AI and Machine learning tools in fashion pedagogy: an Empirical Study

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ABSTRACT

Artificial Intelligence (AI) and Machine Learning (ML) are transforming various sectors of the Fashion Industry. Recent research highlighted the growing importance of Artificial Intelligence and Machine Learning in Fashion Education. AI and ML algorithms are employed for trend analysis, consumer behaviour prediction, and personalized learning experiences. AI and ML revolutionized, especially in fashion marketing, customer targeting, and engagement through recommendation systems and image recognition methods. AI is integrated into fashion processes, from research to manufacturing, and is driving the industry towards responsible practices. These technologies are used to transform traditional pedagogical approaches for enhancing student engagement and learning outcomes. The integration of AI-driven tools in fashion education enables real-time feedback, adaptive learning modules, and virtual simulations, fostering creativity and innovation among students. AI-based pedagogical tools are additionally being developed to assist novice designers in creating sketched representations of product forms, improving their ability to communicate ideas effectively. These advancements demonstrate the potential of AI and Machine Learning to enhance fashion education and industry practices, paving the way for innovative approaches in design, production, and marketing.

This paper explores the application of AI and ML in fashion pedagogy, focusing on how these technologies enhance learning outcomes and curriculum development. The paper attempts to enlist the AI and ML opportunities in fashion pedagogy through reviews and expert interviews.

Challenges such as data privacy and the need for specialized training are also addressed. It is observed that by leveraging AI and ML, educators can prepare future fashion professionals with cutting-edge skills and industry-relevant knowledge, ensuring their readiness for dynamic and competitive global markets. Several key applications of AI and MI are discussed, and their impact on areas like Trend Analysis and Prediction, Personalized Learning, Virtual Try-On and Simulation, Creative Assistance, Supply Chain Optimization, Ethical and Sustainable Fashion, and Industry-Relevant Skills Development are discussed.

Keywords: Artificial Intelligence, Machine Learning, Fashion, Education, Pedagogy

INTRODUCTION

The fashion industry is experiencing a significant transformation with a surge of Artificial Intelligence (AI) and Machine Learning (ML) technologies. These advancements are revolutionizing various aspects of the industry, including fashion analysis, recommendation systems, and synthesis (Chen et al., 2023). AI applications in fashion encompass a wide range of tasks, from popularity prediction and trend analysis to virtual try-on and outfit matching (Mohammadi & Kalhor, 2021). The impact of AI is particularly notable in Business-to-Customer (B2C) fashion e-commerce, where it has been extensively implemented in recent years (Goti et al., 2023). These technological advancements are opening new opportunities for the fashion industry and driving unprecedented changes in how fashion businesses operate and interact with consumers. The objective of the paper is to explore the use of AI and ML in fashion pedagogy, emphasizing their role in preparing students for a rapidly evolving Fashion industry. The survey was conducted, and information was collected from a total of 260 faculty belonging to fashion studies from five fashion reputed fashion schools in India. Observations and interviews were worked upon selected members of 15 faculties who were willing to spend time and share the information, including filling up the quantitative form. The study also views the twin purpose of the informing the AI & ML companies, about the level of acceptable integration in the fashion education and also give awareness to the Fashion fraternity about the available AI & ML support.

LIERATURE REVIEW

Artificial Intelligence (AI) and Machine Learning (ML) are enhancing not only marketing and production but also playing a crucial role in transforming traditional pedagogical approaches in fashion education. In education, AI and ML enhance pedagogical approaches, shifting from traditional to digital learning methods (Okagbue et al., 2023; Baranidharan et al., 2023). These technologies enable personalized learning paths, automated tutoring, and improved assessment techniques (August & Tsaima, 2021). AI and ML act as "exoskeletons" for instructors, allowing them to provide better guidance and focus on authentic learning experiences (August & Tsaima, 2021). In fashion marketing, AI and ML algorithms revolutionize customer targeting, engagement, and conversion through recommendation systems, image recognition, and predictive modelling (Rathore, 2017). The integration of these technologies streamlines operations and enhances customer experiences in the digital landscape (Rathore, 2017). As AI and ML continue to evolve, they are expected to bring about further transformations in both the education and fashion industries (Okagbue et al., 2023). Fashion students, educators, and professionals are adopting AI-driven tools to keep pace with a fast-evolving industry. AI enhances efficiency in manufacturing,

improves consumer targeting, and promotes sustainability, while in education, it fosters creativity and innovation through adaptive learning modules and virtual simulations.

Artificial Intelligence (AI) and Machine Learning (ML) are revolutionizing the fashion industry, offering innovative solutions across various domains. AI-powered tools can analyse social media images to forecast patterns and styles (Rani et al., 2023), while also enhancing customer experiences through personalized recommendations and virtual try-on capabilities (Bharati, 2017). The integration of computer vision and ML algorithms is opening new opportunities in fashion marketing, enabling more effective targeting and engagement strategies (ibid). Researchers have categorized fashion-related AI applications into 22 distinct tasks, providing a structured framework for future studies (Seyed Omid Mohammadi & Kalhor, 2021). As the field continues to evolve, AI and ML are expected to play increasingly significant roles in fashion popularity prediction, trend analysis, outfit matching, and virtual fashion experiences (Chen et al., 2023).

Recent research highlights the growing impact of AI and machine learning in the fashion industry. These technologies are revolutionizing various aspects, including fashion marketing, analysis, and applications. Fashion studies have gained attention in computer vision and machine learning communities, focusing on low-level recognition, middle-level understanding, and high-level applications (Gu et al., 2020). Key areas of development include fashion analysis, recommendation, and synthesis, with techniques such as popularity prediction, outfit matching, and virtual try-on (Chen et al., 2023). The integration of AI in the fashion industry is opening new opportunities, with research categorized into 22 well-defined fashion-related tasks. This structured approach provides clear research directions and improves access to relevant studies, supported by a comprehensive list of public fashion datasets (Mohammadi & Kalhor, 2021).

The paper will explore how AI and machine learning are reshaping fashion education by enhancing traditional pedagogical approaches. These technologies facilitate personalized learning experiences and improve student engagement. Table no. 1 and 2 will show the application of AI and ML in different areas in fashion education:

Table 1: AI and ML Applications in Different Areas of Fashion Education

Sl. No	Areas of Fashion Education	Application	References
1	Trend Analysis	Market dynamics, Analysing historical data, social media trends Virtual Try-ons	Gu et al., 2020; Chen et al., 2023; Mohammadi & Kalhor, 2021
2	Personalized learning and virtual simulations	Adapting learning modules, Virtual simulation, Virtual design & draping, techniques tools like AISs and LMSs, VR & AR	Tiwari, 2023; Dai & Ke, 2022
3	Creative Assistance for Novice Designers	Generating Visual ideas from sketches, effective communication of design concepts. Tools like Sketch2Vis.	Stacey et al., 1999; Li et al., 2012, Teng et al., 2021
4	Virtual Try-On and Augmented Reality	advancements in virtual try-on and AR enable real-time 3D modelling of clothing on customers, virtual garment fitting	Marelli et al., 2022; Imran et al., 2023; Luidolt & Zhou, 2023
5	Consumer Behavior Prediction	sentiment analysis, productive analysis, trend forecasting, and personalized recommendations, product placement and marketing	Prakash et al., 2023; Gautam Srivastava & Singh, 2021; Rajani & Goswami, 2024
6	Supply Chain (SC) Optimization and Sustainability	Enhance risk management & operational efficiency with tools like neural networks and time series models. Tracking and transparency in SC using block chain	Younis et al., 2021; Edhrabooh & Al-Alawi, 2024; Pal, 2023; Louis & Eyo-Udo, 2024
7	Ethical and Sustainable Fashion	Enabling forecasting, optimising SC, reduce waste. By Predictive analysis promoting Circularity	Ijsrem Journal, 2024; Ramos et al., 2023; Rathore, 2023
8	Industry-Relevant Skills Development	productivity through automation, personalize vocational education and advance sustainable manufacturing.	Krishna AL Sannasy Rao et al., 2024; Muhammad Yahya et al., 2023; Pritam Chattopadhyay, 2020

Table 2: Examples of AI and ML tools in Fashion Education

Sl. No	Areas of Fashion Education	Examples
1	Trend Analysis	Heuritech – AI-driven platform for fashion trend forecasting using social media and images.
		Editd – Data-driven platform for real-time retail and fashion trend analysis
		WGSN – Provides predictive insights for fashion and lifestyle trends
		Fashion Brain – Uses AI to analyze fashion data for trend forecasting
		Metail – AI-powered virtual fitting room and personalized trend analysis.
2	Personalized learning and virtual simulations	Knewton Alta - Personalized study plans and resources based on performance.
		DreamBox Learning - Adaptive mathematics lessons for K-8 students.
		Squirrel AI - Individualized learning paths with real-time feedback.
		Labster - VR simulations for hands-on STEM experimentation.
		Squirrel AI - Individualized learning paths with real-time feedback.
3	Creative Assistance for Novice Designers	Runway ML – AI-powered creative tools for design and animation.
		DeepArt – Transforms images into artistic styles using AI.
		Canva Magic Resize – Automatically resizes designs.
		Fotor – AI-based photo editing for designers.
		Daz 3D – AI tool for generating 3D designs.
4	Virtual Try-On and Augmented Reality	Zyler - Virtual try-on for clothing and accessories using photos
		Vue.ai - Personalized styling and outfit recommendations.
		Obsess - AR shopping with 3D virtual stores
		Wannaby - AR footwear try-on in real-time.
		Snapchat AR - Virtual try-on and AR filters for brands
5	Consumer Behavior Prediction	Google Cloud AI – Analyses customer data to predict buying patterns
		IBM Watson – Predicts consumer preferences and sentiment analysis
		Kissmetrics – Analyses consumer actions to forecast behavior trends.
		Data Robot – Utilizes AI models to forecast consumer behavior.
		Salesforce Einstein – Predicts customer behavior for personalized experiences

6	Supply Chain (SC) Optimization and Sustainability	Blue Yonder – Enhances supply chain agility with predictive analytics
		IBM Sterling – Improves supply chain transparency and traceability
		Coupa Supply Chain Design – Assesses and reduces environmental impact
		Logility – Optimizes supply chain for cost savings and waste reduction.
		Infor Nexus – Promotes collaboration and ethical sourcing
7	Ethical and Sustainable Fashion	StyleSage – Analyses fashion trends and sustainability metrics.
		Sustainability-X – Assesses material sustainability.
		Higg Index – Measures environmental and social impacts
		Circular Fashion – Promotes circular economy practices
		Eco-Age – Provides insights on ethical practices
8	Industry-Relevant Skills Development	Moodle – AI tools for customized learning experiences.
		Coursera – Personalized learning paths for industry skills
		Udemy – AI-driven course recommendations based on user interests
		LinkedIn Learning – Adaptive learning for professional skills
		EdX – Personalized learning for career advancement

The above tables have a limited information in terms of AI related software information available in the market in the field of Fashion and Designs. However, it unsure that the mentioned softwares are been optimally explored in the pedagogy of Fashion studies. The study tries to explore the use of the AI and ML in fashion education.

METHODOLOGY

This study uses a mixed-method approach comprising secondary research through literature reviews and primary data collection via expert interviews. Secondary data was collected from academic journals, focusing on the intersection of AI, ML, and fashion education. Additionally, interviews were conducted with fashion educators, to gain insights into how these technologies are being implemented and their impact on learning outcomes and industry practices.

This study employs a mixed-methods approach: Surveys and questionnaires were administered to educators, to gather insights on the use and perception of AI and ML in fashion education. Observations and interview with Fashion academia was also documented for understanding.

RESULTS AND DISCUSSION

The research study was a mixture of a quantitative questionnaire and qualitative observations and interviews in academia. The following details can be noted from the

information collected. A total of 350 Faculty of Fashion studies/ education were sent using the convenient sampling method out of which only 260 people replied on the form. Observations and interviews were worked upon selected members of 15 faculties, who were willing to spend time and share the information, including filling up the quantitative form. The objective of the quantitative research was to identify the depth of AI involvement in design academia in India. The questions asked were more on awareness, challenges, and techniques used in their pedagogy using AI/ML. The ratio of designation ranged from 20% of professors, 75% associate professors with more than 20 years of experience and 15% of assistant professors and lecturers with approximately 15 years of an experience. Most of the design faculty (77%) rated their awareness of AI/ML as medium scale, however on the question of competence on AI &ML as high on the scale. Only 46.2% replied they use AI occasionally. As informed in the response, 15% (39 respondents) of faculties integrate AI/ML tools in their pedagogy, but only 20 respondents mentioned the tools that they were using, the rest chose not to reply. Another point what noting except for Chat GPT, the names of AI & ML used were generic in nature and did not give any specific proper noun. For example: image generators, and research clothing design tools. Due to an internal course given by the government of India few academicians were aware of the ethical use of AI & ML.

While the respondents on quantitative feedback had a very basic understanding of AI, some of the observation during interview of 15 academicians were as discussed below: Most of the academicians used Chat GPT frequently for all purposes, from information to image creator options, primarily as there is a free version. They don't use the paid version as they are not sure how much that may benefit. The limited answers nature of ChatGPT free version is usually solved by using different email Ids. Midjourney free version is used to create images while Adobe Firefly is very much sought after, but unused as respondents believe that it is a paid version and hence will be complicated to use. Just 2 people were aware of the software Dall-E which is an open-source image and it has not been explored by most. Softwares like, Figma, chrome, WhatsApp, Microsoft windows plug-in AI systems have been explored at the individual level by different users as per their needs. Clo-3D was a very popular software but was not very accessible and understandable by non-design faculty. Quite a few respondents have worked on logo generators like Design.ai and Canva, Kroma and Uizard is used very less as Figma solves most of the issues in the UI context. But by far the most elaborate use of AI was to research paper writing by using software like Paperpal, Elicit, Mendeley, Zotero, and Grammarly.

When the faculty were interviewed about the use of AI & ML with reference to Ethics, it was found that few faculty face challenges in issues like Data Privacy and Security, Infrastructure Costs, Technological Adaptation in Traditional Institutions, etc.

CONCLUSION

While awareness is relatively high, actual implementation of AI&ML tools in teaching is less frequent, indicating a gap between knowledge and application. From the above data the research concludes that the academia is aware of AI & ML presence in the Fashion field, but it is not much applied on a regular basis in the fashion pedagogy. It is interesting to note that AI is related more towards ChatGPT than regularly used softwares like Meta AI (WhatsApp), Gemini, (Google), the faculty did not even mention about these regular freely available softwares. However, the concept of ethics was very clear among the fashion faculty which may be attributed to the training given. From this collected information it is derived that there is a scope of training and intervention for the same especially in the research paper writing.

It is worth noting that these virtual tools can be used to trained the fashion professionals, of AI supports in trend prediction, sustainable practices, and improved customer studies, personalized learning and virtual simulations, Creative Assistance for Novice Designers, Virtual Try-On and Augmented Reality, etc.

By embracing these technologies, fashion educators and professionals can bridge the gap between academic knowledge and industry practices, ensuring students are well-prepared for the dynamic fashion landscape.

Incorporating AI in fashion education will enable future professionals to design innovative solutions that promote ethical practices, thereby contributing to a more responsible industry. Future scope of the study can be on the use of AI & ML among the students and other Fashion professionals.

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