

ARTIFICIAL INTELLIGENCE IN FASHION: A CASE STUDY ON INDUSTRY-ACADEMIC COLLABORATION FOR DIGITAL TRANSFORMATION

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Abstract

Since the Industrial Revolution, six essential innovation waves have been widely acknowledged as having significantly transformed the world economy and society. Today, we are experiencing the emergence of the sixth wave, which is characterized by breakthroughs in artificial intelligence (AI) and the shift toward sustainable energy solutions. In the fashion sector, AI has already emerged as a game-changer. It can enhance trend forecasts and design processes, optimize supply chain management, enable the creation of hyper-realistic virtual models, and boost personalized customer engagement. All these innovations collectively lead to significant efficiency, profitability, and sustainability within the sector. The rapid convergence of fashion and technology has created an increasing and pressing need for individuals possessing strong digital skills. Fashion companies must rapidly adjust to this changing environment, while fashion education must simultaneously progress to provide students with essential competencies. This paper delineates a case study of a collaborative workshop between a university and a company aimed at providing students with hands-on experience in advanced AI applications within the fashion sector. This effort enables students to deeply understand the industry's digital transformation while cultivating a passion for upcoming technologies. The authors hope that the ideas and experiences presented in this paper will be a valuable resource for researchers and practitioners investigating the convergence of fashion, design, and technology.

Keywords: *AI fashion, digital fashion, fashion design education, university-company collaboration.*

1. Introduction

Innovation has constantly substantially influenced the global economy throughout contemporary history. Experts have attempted to categorize these cycles of invention using the hypothesis of the “Six Waves of Innovation.” This concept originates in the early 20th century, with Austrian economist Joseph Schumpeter establishing the intellectual groundwork in his seminal work *Capitalism, Socialism and Democracy* (1942), wherein he posited that capitalist economies progress through cycles of creative destruction—intervals during which clusters of innovations disrupt existing frameworks and engender new economic paradigms.

As of today, six significant waves have been broadly recognized. The initial wave was propelled by the mechanization of the textile sector and the utilization of hydraulic power in the late 18th century. During the mid-19th century, the second wave was driven by the emergence of steam power and the proliferation of railway networks. The third wave arose in the late 19th and early 20th centuries with the expansion of electricity, steel manufacturing, and chemical industries. The fourth wave emerged in the mid-20th century, characterized by the mass manufacturing of automobiles and airplanes and the extensive utilization of fossil fuels. The fifth wave, starting from the late 20th century, signified the revolution in information and communication technology, encompassing the emergence of computers, the internet, and digital media (Freeman & Louca, 2002). Currently, we are witnessing the emergence of the sixth wave of innovation, defined by the convergence of artificial intelligence (AI), sophisticated robots, the Internet of Things (IoT), and a significant societal transition towards sustainable energy solutions (Silva & Di Serio, 2016).

In the fashion industry, AI has already become a transformative force. It can improve trend predictions and design processes, optimize supply chain operations, and enhance tailored consumer interactions. These advances collectively result in substantial efficiency, profitability, and sustainability within the sector. Transitioning from the prevailing traditional production paradigm to a more streamlined model by embracing digital AI technology has become an urgent requirement and the next normal (Bertola & Teunissen, 2018; Gonzalo et al., 2020).

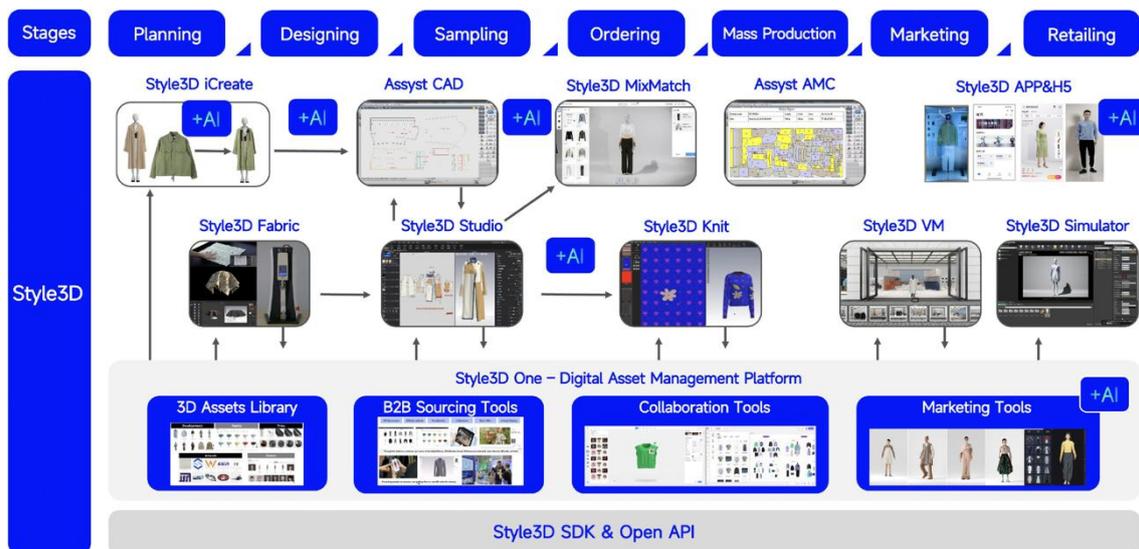
The rapid convergence of fashion and technology has created an urgent need for professionals possessing digital expertise and skills across all fields. A global survey by MOTIF, involving insights from 900 professionals across the value chain, reveals that 57 percent of respondents encounter difficulties in filling positions that necessitate digital skills, especially in digital creation (Alvanon, 2020). The discovery indicates that conventional skill sets are inadequate in this rapidly evolving landscape. It is essential to reconfigure the talent development pipeline and provide upskilling initiatives, particularly in digital competencies, to reconcile the disparity between business demands and existing educational offerings.

Nonetheless, integrating advanced AI technologies into fashion curricula encounters significant challenges, especially for traditional public universities. Unlike private schools, which exhibit superior adaptability and stronger connections with commercial partners, state universities can endure cumbersome and protracted procedures for curriculum updates, making implementing essential technology advancements more challenging. Establishing collaborative educational pathways between private enterprises and public universities may provide a viable and pragmatic solution to this issue (Ingaramo, 2022). This paper presents a case study of a joint workshop activity between Style3D and POLI.design, founded by Politecnico di Milano, examining how university-industry partnerships might leverage AI technology to foster innovation in fashion design education. The authors hope that the insights and experiences detailed in this paper will be a helpful reference point for other researchers exploring digital fashion and design practice in relevant areas.

2. Style3D digitalization ecosystem

Style3D is a science-driven enterprise offering a comprehensive digital infrastructure tailored to the fashion industry. By seamlessly integrating advanced 3D modeling and artificial intelligence (AI) technologies, Style3D facilitates the creation, visualization, and collaboration of digital assets, thereby driving the digital and innovative transformation of the global fashion industry (Figure 1). Its digitalization ecosystem spans three primary domains: 3D tools for fashion (Studio, Fabric, MixMatch, Cloud), AI tools for fashion (iWish, iCreate), and 3D tools for computer graphics (Alelier, Simulator).

Figure 1. Style3D 3D+AI digitalization ecosystem. Source: Style3D.



Their AI tools, Style3D iWish and Style3D iCreate, exemplify the application of AI in accelerating and enhancing fashion design processes. Style3D iWish supports creative efficiency by generating lifelike virtual models with diverse ages and skin tones, enabling AI-powered scene swapping for seamless integration into various contexts and allowing detailed garment refinements for photorealistic output.

Complementing this, Style3D iCreate leverages deep learning to expedite the creation and modification of apparel, accessories, and design concepts. It lets designers quickly visualize garment combinations on digital models, generates high-quality product images from text, sketches, or references, and precisely modifies product components, including color harmonization and graphic detailing.

In the following sections, the authors focus on the functionalities and applications of the Style3D iCreate software. The illustration is framed through a case study of a collaborative workshop designed to offer students hands-on experience with advanced AI applications. By engaging directly with such a tool, students gain practical insights into the digital transformation of the fashion industry while fostering a deeper interest in emerging technologies.

3. Case study: An immersive AI experience

The one-day immersive AI experience workshop in March 2025 is a collaborative activity between Style3D and POLI.design, founded by Politecnico di Milano. This workshop primarily acquainted students with the problems, advancements, and trends currently influencing the fashion industry, as well as how Style3D’s innovative AI technologies may enhance the capabilities of designers and marketers in multiple ways. Company representatives presented a comprehensive overview of two newly developed software solutions: Style3D iWish and Style3D iCreate (Figure 2, left).

Students were permitted to investigate and evaluate the various functions of Style3D iCreate beforehand (Figure 2, right). Despite these tools being in development, interaction with cutting-edge technologies in the industry greatly benefits students. The swift progression of technological innovation underscores the imperative for cooperation between corporations and academic entities. These contacts and experiences enable students to stay aware of evolving market demands, equipping them with the attitudes crucial for their future careers. The following part delineates students’ immersive experience with Style3D iCreate, offering a comprehensive overview of its capabilities and applications.

Figure 2. Style3D Representatives presented the software, and students tried the functions beforehand.



Style3D iCreate is an inspiration accelerator for designers that utilizes the sophisticated features of Artificial Intelligence Generated Content (AIGC). This program streamlines the development and refinement of design concepts, enabling designers to operate more efficiently (Dong, 2024). The Style3D iCreate functionalities are categorized into two modules: StyleNext (previously called AI Editor) and InnoStyle (previously called AI Creator); each module is specifically designed to address different stages of the design process (Table 1).

Table 1. Two modules of Style3D iCreate: StyleNext and InnoStyle.

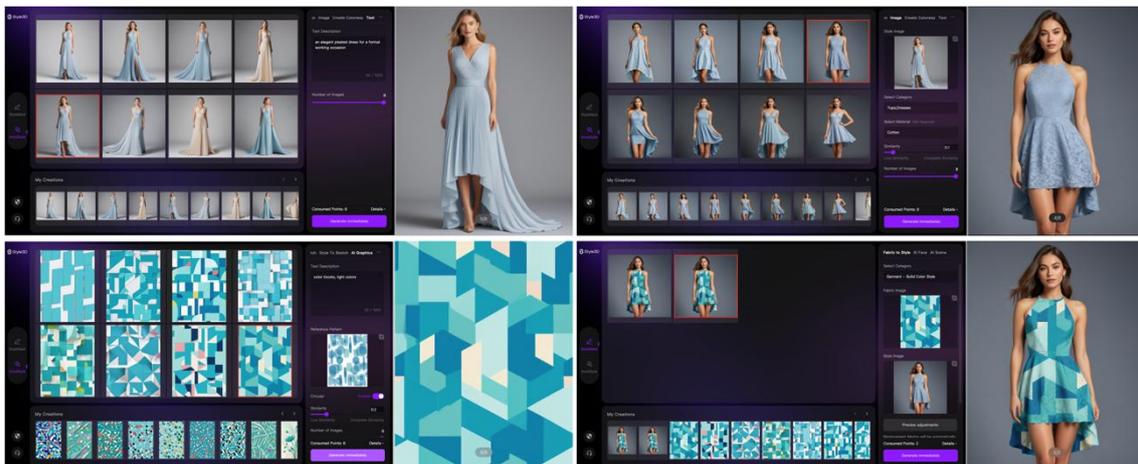
| | |
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| StyleNext | Designers can fine-tune details such as garment features, proportions, ensuring the result aligns with their vision. This iterative editing process enables users to achieve further customization and refinement, facilitates virtual try-ons with suitable virtual models and renders high-quality visual outputs of the pre-defined designs. |
| InnoStyle | Enables designers to generate initial design concepts rapidly. By inputting textual descriptions as prompts, uploading an image or a design sketch, users can direct the AI to create corresponding designs and partially modify the designs. This feature simplifies the ideation process, offering designers various options from which to start. |

During the workshop, the company experts provided students with hands-on guidance to explore the functionalities of Style3D iCreate. This was achieved through four workflows, each designed to showcase a different entry point for initiating the design process.

- Workflow 1 Starts with a sketch
Upload a sketch and ask InnoStyle to generate garments accordingly, then partially replace the detail and color.
- Workflow 2 Starts with a textual prompt
Type a precise textual description as a prompt and ask InnoStyle to generate garments accordingly, then generate a pattern. Finally, back to StyleNext to fabricate the pattern to style.
- Workflow 3 Starts with images
Upload two garment images and ask InnoStyle to combine and generate a new garment accordingly, then partially replace the details and color.
- Workflow 4 Free creation
After completing the previous three workflows, students can freely create their own workflow for their designs.

The following illustrates one participant's trial (Workflow 4) during the workshop as an example of how Style3D iCreate AI-assisted design tools were utilized. The participant began by using InnoStyle, where she entered a textual prompt: "an elegant, pleated dress for a formal working occasion." In response, the AI generated a series of proposals aligned with the prompt. From these, the participant selected a preferred option (Figure 3, top left). To further explore stylistic variety, the participant reinserted the initially selected image into InnoStyle, prompting the AI to generate alternative dress designs with low similarity. This iterative process—repeating the image-to-image prompt with modified criteria of similarity—was carried out several times. Eventually, one satisfactory dress was chosen (Figure 3, top right). Thereafter, the participant employed the AI Graphics function in InnoStyle. By uploading a reference pattern and providing a new textual prompt - "light color blocks" - the AI generated a series of custom textile patterns to be chosen from (Figure 3, bottom left). Finally, using the Fabric to Style feature in StyleNext, the participant merged the selected dress silhouette with the chosen generated pattern, creating a final garment design (Figure 3, bottom right). The entire workflow took the participant several dozen minutes to complete. Naturally, these steps can be repeatedly integrated and iterated in practical use to achieve a fully satisfying design outcome.

Figure 3. One example of the workshop outcomes.



4. Conclusion and future directions

Upon trying the software, students were impressed by the efficiency and ease facilitated by today's AI technologies. Company representatives indicate that this software is now undergoing modification; subsequent versions of Style3D software will incorporate an enhanced capability to instantly transform imported photographs into 2D patterns, which may thereafter be effortlessly modified in 3D within the platform. These improvements optimize the design process and augment designers' efficiency.

Nevertheless, this convenience introduces new obstacles. A primary concern is reconciling the use of AI-generated outputs with preserving the designer's creative contributions and conceptual profundity. Although technologies such as Style3D iCreate possess significant potential to transform design workflows, their incorporation into professional and educational settings must be cautiously undertaken. Deliberate tactics are necessary to guarantee that these tools augment creativity rather than serve as substitutes, preserving the distinctive personal and creative vision that characterizes significant design work.

The educational structure must adapt to confront these simultaneous opportunities and difficulties, as this is an inevitable future trend. Students require systematic direction to integrate AI tools while preserving their creative potential. This entails promoting critical thinking, iterative design methodologies, and reflective assessments that guarantee AI-generated ideas only augment their original thoughts. Activities such as brainstorming, concept research, mood board development, and narrative storytelling, carefully overseen by teachers, can guarantee that students possess a distinct and innovative vision for their projects, preventing the AI tool from overshadowing the human design process. The authors hope that the ideas and experiences presented in this paper will be a valuable resource for researchers and practitioners investigating the convergence of fashion, design, and technology.

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