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Application of AI in Garment Industry

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Textile-Damage Detection

Imagine a robot with super-eyes, that's AI looking at clothes! AI helps find boo-boos in fabric super fast. Let's see how AI keeps our clothes perfect!

How Does AI "See" Fabric Flaws?

AI Learns "Good" Fabric

AI studies what perfect fabric looks like, like learning the alphabet!

Training with Pictures

It sees many pictures of good and bad fabric to understand differences.

Spotting Mistakes

Then, AI spots mistakes like a puzzle master finding missing pieces!

AI can find holes, stains, or uneven colors in fabric. It learns what is normal, then flags anything that is not.

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Textile-Damage Detection

AI to the Rescue: Finding Textile Troubles

1 — **AI Cameras Watch**

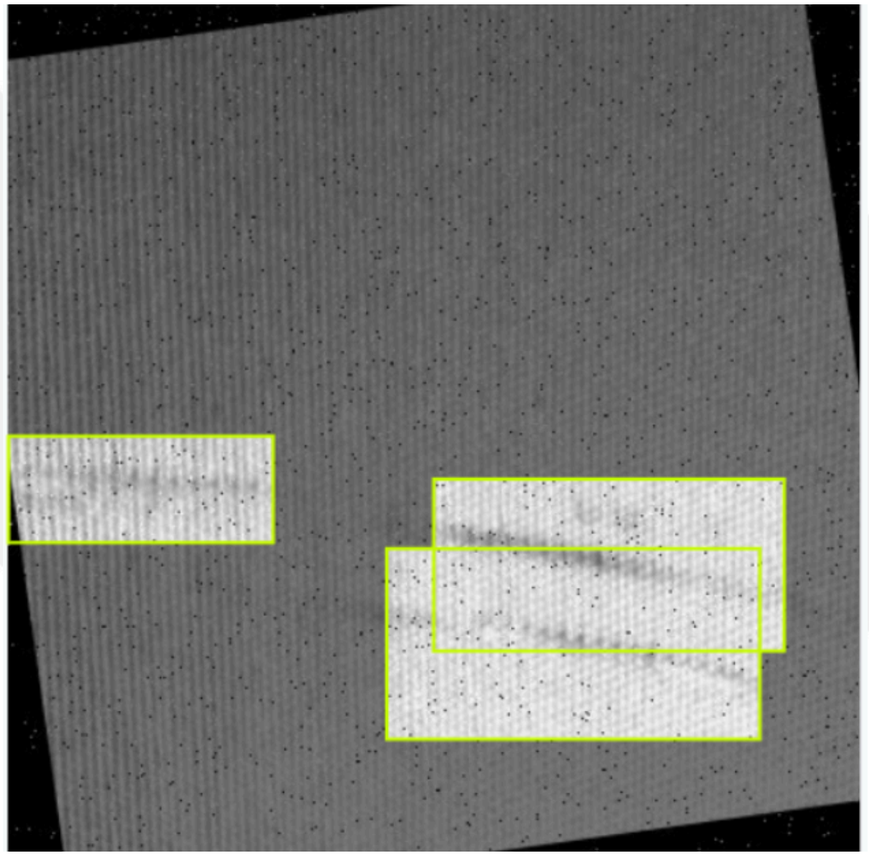
Factories use AI cameras to check fabric as it's made.

2 — **Pictures are Taken**

The AI camera takes a picture of the fabric.

3 — **AI Checks Every Inch**

The AI quickly looks for issues and doesn't get tired!



It's like having a superhero inspector watching every thread, making sure nothing is missed. This helps production stay efficient.

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Textile-Damage Detection

Dataset Information

- **Source**: Roboflow (textile-defect-ig0ek dataset)
- **Split**:
  - Training: `train/images/`
  - Validation: `valid/images/`
  - Testing: `test/images/`
- **Class**: Single class ('0' - defect)
- **Format**: YOLO format annotations

Model Details

- **Base Model**: YOLOv8-nano
- **Architecture**:
  - Input size: 640x640 pixels
  - Number of classes: 1 (defect detection)
  - Backbone: CSPDarknet
  - Neck: PANet
  - Head: Detection head

Parameters

1. **Training Parameters**:
   - Batch size: 8
   - Epochs: 100
   - Image size: 640x640
   - Learning rate: Auto (AdamW optimizer)
   - Augmentation:
   - Mosaic: 0.5 probability
   - Mixup: Disabled
   - Copy-paste: Disabled

2. Model Parameters:
   - Confidence threshold: 0.25
   - IoU threshold: 0.7
   - Max detections: 300

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Textile-Damage Detection

What We're Predicting

Task: Object Detection

- Output:
  - Bounding boxes around defects
  - Confidence scores
  - Class predictions

- **Metrics**:
  - mAP50 (mean Average Precision at IoU 0.5)
  - Precision
  - Recall
  - F1-score

Performance Metrics

- Real-time processing capability
- High detection accuracy
- Low false positive rate
- Fast inference speed

Output

- Trained model saved as 'textile_defect_model.pt'
- Training logs and metrics in 'runs/train/'
- Visualization of predictions
- Performance metrics and graphs

Training Process

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
61/100	1.34G	1.171	0.8405	1.239	7	640:
	Class	Images	Instances	Box(P	R	mAP50
	all	1005	1209	0.895	0.897	0.933

1. Data preprocessing
2. Model initialization with pretrained weights
3. Training with early stopping (patience: 50)
4. Validation on separate dataset
5. Model saving and evaluation

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Inventory Management

Welcome & Introduction

Smarter Sales with AI

What if we could **predict which clothes will sell more next month?**
That’s what this simple **AI tool** helps us do!
Let's see how it can help **you**, the **people behind the production and selling** of our garments.

Inventory Management

Too Much Stock? Not Enough Stock?

Sometimes we make **too many pieces** of one item that doesn't sell.

- Other times, **popular items run out** too soon.
- This leads to **wasted fabric**, **lost profits**, and **frustrated customers**.

How the AI Tool Works?

- AI looks at: Date of sales, Product categories, Past sales numbers. It finds patterns (e.g., "Sarees sell more during festivals").
- Then, it predicts how much of each item will be needed in the future.

🎯 "It's like guessing demand — but more accurate!"

Inventory Management

How This Helps You

✔**Cut Waste**: Produce just the right amount — not too much, not too little
✔**Better Planning**: Know what's in demand — get materials and staff ready in advance
✔**More Sales**: Always have best-sellers ready when customers ask
✔**Less Stress**: Avoid last-minute changes in orders

Inventory Management

Dataset Overview

Columns in Dataset:

- **DATE → Date of sale**
- **VALUE → Unit price (₹ per kg)**
- **PFco_Code → Fabric/Product code (categorical)**
- **Total_values → Total transaction value (₹)**
- **QUANTITIES_Kgs → Quantity sold (Target Variable)**

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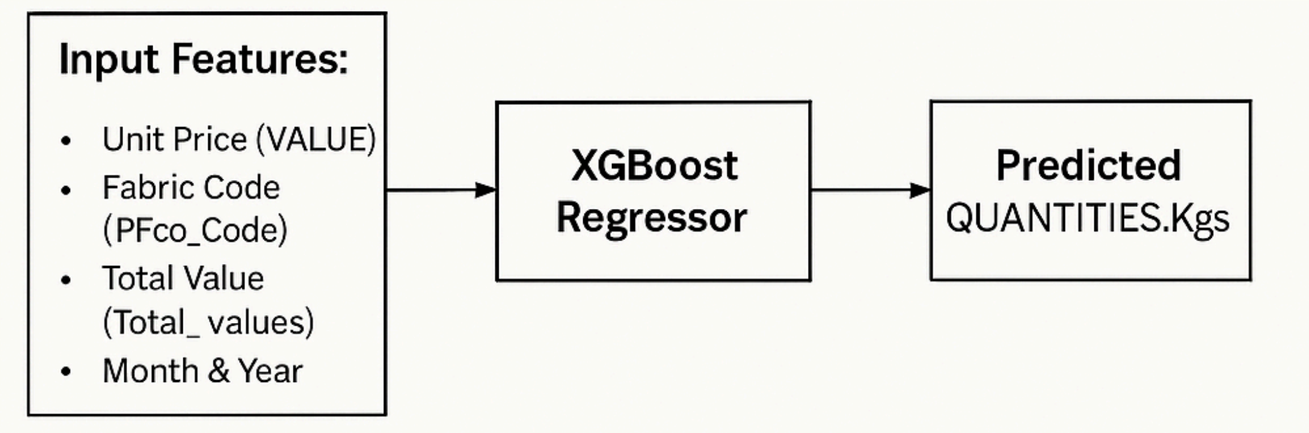
Inventory Management

How the ML Model works?

What Are We Predicting? The amount of fabric that will be sold in kilograms.

Which Model? XGBoost Regressor — a powerful algorithm using decision trees.

Why XGBoost? Fast and accurate and can handle complex relationships in data



Demand Prediction

How Demand Works — A Simple View for Shop Owners

Imagine you run a clothing shop. You want to know:
"How many shirts will I sell this Monday?"
That’s called predicting demand — figuring out how much stock you'll need ahead of time.

Demand Prediction

What affects demand?

Here are some everyday things that influence how much people buy:

- Day of the Week: People shop more on weekends!
- Events or Holidays: Sales go up during festivals and holidays.
- Product Type: Jackets sell more in winter; T-shirts in summer.
- Location: Rainy cities sell fewer summer clothes.
- Discounts: A 30% off sale gets more buyers than 5%.
- Weather: Cold weather boosts demand for warm clothes.
- Gender & Size: Depending on the area, Men's or Women's items may sell more.

These are called features or factors — and we use them to understand patterns in customer behavior.

Demand Prediction

How Does Machine Learning Help?

Instead of guessing, we use a machine learning model that:

- Looks at your past sales (e.g., 1 year of data)
- Learns how different factors (day, price, weather, etc.) affect sales
- Predicts future demand automatically

So next time you ask:

"How many jeans should I stock for Friday?"

You just enter some details into the app — and it tells you:

📜 "You'll likely need 83 jeans."

Why It's Helpful for Shopkeepers

No guesswork — avoid understocking or overstocking
Less waste — no extra unsold clothes
Better planning — order only what's needed
Smart decisions — made by your data!

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AI Worker Helper

What Is AI & ML? Your New Helper

AI = **Computer Brain**: Think of it as a smart helper that learns from past stitching patterns.
ML = **Learning from Data**: Just like you learn by practicing stitches, ML learns by looking at numbers like how fast you sew or how thick the cloth is.

Why It Helps You:

Fewer Mistakes: Alerts you when you're about to make more stitch errors.

Work Steady: Suggests best speed so your hands and machine don't get overwhelmed.

More Earnings: Less rework means more finished pieces and more pay.

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AI Worker Helper

AI in Your Daily Stitching

- **Predict High-Error Batches**: AI checks your speed, cloth thickness, and experience to warn if errors may spike.
- **Set Best Speed**: It tells you a comfortable stitches-per-minute so fewer loose threads or skipped stitches.
- **Right Cloth, Right Settings**: For very thick cloth, AI suggests slowing down; for thin cloth, you can safely speed up
- **One Light, Zero Code**: See a green light for “go ahead” or red light for “slow down.” No typing, no apps.

AI Worker Helper

🧵 Dataset Summary: What We Collected

We used real-world stitching factors to train the AI:

Column Name	What It Means (Layman Terms)
`Speed`	How fast you stitch (stitches per minute)
`Fabric_Thickness`	Type of cloth: thin (1), medium (2), or thick (3)
`Experience_Years`	How long you've been stitching (in years)
`Error_Count`	How many mistakes were made in a batch
`High_Error_Risk`	AI's label: 1 = "risky batch", 0 = "safe batch"

📊 **Total Rows:** 1000 worker entries (each = 1 batch stitched)

✅ **Target Column:** `High_Error_Risk` – this is what the AI predicts.

ML approach

🤖 **Machine Learning Architecture:** How AI Thinks
We used a Decision Tree Model – like a flowchart AI uses to decide "risky" vs. "safe":
Input: Speed, cloth type, experience
Check:
Is stitching too fast for thick cloth?
Is the worker less experienced?

Output:
“Green light” (safe batch) or
“Red light” (high chance of errors)
🧠 Why Decision Tree?
Simple & fast – perfect for real-time alerts
Easy to explain to workers (like following yes/no steps)

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AI Worker Helper

Analysis & Take-Home Points

- ✔️ **Reliable Safe Batches:** Most green-lighted batches really are safe (88% recall).
- ✔️ **Strong Warning Signal:** Red-light warnings are accurate (82% precision), so workers can trust slowdown alerts.
- ⚠️ **Missed Risks:** AI still misses about 36 out of 100 truly risky batches—so human judgment remains important.
- 💡 **Practical Use:**
  - **Green Light (0):** Keep stitching at this speed/setting.
  - **Red Light (1):** Slow down or ask for help—AI caught a pattern that may cause more mistakes.
- 📈 **Business Impact:** Fewer reworks → faster production → more pay for safe batches

What is Computer Vision

🔍 What is Computer Vision?

- It's like giving **eyes and brain** to a computer
- Helps it **see and recognize patterns** in images
- Just like we identify clothes by looking, **AI learns to do the same!**

Why Computer Vision

Why It Matters for the Garment Industry

- 🏭 **How it helps:**
  - ✔️ **Sorts clothes automatically** in warehouses
  - ✔️ Makes **online shopping smarter** (find similar items)
  - ✔️ Helps manage **inventory faster**
  - ✔️ **Reduces human error**

Why Computer Vision

Layman Analysis & Take-Home Points

- ✔ Smarter Stores
- ✔ Faster Procesing
- ✔ Happier Customer

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Precision Fashion: HOG and KNN for Image Classification

Objective

Classify fashion images with high accuracy. We leverage Histogram of Oriented Gradients (HOG) for feature extraction. K-Nearest Neighbor (KNN) handles the classification. It performs well even on small datasets.

HOG Features

Extract rich descriptive features from images. This captures object shape and appearance. It focuses on gradient orientation and magnitude.

KNN Classification

Utilize K-Nearest Neighbors for robust classification. It finds the closest training examples. This determines the class of a new data point.

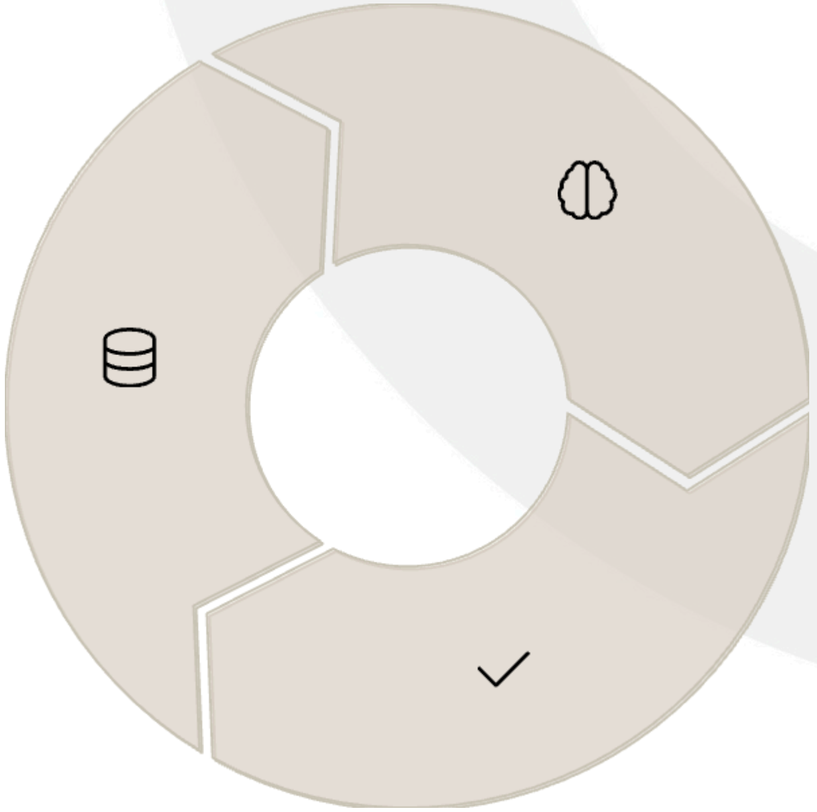
How AI Helps in Fashion Image Classification

- **Automates Product Tagging:** AI models classify fashion items (e.g., "Dress", "T-shirt") from images, eliminating manual labeling.
- **Learns Visual Patterns:** Through Histogram of Oriented Gradients (HOG) feature extraction and K-Nearest Neighbors (KNN) classification, the system learns how product types differ visually.
- **Improves Accuracy and Consistency:** AI ensures uniform classification, even on thousands of images, reducing human errors.
- **Scalable to Larger Systems:** This classical AI approach is a foundation for more complex deep learning models (e.g., CNNs), enabling smart search, recommendations, and trend analysis.

Training and Evaluating the KNN Model

Data Splitting

Divide the dataset into training and test sets. This ensures unbiased model evaluation. Typically 80% for training, 20% for testing.



Model Training

Train the KNN classifier. It uses the extracted HOG feature vectors. The model learns patterns from the training data.

Performance Evaluation

Achieve around 98% accuracy. Validate through confusion matrices. Classification reports provide detailed metrics. This ensures reliable performance assessment.

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Why HOG-KNN is a Game Changer

98%

Accuracy

High classification accuracy achieved. Validated across diverse fashion items.

500

Small Data

Especially suitable for small image datasets. Avoids complex deep learning models.

1

Interpretability

Lightweight and easily interpretable solution. HOG features are visually intuitive.

100%

Extendability

Easily extendable to other datasets. Adaptable to various image classification tasks.

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THANK YOU

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