Project Documentation

# Project Title

**Pattern Sense: Classifying Fabric Patterns Using Deep Learning**

# Team Members

Team ID : LTVIP2025TMID35328

Team Leader : N Jaswanth

Team member : B Govardhana Reddy

Team member : Himanth Mandala

Team member : Mamuduru Jagadeesh

**Phase 1: Brainstorming & Ideation**

## Objective:

Generate a viable and innovative idea to classify fabric patterns using deep learning.

## Key Points:

* **Problem Statement:** Manual sorting of fabric patterns is inefficient, subjective, and unscalable.
* **Idea:** Build an AI-powered image classification system that can detect and label fabric patterns like floral, striped, geometric, Ethnic style etc.
* **Inspiration**: Challenges in textile/fashion industries, high demand for automation.
* **Technologies Considered:** CNN, TensorFlow, OpenCV, Flask/Streamlit, Transfer Learning (ResNet50/MobileNet).
* **Final Direction:** Train a CNN model and deploy it via a simple web interface for easy use.

# Phase 2: Requirement Analysis

### Objective:

Identify functional and technical requirements of the solution.

### Functional Requirements:

* Upload an image of fabric through a web interface.
* Predict and display the pattern class (e.g., Ethnic style, geometric).
* Display a confidence score.

### Non-Functional Requirements:

* Real-time prediction (under 2 seconds).
* Accuracy above 85%.
* Responsive and secure deployment.

### Technology Stack:

* Python, Flask, TensorFlow/Keras, OpenCV.
* **Dataset:** Kaggle clothing pattern dataset + custom augmentation.

### Data Flow:

User → Web UI → Flask Backend → CNN Model → Predicted Output

# Phase 3: Project Design

### Objective:

Plan the system architecture and UI components.

### Key Points:

* **Architecture:**

User uploads image via frontend.

Flask backend handles preprocessing and inference. CNN predicts the pattern and returns output to user.

### Model Design:

Transfer learning with MobileNet/ResNet50.

**Image preprocessing:** resize, normalize.

**Metrics:** Accuracy, Precision, Recall, F1-score.

* UI/UX Design:

Simple upload button.

Clear output with label and confidence score.

# Phase 4: Project Planning (Agile)

### Objective:

Divide project into iterative sprints for timely execution.

### Sprints:

* Sprint 1: Dataset cleaning and augmentation.
* Sprint 2: Model training and evaluation.
* Sprint 3: Web UI development (Flask).
* Sprint 4: Integration, testing, documentation.

**Project Tools:** GitHub, Jupyter Notebook, VS Code

# Phase 5: Project Development

### Objective:

Develop the model and integrate it with the interface.

### Technology Stack:

* Frontend: HTML/CSS (minimal Flask templating)
* Backend: Flask (Python), TensorFlow/Keras
* Model: Transfer Learning (ResNet/MobileNet), trained on augmented dataset
* **Deployment:** Local server / Streamlit / Docker (optional)

# Phase 6: Functional & Performance Testing

### Objective:

Ensure system accuracy and speed meet expectations.

### Performance Results:

* Accuracy: 87.2%
* Precision: 86.5%
* Recall: 88.0%

- F1-Score: 87.2%

* Inference Time: ~1.89 sec per image
* UI Responsiveness: Under 2 sec for full prediction cycle

### Test Types:

* Unit Testing (model input/output)
* Integration Testing (UI + backend)
* User Testing (for usability)

# Final Submission

### Deliverables:

* Trained Model (.h5/.pb)
* Flask Application Source Code
* Documentation (this file)
* Dataset Source Reference
* Demo video

# Github Link

https://github.com/jaswanth-code/Pattern-Sense-Classifying-Fabric-Patterns-using-Deep-Learning

# Conclusion

This project demonstrates the power of deep learning in textile pattern recognition. It achieves reliable performance, reduces manual effort, and provides a scalable solution for fabric classification in fashion-tech environments.

# Future Scope

* Mobile app integration
* Multi-label classification (e.g., texture + pattern)
* Real-time camera-based predictions
* REST API for third-party integration
* Edge deployment using TensorFlow Lite