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Editorial

Digital Fashion Innovations for Real World and Metaverse

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The initial aim of digitalising the fashion industry was to streamline the design, production and business of physical products for real world and to achieve sustainability with the help of different digital tools. However, with the recent emergence of metaverse, the parallel world in virtual reality, a new horizon of digital fashion has been opened. In general, the innovations in digital fashion can be clustered into following four themes – 1) Digital design and e-prototyping, 2) Digital business and promotion, 3) Digital human and metaverse, and 4) Digital apparel and smart e-technology (Fig.1).

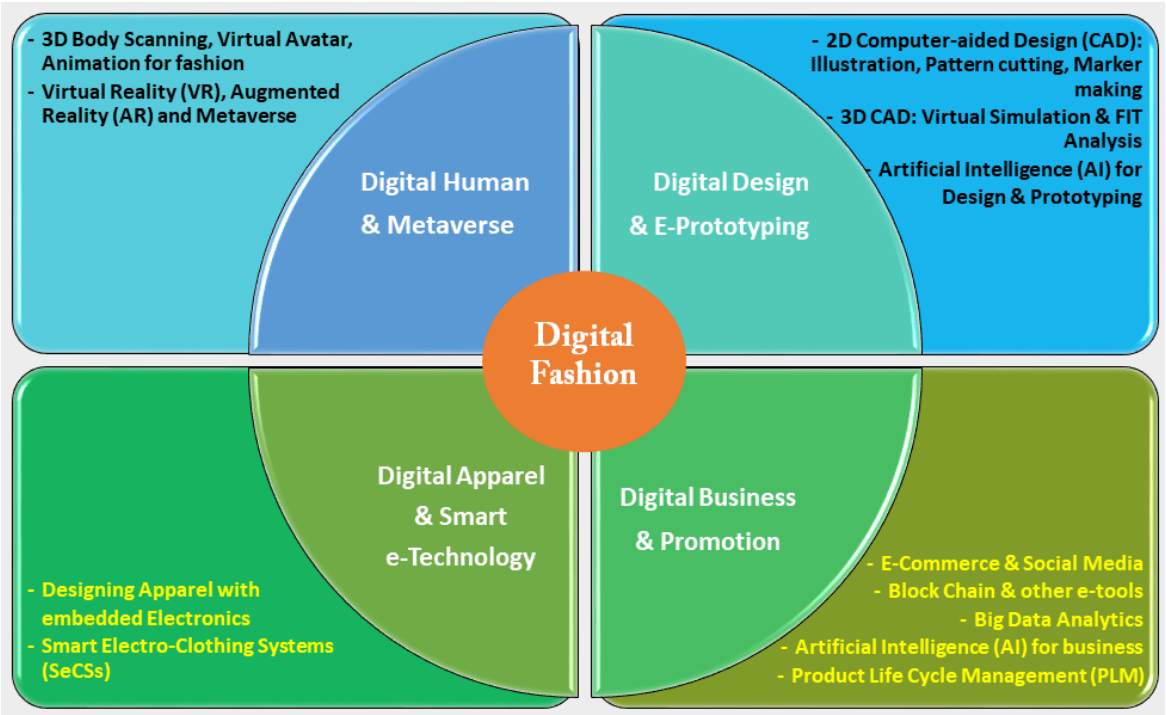

Figure 1: Major themes in digital fashion innovation

This special issue presents eight research articles and two reviews that cover the first two themes of digital fashion innovations – 1) Digital design and e-prototyping and 1) Digital business and promotion.

Computer aided design (CAD) is among the first few digital elements entered into the fashion industry and education. There are a number of CAD systems for two-dimensional (2D) and three-dimensional (3D) design development that are being used in the industry today (Sayem et al. 2010). Traditionally face-to-face teaching approach is thought to be the most effective for teaching these CAD software packages at academic set-ups. However, the Covid 19 pandemic forced us to move to virtual mode of teaching across the world during the most part of the years 2020 and 2021. Likewise, the tutors of fashion CAD had to adopt the new normal quickly and deliver the practical teaching elements of CAD over the online platform like Zoom, MS Teams and Google Meet etc. Lee (2021) looked into the effectiveness of online fashion CAD teaching in South Korea during the pandemic. They compared the grades and results of two separate groups of fashion CAD students; one group was taught 2D CAD systems offline in 2019 and another was taught the same systems online in 2020. Their finding is promising, and it shows that higher scores and grades were achieved by online taught students than the offline taught cohort. Although we do not have readily available similar study from other countries to compare the finding, Lee's (2021) study will give some confidence to the employers and educators about the knowledge and skills gained by students taught remotely during pandemic.

Pattern cutting is the first technical step in apparel manufacturing process that starts materialising a design into a real wearable product in form of a set of technical drawings. In mass production scenario, the pattern pieces of multiple sizes of same style of a garment are arranged into a rectangular area, known as marker, matching the dimension of cutting table and fabric width. The pattern cutting process including marker making is one of the most labour-intensive as well as least

efficient processes in terms of waste generation within the fashion design and development cycle and is responsible for an average fifteen percent fabric wastage (Ramkalaon and Sayem, 2020). Elshishtawy et al. (2021) reviewed the works done on computational methods for cutting problem and zero-waste design thinking. They highlighted the application of CAD technique by Ramkalaon and Sayem (2020) and Weng and Kuo (2011) for zero-waste marker generation and stressed on the importance of collaboration between the fields of cutting and packing (C&P) operational research and zero-waste fashion design (ZWFD). Being the first in covering the two fields of C&P and ZWFD research, the review article by Elshishtawy et al. (2021) is hoped to provoke new research thinking among the academics and researchers in fashion and computer disciplines.

The term "cyborg", a portmanteau of cybernetic and organism, was first coined by Clynes and Kline (1960) to refer to an organism with enhanced capabilities through integration of any artificial component or technology. Later, Haraway (1985) established the depiction of technology-dependent humanity as an existing version of cyborg in her "Cyborg Manifesto". The article by Särmäkari and Vänskä (2021) hosted in this special issue identified tomorrow's fashion designers as cyborgs and proposed a concept of 'cyborg designer 4.0', which refers to a physical and digital craftsperson, through the analysis from two case studies – one on generative clothing design involving machine learning and another on artificial intelligent (AI) aided fashion sketching. They nicely echoed the footsteps of block chain technology, especially non-fungible tokens (NFTs), approaching into digital-only garments design and development and tradable assets, and provided a great food for thought for educators and industry leaders to figure out the construct of tomorrow's fashion designers.

Three-dimensional (3D) printing technology is a direct approach to convert a digital entity into a physical entity in an efficient way. Although this "digi-physi" approach has been around for a fair amount of time, it has been more successful in designing and prototyping fashion accessories than producing drape-able garments (Dip et al. 2021). Rolling's (2021) looked into the designers' perceptions on this technology and identified the efficient and inefficient CAD systems for designing 3D printed fashion accessories. Her work will simultaneously benefit the educators in devising teaching strategy within design curriculum and the software companies to make their system more designer-friendly.

Social media platforms (SMPs) have become an integral part of today's e-commerce and can drive product innovation for manufacturing and retailing business. Fashion companies around the world are trying their best for the maximised usages of SMPs and Alalawneh et al. (2021) studied the levels of SMP usage and innovation performance of Jordanian small and medium scale fashion companies. Their study identified the remaining gaps in utilising SMPs to maximise innovation performance and provoked the discussion of further improvement. This study will act as an appropriate reference for designing similar studies in context of different geometric locations and economies. The study by Sumarliah et al. (2021) discovered how the forced transition to online shopping during Covid-19 pandemic created opportunities for online fashion businesses by making consumers more and more used to with online buying. Although the study focused on Indonesian consumers, there is a scope for generalising the findings for similar economies with similar social settings.

Chatbots have become a part of our digital life. We often come across them in online shopping Platforms. Landim et al. (2021) presented a comprehensive map of chatbot design approaches for fashion e-commerce application through an interdisciplinary review and provided research direction

from both computational and non-computational perspectives. The article will be of interest for both academics and researchers of fashion business and e-commerce App developers.

The work of Tupikovskaja-Omovie and Tyler (2021) revealed the potential application of eye-tracking devices in understanding fashion consumer behaviour on smartphones to develop appropriate m-commerce (mobile commerce) platforms. As smartphone have become a part and parcel of our daily life and a reliable alternative for desktop and laptop computer devices for online shopping thanks to the advent secure payment gateways for m-commerce, this will remain as a noteworthy work in the field of digital fashion business and promotion.

The works by Heim and Hopper (2021) and Chakraborty et al. (2021) are spread over the both first two themes of digital fashion - 1) Digital design and e-prototyping, and 2) Digital business and promotion. Heim and Hopper (2021) revealed the lack of evidence in blockchain technology for facilitating circular economy in fashion and the absence of an affordable or open access platform to materialise a universally digitally connected fashion supply chain. The work by Chakraborty et al. (2021) presented a deep learning approach to train machines in automatic print fault detection for real life deployment in the textile printing industry. This work paves way of connecting textile manufacturing with digital fashion supply chain network envisaged by Okabe et al (1982). This will thus facilitate the digitalisation of full cycle of fashion product development but the integration of artificial intelligence (AI) in textile process control will remain as an area of further research and development in the coming years.

Although this special issue does not include any paper on the digital fashion themes - digital apparel and smart e-technology and digital human metaverse, the readers will still find in this a lot of foods for thoughts and an overview of the contemporary innovations in digital fashion.

I would like to express my heartfelt thanks to my co-editors and all authors for their hard work and patience during the journey of successfully bringing this unique special issue to light starting from the peak of the pandemic.

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