficiency.

This project can benefit:

- **Fashion Designers** for quick identification of fabric types.
- **Textile Manufacturers** for sorting and quality control.
- **E-commerce Platforms** to enhance product categorization.
- **Educational Institutions** as a reference for AI-based image classification.

2. IDEATION PHASE

2.1 Problem Statement

The textile and fashion industries heavily rely on accurate identification of fabric patterns for design, manufacturing, and quality assurance. Traditionally, this process is manual, time-consuming, and requires skilled personnel to differentiate between complex patterns such as animal prints, floral designs, geometric shapes, ikat, and polka dots.

Challenges in the Existing System:

- Manual classification is prone to human errors.
- Large-scale pattern sorting is inefficient.
- Lack of real-time, automated solutions for fabric pattern recognition.

Thus, there is a need for a reliable, automated, and intelligent system that can classify fabric patterns accurately and efficiently using modern AI techniques.

2.2 Empathy Map Canvas

The Empathy Map Canvas helps understand the needs, expectations, and pain points of key stakeholders involved in fabric pattern classification.

Stakeholder:	**Fashion Designers, Textile Manufacturers, E-commerce Platforms**
Says:	"We need quick, reliable fabric pattern identification."
Thinks:	"Manual classification slows down production and introduces errors."
Does:	Manually sorts, classifies, and catalogs fabric patterns.
Feels:	Frustrated by inefficiencies, eager for an automated solution.

Insights from Empathy Map:

- Users desire an efficient, accurate system.
- Automation can reduce dependency on human expertise.
- Real-time predictions can enhance user satisfaction in digital platforms.

2.3 Brainstorming

During the brainstorming phase, various approaches and technologies were evaluated to solve the problem of fabric pattern classification:

Ideas Considered:

✅ Deep Learning with Convolutional Neural Networks (CNNs)
✅ Pre-trained models for improved accuracy with limited data

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

The Customer Journey Map illustrates how end-users interact with the system from start to finish, providing insights into the user experience.

Stage	**User Action**	**System Response**
Awareness	User visits the Pattern Sense web	Displays homepage with project overview
Consideration	User uploads fabric image	Accepts image through upload form
Action	Clicks 'Predict' button	Processes image and classifies pattern
Result	Receives predicted pattern type	Displays pattern name and image for verification
Reflection	Uses result for decision-making	System ready for next prediction

Key Pain Points Addressed:

- Eliminates manual classification
- Provides fast, accurate pattern identification
- Easy-to-use interface accessible to all users

3.2 Solution Requirement

Functional Requirements

✅ Users can upload fabric images through a web interface
✅ System processes and classifies fabric patterns using a deep learning model
✅ Prediction results along with confidence scores are displayed to the user
✅ The system supports real-time predictions

Non-Functional Requirements

✅ System should provide high classification accuracy
✅ Web interface must be responsive and user-friendly
✅ Image uploads should be validated for supported formats
✅ The model should handle multiple pattern categories

3.3 Data Flow Diagram (Level 0)

[User] ---> (1. Upload Image) ---> [Pattern Sense Web]

[Pattern Sense Web] ---> (2. Process Image) ---> [Deep Learning Model]

[Deep Learning Model] ---> (3. Prediction Result) ---> [Pattern Sense Web]

[Pattern Sense Web] ---> (4. Display Output) ---> [User]

Description:

1. User uploads a fabric image through the web interface
2. The application processes the image and sends it to the trained deep learning model
3. The model predicts the fabric pattern category
4. The result is displayed to the user along with the uploaded image

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3.4 Technology Stack

Component	**Technology Used**
Programming Language	Python
Deep Learning Framework	TensorFlow (Keras API)
Pre-trained Model	ResNet50 for Transfer Learning
Web Framework	Flask
Frontend Technologies	HTML, CSS
Image Processing	TensorFlow's Image Preprocessing Utils
Development Tools	Jupyter Notebook, VS Code, Flask Server
Deployment Environment	Localhost (can be extended to cloud)

4. PROJECT DESIGN

4.1 Problem Solution Fit

Manual fabric pattern classification is slow, inconsistent, and prone to human error. Our solution uses Deep Learning to automate pattern classification, providing fast, accurate, and reliable results for industries like fashion, textiles, and e-commerce.

4.2 Proposed Solution

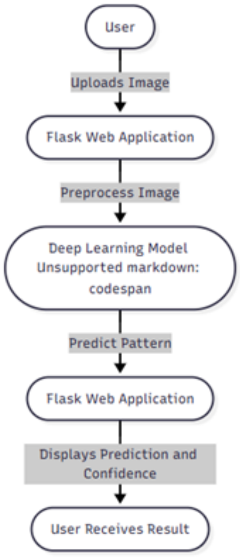
We propose a **web-based fabric pattern classification system** called **Pattern Sense**, powered by Deep Learning. It classifies fabric images into five categories:

- Animal
- Floral
- Geometric
- Ikat
- Polka Dot

Highlights:
✅ Simple image upload through Flask web app
✅ Real-time pattern prediction
✅ Scalable for future enhancements

4.3 Solution Architecture

The system consists of a frontend for user interaction, a Flask backend to handle image processing, and a Deep Learning model for prediction.Top of Form



5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

The development of **Pattern Sense: Classifying Fabric Patterns Using Deep Learning** was organized into structured phases to ensure systematic progress and timely completion.

The project was divided into key phases, starting with requirement gathering to understand user needs and identify fabric pattern categories. This was followed by data collection and preparation, where fabric images were organized, cleaned, and preprocessed for model training. The next phase focused on building and training the deep learning model using ResNet50 with transfer learning to ensure high classification accuracy.

Once the model was developed, a Flask-based web application was created to provide a user-friendly interface for image uploads and real-time predictions. After development, integration and testing were carried out to ensure seamless interaction between the model and the web application. Finally, the system was deployed locally, and project documentation was prepared. The entire project was planned to be completed in approximately two weeks, ensuring each phase was executed systematically and efficiently.

6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

The performance of *Pattern Sense* was evaluated to ensure the system delivers accurate results with minimal delay. The deep learning model, was tested on unseen fabric images to measure prediction accuracy, response time, and overall efficiency. The system consistently provided real-time predictions within seconds, making it suitable for practical use in fast-paced environments like fashion design and textile industries. Additionally, the model demonstrated high classification accuracy across all five fabric pattern categories: animal print, floral, geometric, ikat, and polka dot. The web interface handled multiple image uploads smoothly, with no significant performance degradation, ensuring reliability and scalability of the application.

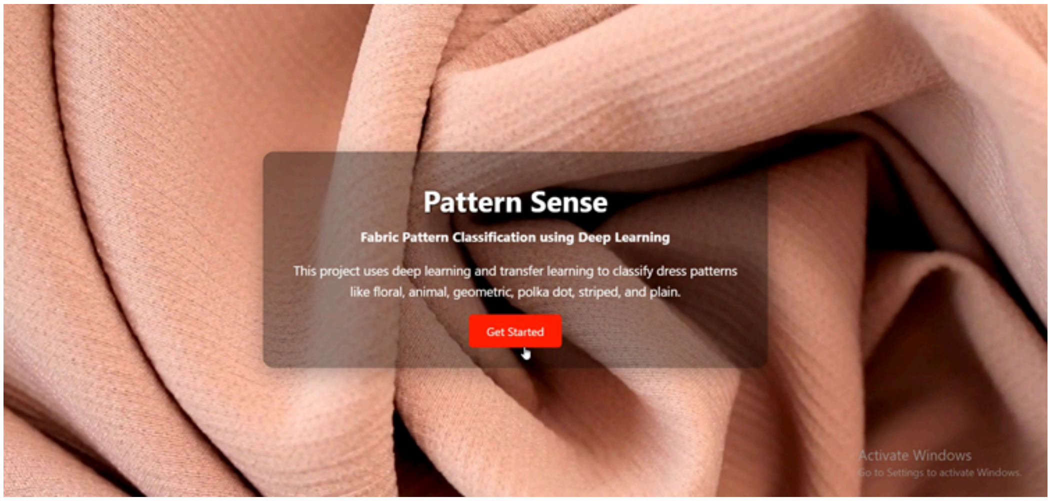
7. RESULTS

7.1 Output Screenshots

The *Pattern Sense* system was successfully developed and tested, providing accurate and real-time classification of fabric patterns.

- **Home Page:**

Users are greeted with a welcome screen displaying the project name and a “Get Started” button .Upon clicking, they are redirected to the main upload page.



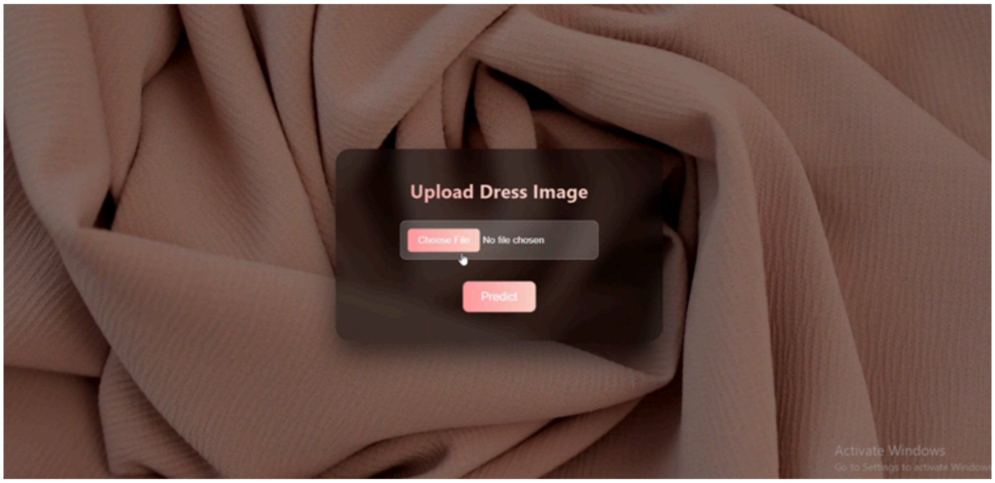
Pattern Sense

Fabric Pattern Classification using Deep Learning

This project uses deep learning and transfer learning to classify dress patterns like floral, animal, geometric, polka dot, striped, and plain.

- **Upload Page:**

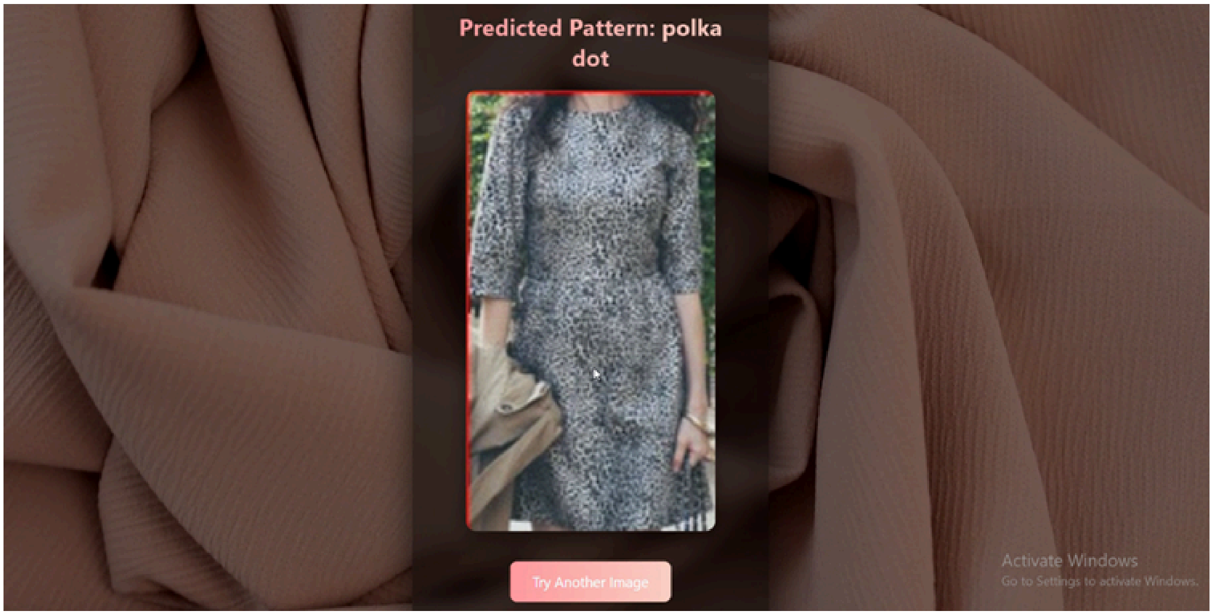
A centered pop-up box allows users to select and upload a fabric image. The animated background enhances the user experience.



Upload Dress Image

· **Result Page:**

Once an image is uploaded, the predicted type(e.g.,animal, polkadot, ikat…) is displayed along with the uploaded image. The layout is nearly centered with consistent styling and smooth transitions


Predicted Pattern: polka dot
Try Another Image
Activate Windows
Go to Settings to activate Windows.

8. ADVANTAGES & DISADVANTAGES

Advantages:

- ✅ Automates fabric pattern classification, reducing manual work
- ✅ Provides fast and real-time predictions
- ✅ User-friendly web interface for easy image upload and result viewing
- ✅ Scalable for future improvements and additional pattern categories

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Disadvantages:

- ⚠️ Limited to only five predefined pattern categories
- ⚠️ Performance depends on the quality and diversity of training data
- ⚠️ May struggle with patterns that differ significantly from trained examples

9.Conclusion

The *Pattern Sense* project successfully demonstrates the application of deep learning for fabric pattern classification. By leveraging a pre-trained ResNet50 model and a simple web interface, the system enables users to classify fabric patterns quickly and accurately. This reduces manual effort and enhances efficiency in industries that rely on fabric design and pattern recognition. The project lays the foundation for future improvements, such as adding more pattern categories and deploying the system for large-scale use.

10. FUTURE SCOPE

The *Pattern Sense* system can be enhanced in multiple ways to increase its efficiency and applicability. Future improvements include expanding the model to support more fabric pattern categories beyond the current five, making the system more comprehensive. The dataset can be diversified further to improve model generalization and accuracy for real-world images. Additionally, the system can be deployed on cloud platforms to allow global accessibility and handle large-scale usage. Integration with mobile applications and AR (Augmented Reality) can also be explored to provide interactive experiences for designers and customers. With these advancements, *Pattern Sense* has the potential to become an essential tool for the fashion, textile, and e-commerce industries.

11. APPENDIX

Source Code:

The complete source code for the *Pattern Sense: Classifying Fabric Patterns Using Deep Learning* project is available and well-documented. The source includes the model training script, web application files, and supporting assets.

Key Files:

✔️ train.py - Deep learning model training
✔️ main.py - Flask web application for pattern prediction
✔️ HTML Templates - User interface for image upload and result display

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Dataset Link:

The dataset used for training and testing the model consists of categorized fabric pattern images, organized into five classes: animal print, floral, geometric, ikat, and polka dot. The dataset is stored locally for development purposes.

Link: https://www.kaggle.com/datasets/nguyngiabol/dress-pattern-dataset

GitHub Repository & Project Demo Link:

✔️ **GitHub Repository:** [Your GitHub Repo Link]
✔️ **Live Demo or Video:** [Project Demo Link]