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Study of the role that AI can play in the Sustainable Fashion Business

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Abstract:

This study investigates the potential application of artificial intelligence (AI) in the field of sustainable fashion by streamlining the production of clothing and incorporating trend analysis. By researching current fashion trends and consumer preferences to identify the most well-liked apparel patterns and designs, the article seeks to optimise supply and demand while reducing surplus production. Fashion garment production can be optimised to fulfil customer demand while minimising waste and lowering costs by incorporating trend research into the manufacturing process. Companies may now invest in clothing concepts that will sell thanks to AI trend forecasting, which reduces some of the uncertainty and human error that now hinder trend forecasting. The fashion industry is infamous for its detrimental effects on society and the environment, including creation of waste and pollution. While the fashion industry has started to adopt more sustainable practises, AI has the ability to quicken the process by offering creative answers to some of the sector's most pressing problems. The study looks at a number of AI-related case studies in the fashion sector, including the use of predictive analytics to cut waste and streamline supply chains, computer vision to enhance textile recycling, and natural language processing to encourage openness and moral work practises.

The paper also examines how AI could revolutionise the fashion business and hasten the shift to a more ethical and sustainable future. The report also highlights the necessity for careful evaluation of these concerns as the fashion industry develops by posing significant ethical and social implications for AI.

INTRODUCTION:

The fashion sector of the global economy has experienced rapid growth in recent years and is now one of the most active. The fashion industry is the second-largest polluter in the world, contributing significantly to greenhouse gas emissions, water pollution, and landfill waste, hence its growth has been harmful to the environment and society. Furthermore, there is a lot of labour exploitation going on, with many employees receiving meagre pay and bad working conditions. Because of this, sustainability has gained significance, and many fashion companies are putting sustainability programmes into place in order to lessen their negative effects on the environment while continuing to be profitable.

Artificial intelligence (AI) is being used to optimise production and manufacturing processes in the fashion sector to attain sustainability. AI is a technology that can carry out tasks and imitates human intelligence. that frequently call for cognitive processes related to perception, reasoning, and learning. Fashion companies may increase sustainability while maintaining profitability by utilising AI. In order to better understand how AI may be used in sustainable fashion enterprises, this research paper will focus on how it can be used to optimise production and manufacturing processes.

There are several ways to use AI to optimise the production and demand of fashion products. Utilising predictive analytics, which entails studying previous data to forecast future demand, is one approach. To estimate demand for diverse products, AI systems can examine a variety of elements like consumer behaviour, trends, weather patterns, and social media trends.

By forecasting demand and identifying slow-moving goods, AI can also be used to improve inventory management. By ensuring that they only produce products that are in high demand, this can help firms lower their inventory costs and increase cash flow.

The article examines how AI technology might be applied to improve the sustainability of the fashion industry as well as the issues that must be resolved in order for it to be widely adopted. This study explores the advantages and drawbacks of using artificial intelligence (AI) to the fashion industry in order to promote sustainable development. In conclusion, AI technology has the potential to be extremely important to the sustainable growth of the fashion industry, and this paper can serve as a roadmap for companies looking to integrate AI into their sustainability projects. The purpose of this research paper is to examine the potential impact of artificial intelligence (AI) on the sustainable fashion industry, particularly
with regard to streamlining production and manufacturing procedures to increase sustainability while retaining profitability.

Impact of Fashion Industry on Pollution

- 92 million tons of textile waste is produced every year.
- It contributes to 4-5% of the pollution of the human being on planet earth.
- Hence it is very important to reduce the pollution created by fashion industry as it is impacting the sustainability of planet earth.

Research Objectives:

This research paper's main goal is to investigate how AI may benefit the sustainable fashion industry. The paper's specific objectives are to:

1. Analyze the possible advantages of applying artificial intelligence in the fashion sector for sustainable growth.

2. Improving clothing manufacturer supply and demand in the fashion market.

3. Trend analysis of the most recent trends in the fashion industry.

Research Methodology:

This study will examine how AI may contribute to the sustainable fashion industry using a qualitative research methodology. A review of the existing academic papers, books, and reports on AI and sustainable fashion will be done as part of the project. A case study analysis of fashion companies that have previously incorporated AI for sustainable development will also be part of the project.

The research methodology will involve the following steps:

1. Literature review: To determine the possible advantages and difficulties of utilising AI in the fashion industry for sustainable growth, a thorough evaluation of the body of knowledge on AI and sustainable fashion will be done.

2. Case study analysis: To determine if AI in the fashion sector is effective for sustainable development, a case study analysis of enterprises that have already used the technology will be carried out.

3. Data analysis: To get insights into the potential role that AI might play in the sustainable fashion industry, the data gathered from the literature research and case study analysis will be analysed.

4. Findings and suggestions: We will suggest ways for fashion companies and policymakers to apply AI based on the data analysis findings of sustainable development.

Literature Review:

Sustainability issues in the fashion business are well-documented in the literature. Numerous studies have emphasised the industry's considerable environmental effects, which include waste, greenhouse gas emissions, and water pollution. The production and manufacturing process involves a large number of partners, making the industry's supply chain complex. As a result, everyone involved in the fashion industry—manufacturers, suppliers, retailers, and consumers—must work together to achieve sustainability.

In recent years, the application of AI in the fashion sector has drawn more attention. Numerous research has investigated how AI might be used to streamline production and manufacturing procedures, ultimately cutting waste and boosting effectiveness. AI can assist in locating patterns in data and offer perceptions that can guide judgement. AI, for instance, may be used to forecast consumer demand, improve inventory control, and cut supply chain waste.

AI can also be utilised to increase the textile industry's sustainability. Textile manufacture is a highly resource-intensive process that uses a lot of water and energy. By using less water and energy during production, AI can improve efficiency and lessen its negative effects on the environment. AI can also be employed to find sustainable resources and modern alternatives to conventional industrial processes.

Following is the research paper which were reviewed for literature study.

1. (Chen, I.-F.; Lu, C.-J 2021) This research paper explores the use of k-means clustering, extreme learning machines, and support vector regression to construct cluster-based models for demand forecasting in the fashion industry. The results showed that integrating clustering analysis can improve prediction accuracy, making it a suitable demand forecasting method for the fashion industry. The study emphasizes the importance of accurate demand forecasting in the highly competitive and rapidly changing fashion industry, and how AI can help improve sustainability by reducing waste and optimizing supply chains.

2. (Xianyi Zeng · Yingmei Xing · Zhenzhen Xu 2023) This paper proposes a new interactive design approach for customized garments using machine learning techniques, including RBF ANN, GA, PNN, and SVR. It was tested on leisure pants customization and found to be more accurate, fast, intelligent, and sustainable than existing approaches. It also establishes an effective communication channel among consumers, fashion designers, pattern designers, and garment producers.

3. (Shaik Vaseem Akram , Praveen Kumar Malik , Rajesh Singh, 2022) This study examines how the fashion industry can promote sustainable consumption and production by integrating digital technologies such as IoT, AI, blockchain, AR, and VR. The paper explores different studies that implemented these technologies in the fashion industry and provides recommendations for future enhancements.

4. (Eunjung Shin , Sohyun Kim 2022) This study focuses on the impact of fashion Artificial Intelligence (AI) curation services on promoting sustainable consumption. Women in their 20s and 30s living in the metropolitan area were surveyed via an online questionnaire from March 29 to June 4, 2021. Participants were instructed to take photos of their clothes using the "Style Bot" application and store them in a virtual wardrobe before answering the questionnaire using the AI recommended coordinating function. The study found that convenience, speed, and usefulness positively affect the use of clothes, while promptness had no effect. Clothing utilization was found to have a positive effect on environmental sustainability, which in turn had a positive effect on satisfaction. The study concludes that an in-depth understanding of the properties of fashion AI curation services could promote the

active use of clothes and contribute to environmental sustainability. These findings could help develop and improve fashion AI curation services, ultimately promoting sustainable consumption in the fashion industry.

5. (Yoon Kyung Lee,2021) This study proposes a sustainable real-time fashion system (RTFS) using information communication technology, AI, and virtual environments for active customers in 3D clothing production systems. The RTFS is aimed at automating and democratising product customisation and

personalisation processes and proposing individual designs with perfect styles and measurements. 3D fashion products in the RTFS supply chain are entirely digital, saving time and money with sampling and tracking capabilities, secured and trusted with personalised service delivery.

6. (Shi, M.,Chussid, C.,Yang, P.,2021)
Fashion trends change rapidly, making trend forecasting crucial in the industry. However, traditional forecasting is costly and time-consuming. This study proposes an A.I. approach to abstract fashion image-based information quickly and accurately. The A.I. model was trained to identify garments and classify clothing attributes from runway photos and videos, allowing it to summarize fashion trends.

7. (Xing, Yingmei·Xu, Zhenzhen ,Bruniaux,n ,2023) This paper proposes a sustainable 3D reverse garment design approach that uses machine learning techniques to create personalized fashion products. It involves drawing a 3D basic garment on a scanned mannequin and using a probabilistic neural network to predict garment fit, followed by genetic algorithms and support vector regression to estimate and control garment parameters. A comprehensive evaluation characterizes the relationship between the consumer and the designed garment profile, resulting in a personalized garment. This approach offers a cost-effective and eco-friendly solution for developing personalized fashion products.

8. (Lee, Yoon Kyung,2022) Artificial intelligence (AI) technology is expected to provide sustainable solutions in the fashion industry to increase the productivity of fashion products and decrease unnecessary energy consumption, such as the environmental problems caused by inventory handling and overproduction. The fashion system used for designing is a complex and creative domain. As a result, this study investigated the practical application of AI in fashion design which in turn should enable designers to focus on creative work, improve their work, and use AI in creative designs related to complex systems. First, the creation of GANs (generative adversarial networks) and human design was compared. Second, complex system elements involved in AI design creation were defined.

9. (Pereira, Artur M,Moura, J. Antão B, Costa,2022) The fashion industry, being a large and global industry with sustainability and digitalization concerns, can benefit from Decision Support Systems (DSSs). Decision-making in online fashion retail is complex due to changing customer preferences and product availability. Artificial Intelligence techniques can be used to construct customer models (CMs) to inform personalized decisions. The combination of CMs with recommender systems (RSs) is increasingly used for personalized product recommendations. However, research on enhancing CMs for e-commerce or other decision-making chain domains is limited. This paper provides a systematic review of literature on fashion CMs and identifies research topics for future study.

10. (Satinet, Chloe, Fouss, François,2022)
The fashion industry lacks a clear and comprehensive label for environmentally sustainable products, making it challenging for sustainability-focused consumers to identify such products. This paper proposes using supervised machine learning tools to develop a model for assessing the environmental sustainability of clothing products throughout their life cycle. The model is trained on a dataset of clothing products and their

life cycle characteristics, achieving an average accuracy of 91% using the random forest algorithm. The resulting model provides a quick and accurate assessment of clothing products' environmental sustainability with limited data available to online retailers.

Based on the abstract of the research paper, the potential findings of the study could include:

The research paper examines the potential role of AI in the sustainable fashion sector and emphasises how trend analysis of clothing may be used to optimise the production of fashion garments. Fashion garment production can be optimised to fulfil customer demand while minimising waste and lowering costs by incorporating trend research into the manufacturing process. In the article, uses of AI in the fashion sector are illustrated, including the use of predictive analytics to cut waste and streamline supply chains, computer vision to enhance textile recycling, and natural language processing to encourage openness and moral work practises.

The research paper's key discovery is that some of the uncertainty and human mistake that currently hinder trend predicting is eliminated by AI trend forecasting. allowing businesses to invest in fashion ideas that will sell. This may result in less waste and excess manufacturing, lowering the harmful effects of the fashion industry on the environment and society. The study also emphasises that while the fashion industry has started to adopt more sustainable practises, AI has the ability to quicken this process by offering creative solutions to some of the sector's most pressing problems.

The ability of AI to revolutionise the fashion industry and hasten the transition to a more ethical and sustainable future is another significant result. The paper, however, raises questions about the ethical and societal implications of AI in the fashion business, highlighting the need for careful examination of these issues as the sector develops. For instance, the use of AI may result in job losses for individuals employed in the fashion industry, particularly for those performing manual labour, and it may worsen already existing disparities in the sector.

Overall, the research report contends that AI has much potential for the sustainable fashion sector, but careful thought is required to ensure its ethical and responsible application. The article makes a significant contribution to the current debate on AI's role in the fashion industry emphasises the need for more research and development to solve the problems and opportunities this technology brings to the industry.

How AI can create sustainability in fashion industry.

By streamlining the manufacturing of fashion items and putting trend analysis into it, AI can promote sustainability in the fashion sector. AI can identify the most popular clothing styles and designs by studying current fashion trends and consumer preferences; this information can then be utilised to optimise the supply and demand of fashion goods. This minimises waste and lowers expenses while also ensuring that businesses are creating clothes that there is a market for.

Additionally, by forecasting consumer demand for certain products, AI can help businesses optimise their supply chains and lower overproduction. AI algorithms can reliably forecast future demand by assessing historical sales data and other pertinent data, enabling businesses to produce only what they are certain will

sell. This can lower the quantity of unsold stock and, ultimately, stop surplus production, one of the biggest sources of waste in the fashion business.

AI can also be utilised to enhance textile recycling. By identifying and classifying textiles according to their material makeup, computer vision, a type of AI technology, can increase the effectiveness and efficiency of textile recycling. This can encourage a circular economy in the fashion sector and lessen the amount of textile waste that is dumped in landfills.

Another sort of AI technology called natural language processing can be utilised to advance ethical work practises and transparency in the fashion business. In order to find possible problems with employment practises and sustainability, this technology can be used to examine data from a range of sources, including social media, news articles, and government reports. This can assist businesses in proactively addressing these problems, improving their procedures, and fostering greater transparency across the board.

In conclusion, AI can contribute to sustainability in the fashion sector by streamlining the manufacturing process, lowering waste, and fostering greater openness and ethical behaviour. Companies may make clothing that are in demand, reduce waste, and ultimately lessen the damaging effects of the fashion industry on society and the environment by utilising AI technology.

Conclusion:

This study paper concludes by highlighting the potential contribution of AI to the sustainable fashion sector. Fashion garment production can be optimised to fulfil customer demand while minimising waste and lowering costs by incorporating trend research into the manufacturing process. By using AI to predict trends, some of the uncertainty and human error that now hamper trend forecasting are reduced, allowing businesses to invest in clothing concepts that will be successful.

The case studies studied in this article demonstrate the creative solutions that AI can offer to some of the major difficulties facing the fashion industry, such as waste reduction and supply chain optimisation. The industry may hasten the transition to a more ethical and sustainable future by implementing AI technology.

The article also poses significant ethical and social implications for AI in the fashion business. Artificial intelligence (AI) use may lead to job displacement and a loss of human expertise, which could have a bad effect on communities and people individually.
Additionally, there is a chance that AI-driven decisions would not take critical ethical factors into account, such the influence on the environment and fair labour practises.

Because of this, it is crucial to carefully weigh the possible dangers and benefits as the fashion industry moves forward with the implementation of AI technology and to make sure that ethical and social issues are incorporated into decision-making processes. By doing this, the sector may use AI to promote sustainability and beneficial effect while minimising any potential drawbacks.