

# IMPROVEMENTS IN TEXTILE INDUSTRY USING AI/ML

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*"By far the greatest danger of Artificial Intelligence is that people conclude too early that they understand it."*

*BY: - Eliezer Yudkowsky*

## 1.ABSTRACT

The textile industry is one of the oldest and most important industries in the world. It is also an industry that is constantly evolving and changing. In recent years, one of the biggest changes to the textile industry has been the introduction of artificial intelligence (AI). The textile industry has a detrimental impact on the environment and faces challenges to meet climate and environmental goals. The core problem is its linear system where only a small fraction of used garments is reused or recycled.

AI is already having a major impact on the textile industry and is only going to become more important in the future. There are many different ways that AI is being used in the textile industry, including:

1. Automated design: AI can be used to create new designs for textile products automatically. This can be done by either creating new designs from scratch or by modifying existing designs.

2. Manufacturing: AI can be used to help automate the manufacturing process of textile products. This includes tasks such as fabric cutting, sewing, and printing.
3. Quality control: AI can be used to help improve the quality control of textile products. This includes identifying defects in products and making sure that they meet customer specifications.
4. Sales and marketing: AI can be used to help with sales and marketing of textile products. This includes tasks such as identifying potential customers and helping to promote products to them.

Data mining studies, including classification and clustering techniques and machine learning algorithms, implemented in textile industry were presented and explained in detail in this report to provide an overview of how clustering and classification techniques can be applied in the textile industry to deal with different problems where traditional methods are not useful.

## 2. PROBLEM STATEMENT

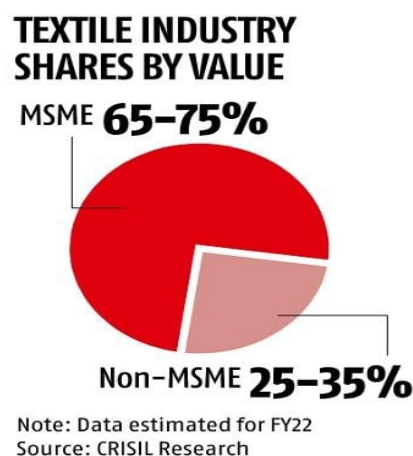
Some problems/challenges that textile industry faces in the current landscape:-

- Fabric defects can reduce the value of the textile.
- Manually doing pattern inspection by human inspectors is an inefficient way to ensure product quality.
- Through location intensive study, the research resulted into a classification system based on the following dimensions of the challenges faced:
  - (i) Personal, cultural and social: Included family, culture and society issues.
  - (ii) Logistical and financial: Included barriers related to machinery capital, rent, electricity and water, transport and supply etc.
  - (iii) Managerial and marketing: Encompassed issues related to labor, health, strategy and communication, competition etc.

### 3. ASSESSMENT

- MARKET NEED ASSESSMENT

The fashion marketing strategies are hugely depended on the marketing mix and fashion marketing mix in this case. The fashion marketing mix consists of the 4P's which are Fashion *product* the first, fashion *promotion* the second, fashion *place* the third and fourthly and lastly the fashion *price* (Armstrong, Kotler, & He, 2005).



- CUSTOMER NEED ASSESSMENT

Most informal micro and small businesses do not engage much in marketing but rely on word of mouth as their means of advertising, which means that they should always put the customer first. This is also the view of the Consumer Goods and Services Ombud, Adv. Neville Melville (2014: 1–2):

“If someone cannot treat customers fairly and honestly and provide quality goods and services at a reasonable price, one must question why they should be allowed to conduct a business at all.”

Product quality has two dimensions, namely the *physical features* (what the product is) and the *performance features* (what the product does or can do) so while using the product, customers reach satisfaction decisions by comparing

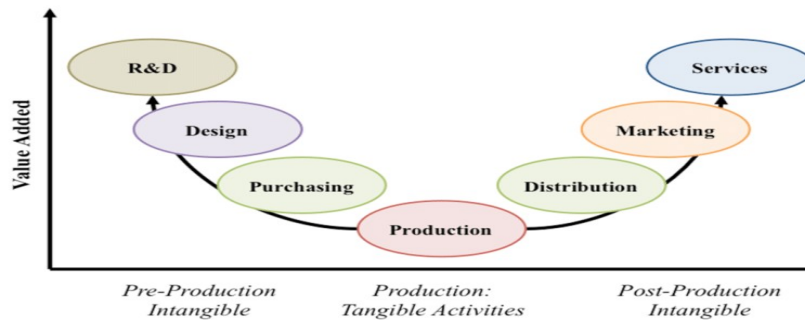
their prior expectations about how the product should perform with the perceived product performance, and note whether there is a difference or not .

- **BUSINESS NEED ASSESSMENT**



Looking at the Global scenario, Indian Govt. is also promoting man-made fibers and thus it is an alarm as well as opportunity to Textile Machinery Manufacturers for the development of machines and components especially for the processing of these fibers and also to the User Industry to decide the appropriate Machine Maintenance Management in order to have a smooth functioning of these MMF. Specifically those SME Enterprises working under Cluster activity in the decentralized sectors needs to revamp/restructure their Maintenance Management in a very systematic way in order to acquire the high performance functioning of these fibers.

## 4. TARGET SPECIFICATION



Here are some targets for the small business owners in fashion and textiles industry to pursue this decade are:-

- ✓ Use machine learning to make sure pieces of apparel or other goods are cut correctly so little to no fabric is wasted.
- ✓ Use a hybrid approach to optimize production processes in the industry with ML methods.
- ✓ Applying neural networks in machine learning in this industry help computers inspect fabrics and quickly identify defects.
- ✓ Make a systematic approach in segregating which finished products can be classified as rejects and which can be tagged as premium quality.
- ✓ Fabric color is part of a fashion designer's brand strategy, so making a mistake in color tinting can impact the reputation of your business.
- ✓ Product Tests
- ✓ Take Your Product to the Market
- ✓ Scale your Business

## 5. EXTERNAL SEARCH

The sources I have used as reference for analyzing the challenges that SMEs in the textile industry face in the current landscape and how E-commerce giants have been using the technique to boost up online sales, have mentioned below:

- ❖ [Machine-learning-textile-industry](#)
- ❖ [Challenges face by SMEs](#)
- ❖ [How to Help a Clothing Business to Grow](#)

## ❖ [How-artificial-intelligence-could-change-the-textile-industry](#)

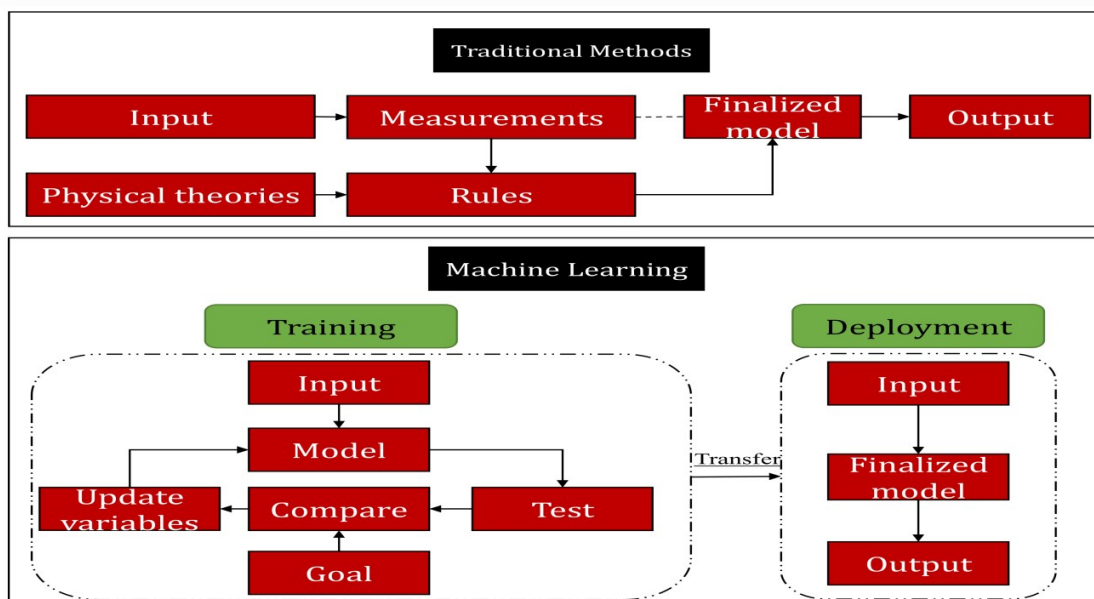
### 6. BENCHMARKING ALTERNATE PRODUCT

A clothing store has the advantage of a simple business model. You acquire inventory, display the inventory and market the inventory to drive traffic and sales. It's easier to launch than many businesses, and you can start small and build.

The downside is the effort and time required to track inventory, setup displays, market the business, as well as managing employees. That downside is consistent across most business models, but a small clothing and shoe store is especially difficult, as resources are often stretched thin and a small number of people are accountable for a significant amount of work.

In a standard clothing retail business, brands will require specific pricing and displays on their goods. The store owner is limited, and in some cases, they can't even discount older goods to move inventory. Brand requirements are a burden – in some cases – but popular brands sell well. That, ultimately, drives profits.

The upside to brand requirements is the brand doing their advertising and marketing to build demand around the product. They also research the display and pricing to maximize sales conversions. They want to succeed, and the retail store is critical for their business model.



## 7. APPLICABLE PATENTS

[Circular Textile and Apparel in India Policy Intervention Priorities and Ideas](#) :- This patent provides an overview of the textile sector and some components of circular economy, along with the priority areas that need focus in the coming years.

[Introductory paper on SMEs and Responsible Business Conduct in the Garment Sector](#) :- The current patent may incorporate this patent for survey results and key considerations.

There are a lot of patents that can be looked upon, but since these two relates the most so, I have mentioned them.

## 8. APPLICABLE REGULATIONS

- Use of chemicals for dyeing of clothes
- Being responsible by design, product and material.
- Delivery/Transportation:- legal framework Like Product defect

The directive applies to all types of products. Under the law, “product” is defined as all movables even if incorporated into another movable or an immovable.

- Accidents and safety law:-

An undertaking is defined by the set of activities carried out by an organization; this extends to the design and manufacture of products/clothes.

- Regulation of environmental damage and use of chemicals in general:-

The application of chemicals which may affect the environment is tightly controlled.

## 9. APPLICABLE CONSTRAINTS

- Increase in the cost of raw materials.
- Lack of skilled workforce.
- Continuous data collection and maintenance
- Taking care of rarely bought products, less wastage of fabric
- Water pollution, air pollution and solid waste pollution.

## 10. CONCEPT GENERATION

We find that ML technologies are being increasingly adopted in enterprises, but that small and medium-size enterprises (SME) are struggling with the introduction in comparison to larger enterprises.

These are major factors driving the AI growth in textile market:

- The increased request for quality products has resulted in automation and AI being used by the textile industry to reduce labor and manufacturing costs and to deliver items according to our customers' demands.
- The artificial neural network (ANN) technology makes it easier to spot defects in models like weaving and knitting.
- A high-performance LED lighting bar is produced by the machine with a powerfully coupling high-resolution camera to be mounted up to 90% by an electric motor. This is utilized for monitoring the fabric.
- Technologies like data analytics, NLP, and virtual assistants enable AI to provide optimal communication between manufacturers, manufacturing, retailers, and customers.
- Frontier is a cloud-based platform that uses an AI engine to accurately search our supplier database for the fabric pattern you need. The digital fabric swatches can also be used for 3D prototyping for a more convenient and efficient visualization process that can lead to faster product turnouts.

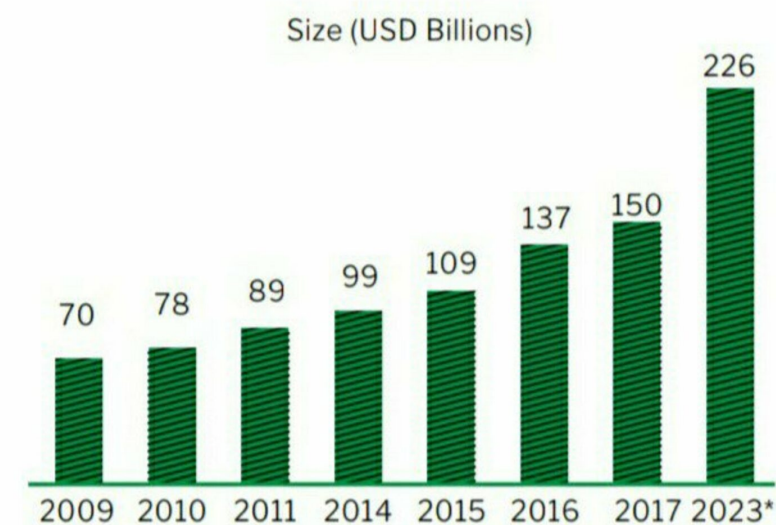
## 11. BUSINESS OPPORTUNITY

Both suppliers and fashion designers can benefit from the power of our AI-enhanced system to cut down logistics cost, expand the business network, access more extensive fabric design varieties, and churn out products quicker, as textile industry in India traditionally, after agriculture, is the only industry that has generated huge employment for both skilled and unskilled labor. The textile industry continues to be the second-largest employment generating sector in India. It offers direct employment to over 35 million people in the country. Keeping all the things mentioned here and other one's



previously under consideration, one thing is for sure to happen – market, business & customer needs are met to a greater extent, for sure. Now, this textile industry is highly multi-dimensional because it not only covers big enterprises but equally focuses on opportunities for small & medium enterprises.

### Textile and apparel industry in India



(Source: Ministry of Textiles)

\* Estimated

## 11. CONCEPT DEVELOPMENT

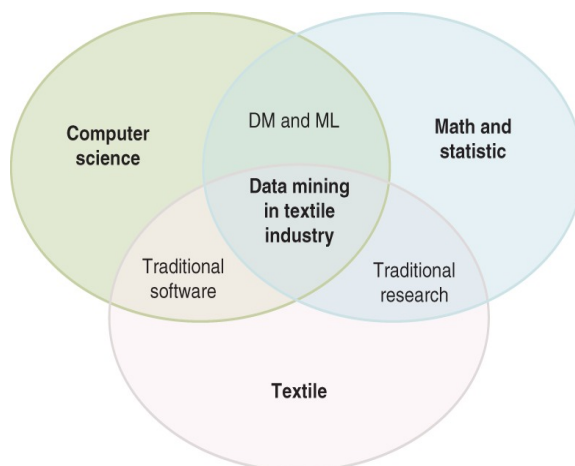


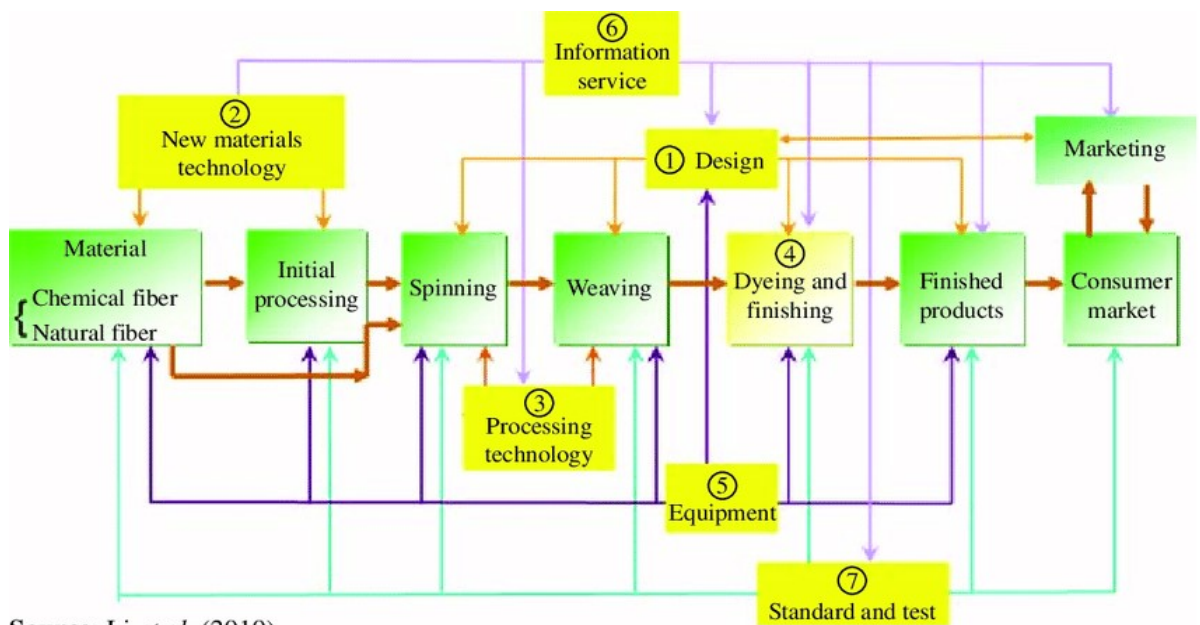
## 12. FINAL PRODUCT PROTOTYPE

The final product is a service that provides SMEs with detailed information on how to reduce wastage and opt out for AI and machine learning techniques instead of traditional methods and other similar useful insights into how to increase the sales of their business.

Application of data mining on the industry's product data, i.e., data related to a garment, such as fabric, trim, print, shape, and form. The purpose of this report is to use data mining and symmetry-based learning techniques on product data to **create a classification model** that consists of two subsystems: **(1) for predicting the garment category and (2) for predicting the garment sub-category**.

Classification techniques, such as Decision Trees, Naïve Bayes, Random Forest, and Bayesian Forest were applied on the available database.





Source: Li *et al.* (2010)

## 13. TECHNICAL SPECIFICATIONS

### 13.1 ALGORITHMS THAT CAN BE USED :-

The team will be developing the model at back end using these machine learning algorithms for Garment Classification:-

- Naïve Bayes (NB) Classification:- Naïve Bayes classifier is a probabilistic machine-learning model, which is a collection of classification algorithms based on Bayes' Theorem. It is considered fast, efficient, and easy to implement
- Decision Trees (DT):- Decision trees are one of the most widely implemented supervised learning algorithms and are considered a structured approach for multiclass classification. They are robust and can achieve high accuracy in various tasks while being accountable. The information gained by a decision tree during the training phase is formulated into a hierarchical structure. The development of DT usually involves two steps—induction and pruning—in the formation of a tree-like structure.
- Random Forest (RF):- A random forest is an ensemble of multiple decision trees. It is a popular and highly efficient ensemble method for supervised learning algorithms and can be used for both regression and classification. Bagging is the process of creating sub-training datasets using the existing

data with replacement. Thus, there could be duplicate values in the sample datasets. It is comparatively a faster method that can identify non-linear patterns in data and is a good solution to a common problem with decision trees of overfitting.

- Bayesian forest:- It draws the weights of the trees from an exponential distribution and the prediction is an approximate posterior mean.

## 13.2 TEAM REQUIRED

We need to understand what type of developers / engineers we need to work as a harmonious team and are as follows –

- ☐ Process engineers
- ☐ Computer software developer
- ☐ Fashion designer / experts
- ☐ Mechanical engineer
- ☐ Data Analyst
- ☐ Textile product developers
- ☐ Data scientist

## 13.3 VISUALIZATIONS ON REAL WORLD DATA

Here, I attached some examples of using AI/ML techniques in textile industry:-

- ❖ [Garment categorization using data mining techniques](#)
- ❖ [Fashion clothing product dataset for SMEs to draw some insights of this industry.](#)

## 14. CONCLUSION

Fully utilizing machine learning in the textile industry can drastically reduce manufacturing costs, wastage of fabrics and improve product quality.

The technology is still in the infancy stage, but traditional garment manufacturers are seeing the clear advantages of using AI-powered systems.

The opportunities that Machine Learning offers to SMEs were identified and described, relating the dimensions of business and technology. First, a literature review is developed. Then, the different perspectives in which the adoption of an improved decision-making process leads to an improvement in organizational performance are described in detail. Finally, recommendations are given for the development of decision-making processes based on Machine Learning.