A.I. INTO FASHION PROCESSES

LAYING THE GROUNDWORK

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Abstract

The article aims to provide a comprehensive understanding of Artificial Intelligence (AI) and its integration into fashion processes, focusing on the research, design, development, and manufacturing stages. First, it offers an overview of AI evolution, from its early developments to the contemporary advanced Machine and Deep learning models, attempting to tackle the challenge of ambiguous terminology and aiming to deal with the different interpretations of AI capabilities. Subsequently, a review of the perspectives on the integration of AI tools within fashion processes will be presented. This overview will underscore the growing need for industries to undergo a conscious technological transformation, adopting AI toward a more sustainable and responsible fashion evolution.

Keywords: *Artificial Intelligence; Technological Innovation; Sustainable Fashion; Fashion Processes Transformation*

Introduction

The fashion sector is undergoing the transformations of the 4th Industrial Revolution, in which several technological innovations are unfolding to positively reshape the current ecosystem towards a more sustainable and customer-oriented business (Bertola & Teunissen, 2018). Within this framework, the recent developments in Artificial Intelligence (AI) started to impact the fashion industry, proving the ability to change the creative, industrial and business processes. In recent years, AI has demonstrated its application potential in many areas, thus becoming more than just a domain of technical interest but involving interdisciplinary research for further progress (European Commission, 2022b). Indeed, the transversal performances of AI intelligent systems, namely systems capable of learning from increasingly complex data, analysing situations and assisting in decision-making processes (Herm et al., 2022), demonstrated their great applicability across the entire complex fashion value and supply chain over the last 30 years. Despite this, fashion industries are still sceptical about its proper integration into their processes due to a lack of knowledge and skills to manage the technology into traditional processes toward a broader paradigmatic shift (Giri et al., 2019) for a positive and responsible change in the sector. The limited knowledge about AI is partially reflected by the terminological ambiguity surrounding the AI domain, characterised

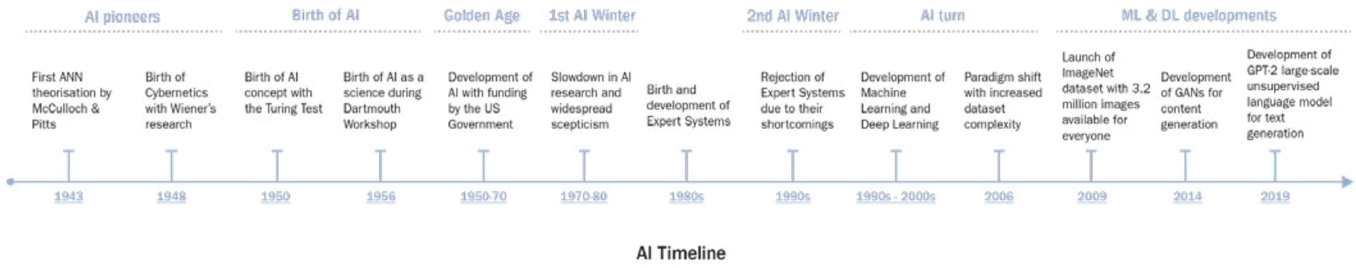

Fig. 1

by intertwining disciplinary backgrounds and interrelated branches, models and algorithms (European Commission, 2022b). The complexity derives one-sidedly from the connection of AI with the concept of *intelligence*, which, by its very essence, encompasses different perspectives on the nature of its meaning, studied at length by psychologists, biologists and neuroscientists (AI HLEG, 2019). Besides this, several terms revolve around AI, making it necessary to clarify their correct definitions and their relationship to the AI interdisciplinary field of research. Given this context, the paper firstly aims to provide terminological definitions and a glossary about AI, and secondly to position AI within the fashion practices and processes, clarifying adopted models and reviewing the state of the art of AI's widespread applications within the fashion Textile and Clothing (T&C) industry.

The History of AI

The conceptual origins of AI trace back to the 1940s, when the pioneers of AI, McCulloch and Pitts, scholars of philosophy, psychology and mathematics, published '*A Logical Calculus of the Ideas Immanent in Nervous Activity*' (1943), in which they first hypothesised that brain functions could be explained according to mathematical logic. The structure of the first embryonic Artificial Neural Network (ANN) capable of learning and reasoning has thus been suggested on a theoretical level, albeit with little success in application. A few years later, Cybernetics arose as a result of '*Cybernetics: Or Control and Communication in the Animal and the Machine*' (1948) by the mathematician and philosopher Wiener. Within the book, the human brain was first compared to a computer, speculating on how human intelligent behaviour could be simulated by machines using feedback mechanisms (Taulli, 2019). These early research directions paved the way for what is recognised as the actual birth of AI, signed by the publication of '*Computing Machinery and Intelligence*' by the mathematician and cryptanalyst Turing in 1950. The article exposed the philosophical question of whether machines can think, inspiring the structure of the well-known Turing test, in which the machine's ability to simulate human responses is assessed.

The term AI, however, originated in the research project '*Study of Artificial Intelligence*' organised in 1956 at Dartmouth University by McCarthy, from which a new scientific discipline called *Artificial Intelligence* was described for the first time. (European Commission, 2020).

The 1950s-1970s marked flourishing developments in AI research; this positive attitude was attributable to the substantial funding from the US Government and the *Defence Advanced Research Projects Agency* (DARPA) for technological advancements supporting Cold War strategies and the Apollo space programme. At the end of the 1970s, however, a sceptical attitude towards AI began to spread due to the economic shortcomings and the technological limitations of that period, clearly expressed by the shortage of computing power, memory and processing speed (Taulli, 2019). This period, named *1st AI Winter*, was overtaken by a phase of flourishing development that began in the 1980s due to the emergence of *Expert Systems* (ES) or *Knowledge-based systems*, which were able to provide assistive knowledge through programming logic within specific domains, achieving excellent results in medical diagnostics, chemistry, electronics, engineering, geology, management, process control and military science (Negnevitsky, 2002). Even though these

systems found broad applicability within the Industry, after the 1990s, they underwent a phase of rejection that introduced the *2nd AI Winter* (European Commission, 2020). The main reasons behind their decline can be recognised in their limited and extremely sectoral applicability, the inability to manage large amounts of knowledge, the inaccuracy of the results, and the lack of funds to update the systems' models (Taulli, 2019).
Between the 1990s and the 2000s, AI research led to the development of increasingly complex mathematical models and algorithms for *Machine Learning* (ML) and *Deep Learning* (DL), which extended their capabilities to various fields. The year 2006 marked a significant turning point in AI development, thanks to the contribution of Fei-Fei Li, a computer science professor at Stanford University, who argued that AI's main limitation could be attributed to the scarcity of datasets, which failed to represent real-world complexity. According to her vision, more data could lead to better models. This insight catalysed a fundamental paradigm shift, shaping the current applications of AI prevalent in diverse domains, including computer vision, speech recognition, natural language understanding, social network filtering, machine translation, bioinformatics, drug design, medical image analysis, material inspection, and games (European Commission, 2020).

Toward a comprehensive definition of AI

The identification of a common vocabulary in AI is a highly complex issue. Historical grounds can be identified behind the terminological misuse and mixup mystification. Indeed, the evaluation of AI has traditionally been divided between two different perspectives that have led to divergent methods of assessing its results. On the one hand, its cognitive drive, associated with empirical science, has been interested in reproducing human intelligence. This approach involves observations and hypotheses about human behaviours, assessing the success of the machine according to its fidelity to thinking and acting like human beings. On the other hand, the engineering nature of AI is aimed at reproducing intelligent behaviour; in this case, the achievement of the goal is evaluated according to the ideal performance of AI systems (Russell & Norvig, 2010; Floridi, 2022).
Therefore, two different scientific scopes led to this dichotomy: (i) to determine the connections between AI knowledge representation, learning

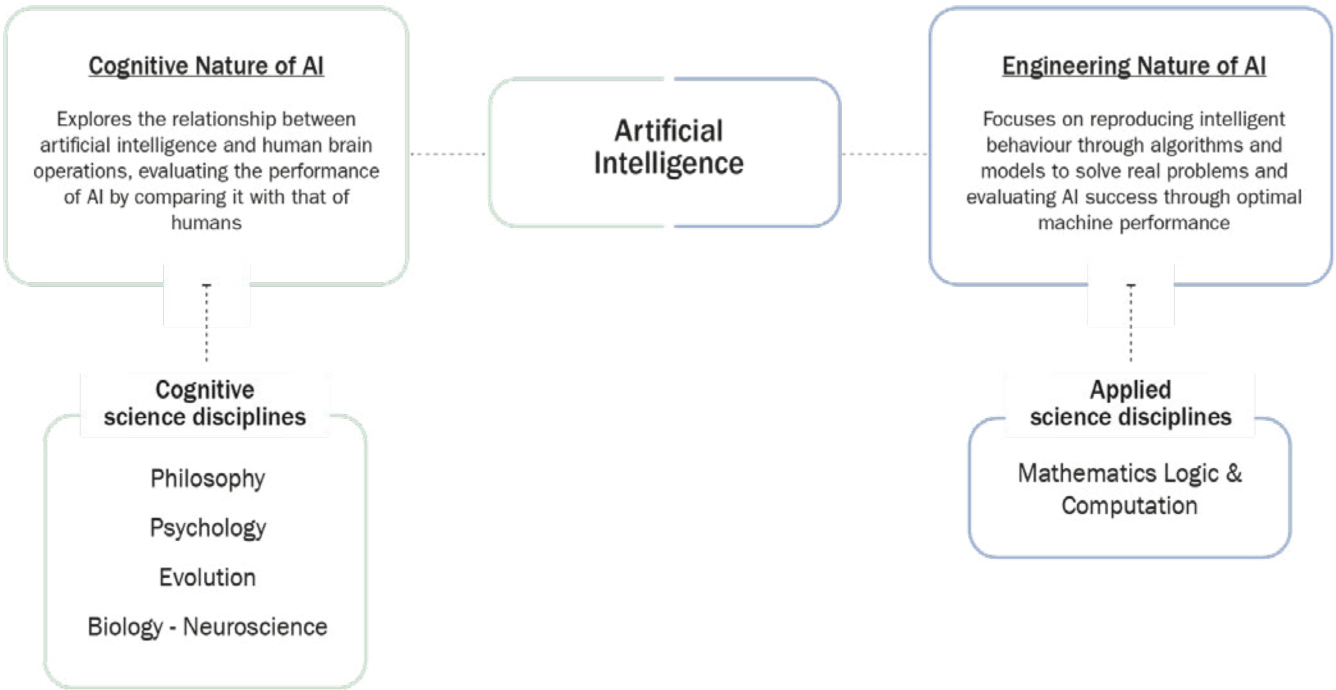

Fig. 2

rules and human intelligence, pursued mainly by psychologists, philosophers and cognitive scientists, and (ii) to employ knowledge representation and learning rules in solving real-world problems, pursued by computer scientists and engineers.
In acknowledgement of the diverse interpretations of AI, the attempt is to remain as impartial as possible, drawing on the definition proposed by the AI HLEG and used by the *European Commission* in the '*AI Watch*' document (Samoili et al. et al. 2020): "*Artificial intelligence (AI) systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal.*" (AI HLEG, 2019, p. 6).
From this description, three primary capabilities of AI emerge (i) '*perception*' understood as the collection of data from the environment; (ii) '*reasoning*' interpreted as the set of techniques and symbolic rules transforming data into numerical knowledge, moving from *knowledge representation* to *knowledge reasoning*; and (iii) '*actuation*' meant as the execution of the best-identified solution in response to the problem (AI HLEG, 2019, p. 3).
In its present-day applications, AI intersects with ML when focusing on systems that can learn autonomously from data without being programmed explicitly for the purpose (European Commission, 2022b). ML is based on a statistical method in which the system preprocesses large amounts of information to predict a phenomenon (Yüksel et al., 2023). Its training is mainly based on the following learning models: *Supervised Learning*, focusing on the determination of the relationship between input and labelled values; *Unsupervised Learning*, relying on a process of identifying data with common characteristics from an unlabelled database, which does not require supervision for training but lacks an objective evaluation of its performance and *Reinforcement Learning*, grounded on the classic trial-and-error method, in which machine-generated results are approved or rejected until the system develops the ability to create own solutions (Taulli, 2019; Yüksel et al., 2023). The fourth category of *Semi-supervised Learning* can also be added to the proposed classification, which, as the name suggests, combines *Supervised* and *Unsupervised Learning* using labelled and unlabelled data (European Commission, 2020; Taulli, 2019).
In general, the predictive power of ML systems improves with the increase of the dataset, up to achieving a superperformance. In contrast to traditional programming, the absence of linear correlations between input and output data makes the model difficult to interpret, seldom preventing an understanding of how the algorithm achieved the final result, thus leading to the *Black Box AI* effect (Saranya & Subhashini, 2023; Yüksel et al., 2023).
Within the ML domain lies the subfield of DL, which is used for processing large amounts of data relying on ANNs.The very concept of depth is reflected in the DL structure, based on multiple hidden layers. This type of architecture is currently being exploited in various branches, such as computer vision, speech recognition, natural language processing, and machine translation, where the computational power has reached, if not exceeded, human performances (European Commission, 2022b).

Methodology

A literature review was performed between May and November 2023, drawing on the *Google Scholar* database, selecting the following keywords for the scientific articles' research: '*fashion industry*', '*fashion design*', '*apparel industry*', '*textile sector*', '*fashion supply chain*', '*fashion design creative process*', and '*sustainability*', paired with '*Artificial Intelligence*'. Only results published after 2018 were selected to limit AI's applications to its most recent developments. Furthermore, the authors' prior knowledge filtered the paper screening process to cross-explore the intersection between AI and fashion and report a general overview of the topic by presenting a comprehensive schematisation of AI clustering models within the T&C industry processes.

The review of the state-of-the-art of AI applied to the Fashion Industry

Recently, AI has been integrated across various aspects of the fashion industry, a trend confirmed by the prevailing scientific literature. Indeed, most of the research exploring the application of AI in the textile and clothing (T&C) sectors has emerged in the last decade (Giri et al., 2019). The most widespread applications of AI in the

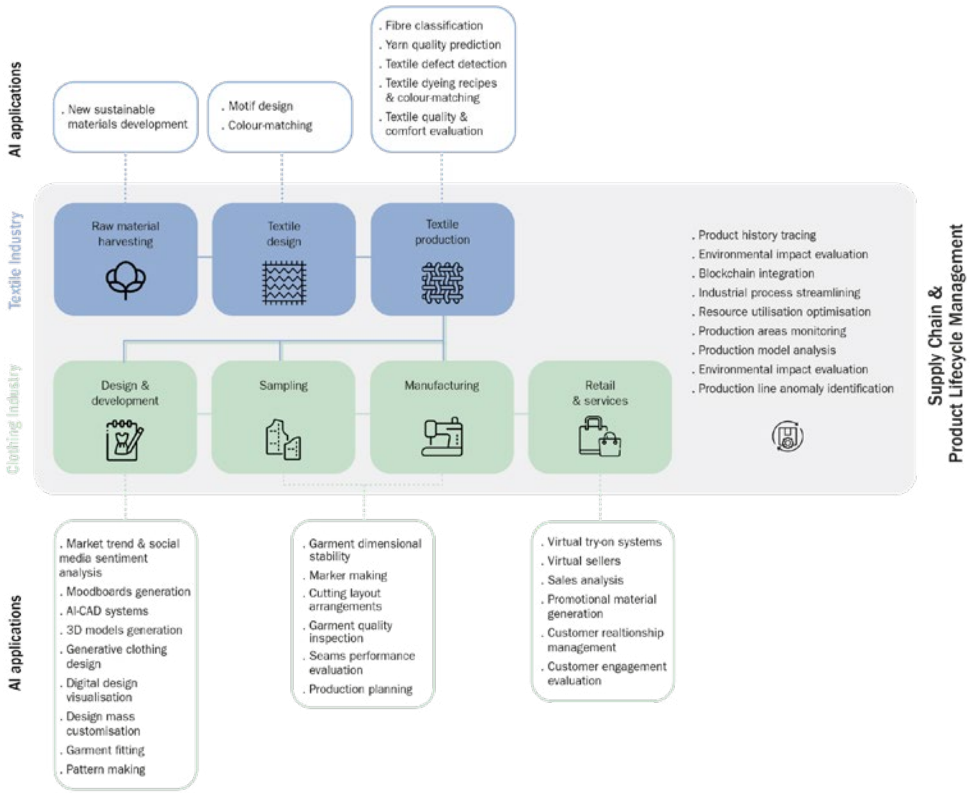

Fig. 3

fashion industry can be classified into several macro-categories, each contributing to different stages of the fashion supply chain. At the *raw material harvesting* stage, AI is used for experimental research in the biomolecular field, paving the way for developing new sustainable materials, such as synthetic spider micro-silk (Sareen, 2022). Within the *textile design* phase, ML tools play a crucial role in enhancing creativity by suggesting attractive patterns and colours in the design of textiles (Varshney, 2021). In the *textile production* process, AI is used for various tasks, including fibre classification, yarn quality prediction, textile defect detection, the creation of textile dyeing recipes with colour-matching predictions (Sikka et al., 2022), and as well as contributing to the evaluation of textile quality and comfort (Sareen, 2022). In clothing *design and development*, AI is being exploited for market trend analysis and social media sentiment analysis for the guidance of new designs, for assisting design using computer-aided design (CAD) systems (Noor et al., 2022), and for generative clothing design and digital fashion design (Särmäkari & Vänskä, 2022). During clothing *sampling and production* phases, AI finds application in marker creation, prediction of garment dimensional stability (Noor et al., 2022), pattern recognition and garment quality control. Furthermore, AI helps in the arrangement of cuts, production planning and optimisation of material used. Finally, at the *retail and service* stage, AI is exploited for virtual try-on systems, personalised shopping experiences through AI-powered chatbots and sales analysis (Sareen, 2022).

In addition to these applications listed above, the refinement of AI systems has thus reached the manufacturing sector, which has grasped the opportunity to achieve the goals of Industry 4.0 (I4.0) through AI's application in the Fashion Product Lifecycle Management (PLM) toward cost reduction, optimised resource management, increased productivity and higher product quality. Indeed, thanks to the implementation of intelligent systems, it is possible to streamline industrial processes by simultaneously monitoring multiple production areas, anticipating and identifying errors before they occur, simulating potential scenarios and analysing models to predict future results (Alenizi et al., 2023). Hence, in the case of the pilot collaboration carried out in 2019 between Google and Stella McCartney, ML technology achieved a comprehensive analysis of environmental impact along the entire supply chain by examining raw materials, resources and production processes, facilitating more informed decision-making (Candeloro, 2020). Moreover, recent studies on the application of ChatGPT have shown how it can support the sustainable management of the fashion supply chain, providing suggestions to textile companies on how to optimise water management, recommending more sustainable production processes, identifying anomalies in the production line and providing insights into the environmental impact of companies (Rathore, 2023; Xu et al., 2023).

In addition to the proposed overview of the functions of AI in T&C, the performed literature review identified several criteria for clustering AI in fashion. As proposed by the European Commission, AI can be categorised into *creation*, including both customisation for mass production as well as novel design creation through generative AI; *production*, where AI efforts are exploited in favour of circular economy objectives; and *user engagement*, in which the computational power is used for analysing emerging trends through extensive data analysis and for increasing the engagement of shopping experiences through digital AI-based assistants (European Commission, 2022a). The literature review by Giri et al. (2019) drew up a different classification of AI applied to fashion divided into *apparel design, manufacturing, retailing, and supply chain management*, thus considering primarily the application of ML and ES to different industrial phases and processes. Nayak and Padhye (2018) highlighted a more comprehensive range of AI performances in the fashion production stages. These applications range from *mechanical property prediction, classification and selection, defect identification and analysis, process control and online monitoring to supply chain management and retail.* Specific areas of interest include the categorisation of fibres and yarns, fabric performance and aesthetic properties prediction, defect recognition, seams performance evaluation, pattern making and garment fitting, production planning optimisation, final garment quality inspection, supply chain optimisation, and retail functions such as forecasting and customer relationship management (Nayak & Padhye, 2018). A similar clusterisation of AI applicability was also proposed in the research by Mohiuddin Babu et al. (2022): "*AI can be applied in all the stages (pre-production, production, and post-production) of textile manufacturing. It involves processes such as conceptualization, design development, production planning and control (PPC), spreading, cutting, bundling, sewing, pressing, and packaging"* (Mohiuddin Babu et al., 2022, p. 5). Differently, the classification proposed by Zou & Wong (2021) focused less on an interpretation from an industrial perspective, offering instead a reading channelling the viewpoints of manufacturers, stylists, designers and fashion enthusiasts alike. The resulting overview of AI applications is clustered into seven categories: *overview*, containing general information on technologies applied to fashion and AI; *evaluation*, summarising research that deals with the drafting of evaluation protocols for fashion research to achieve data collection that meets a scientific criterion; *basic tech*, including the application of AI from the perspective of computer vision based on image processing; *selling* in which the domains of sales, *styling*, design and shopping are brought together, converging in the area of virtual sellers to provide better shopping experiences to online shoppers; *styling* focusing on the provision of online styling services, including the topics of *recommendation* and *classification*; *design* addressing 3D garment generation, garment design detail modification, virtual try-on, promotional material generation via Generative Adversarial Network (GAN); and *buying* which analyses trend forecasting prediction, and selling. More recent literature highlights how research interests have shifted from the AI applied to data analysis to its generative capabilities (Choi et al., 2023), allowing the enhancement of the design phase through the implementation of Deep Generative Models (Croitoru et al.,2023), paving the way for the redefinition of the creative development phase (Rizzi & Vandi, 2023). The turning point in AI's creative agency recognition came in 2019 when fashion designer DeepVogue received an award during an international design competition in Shanghai (Särmäkari & Vänskä, 2022). Indeed, in recent years, a transformation has taken place in the *design and development* phase through the application of GANs for the creation of original images and 3D models (Yüksel et al., 2023), as well as for the generation of mood boards, design visualisations, and merging and modifying specific features of the design item. This allowed designers to explore new solutions beyond the possibilities of currently known design processes (Lee, 2022). However, the effective integration of generative AI tools into design and development processes still requires their alignment with fashion industry standards and learning industry-specific knowledge, which is still difficult to achieve (Choi et al., 2023).

Discussion and conclusions

This study revealed multiple ways of evaluating AI applications in the different phases of the fashion industry. Such a fragmented scenario can be traced to (i) the complex hierarchies and non-linear decision-making processes characterising the fashion industry (Bertola et al., 2018); (ii) the ambiguity in a common-shared vocabulary for defining AI models and applications (European Commission, 2022b), and (iii) the vast set of constantly evolving AI capabilities. Indeed, the computational accuracy achieved by ML and DL in recent years has significantly impacted the design field, integrating into processes both *analytical* and *generative* AI (Choi et al., 2023). Despite these shortcomings, a crucial benefit emerging from the analysis concerns using AI in the T&C industry to increase efficiency, sustainability and circularity, from design to production, involving the supply chain management and the value chain through the customer experience (Sareen, 2022).

This article aims to contribute to the knowledge about AI applications in the T&C processes by presenting a comprehensive overview based on literature review and proposing an AI clustering model adapted to the authors' interpretation and prior knowledge. The proposed model considers AI associated with the two industries of T&C and within the following specific processes: *raw material harvesting, textile design, textile production, clothing design and development, clothing sampling, clothing manufacturing,* and *retail and services*. In addition, the following categorisation encompasses the contribution of AI to the T&C sector within interconnected processes of PLM and Supply Chain Management.

The literature review and the subsequent proposed model of this paper position the groundwork for the hierarchy definition, and clusterization of AI applications in the T&C fashion processes. Thanks to this model on, by vertically studying each specific process and the interconnection between the various processes, it is possible to identify AI trajectories with a view on sustainability and circularity in the fashion industry. From this preliminary overview, it emerges that, in the case of generative AI, the main focus lies on (i) social sustainability toward the definition of a better collaboration and interaction between human operators and AI-based technologies. In addition, the incorporation of AI systems enables resource management optimisation throughout the supply chain and greater control of production cycles, leading toward (ii) economic and (iii) environmental sustainability. Indeed, AI applications to industrial processes can help companies save costs by simultaneously suggesting strategies for reducing their environmental impact.
However, despite the great potential shown by AI, technological and strategic implementation is required to achieve the full performance of AI predictions and gain a true competitive advantage. To this end, fashion companies are called to invest in tangible sources, such as hardware and infrastructure, and intangible sources, i.e., qualified personnel, to effectively manage industrial-technological innovation processes (Mohiuddin Babu et al., 2022). Therefore, the presented research can be read as a foundation for further studies, focusing on the state of fashion companies, the opportunities and challenges they face to harness the full transformative potential of the AI technological revolution toward a more responsible industry definition.

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Captions

[fig. 01] Timeline of the evolution of AI from the early stages to recent developments

[fig. 02] AI schematisation according to its dual Cognitive and Engineering nature and corresponding discipline based on the studies by Bullinaria (2005), Floridi (2022), Russell & Norvig (2010)

[fig. 03] Visualisation of AI applications to support T&C industry processes

References

AI HLEG - High-Level Expert Group on Artificial Intelligence. (2019). Ethics guidelines for trustworthy AI. 6.

Alenizi, F. A., Abbasi, S., Hussein Mohammed, A., & Masoud Rahmani, A. (2023). The artificial intelligence technologies in Industry 4.0: A taxonomy, approaches, and future directions. Computers & Industrial Engineering, 185, 109662. https://doi.org/10.1016/j.cie.2023.109662

Bertola, P., Colombi, C., & Vacca, F. (2018). Fashionabilities: Planning and Managing Design Processes in Fashion. Mandragora.

Bertola, P., & Teunissen, J. (2018). Fashion 4.0. Innovating fashion industry through digital transformation. Research Journal of Textile and Apparel, 22(4), 352–369. https://doi.org/10.1108/RJTA-03-2018-0023

Bullinaria, J. A. (2005). IAI : The Roots, Goals and Sub-fields of AI. https://www. cs. bham. ac. uk/~ jxb/IAI/w2.pdf

Candeloro, D. (2020). Towards Sustainable Fashion: The Role of Artificial Intelligence --- H&M; Stella McCartney, Farfetch, Moosejaw: A Multiple Case Study. ZoneModa Journal, V. 10 N. 2, 91-105 Paginazione. https://doi.org/10.6092/ISSN.2611-0563/11837

Choi, W., Jang, S., Kim, H. Y., Lee, Y., Lee, S., Lee, H., & Park, S. (2023). Developing an AI-based automated fashion design system: Reflecting the work process of fashion designers. Fashion and Textiles, 10(1), 39. https://doi.org/10.1186/s40691-023-00360-w

Croitoru, F.-A., Hondru, V., Ionescu, R. T., & Shah, M. (2023). Diffusion Models in Vision: A Survey. IEEE Transactions on Pattern Analysis and Machine Intelligence, 1–20. https://doi.org/10.1109/TPAMI.2023.3261988

European Commission. Directorate General for Communications Networks, Content and Technology. (2022a). Opportunities and challenges of artificial intelligence technologies for the cultural and creative sectors. Publications Office. https://data.europa.eu/doi/10.2759/144212

European Commission. Joint Research Centre. (2020). AI Watch, historical evolution of artificial intelligence: Analysis of the three main paradigm shifts in AI. Publications Office. https://data.europa.eu/doi/10.2760/801580

European Commission. Joint Research Centre, (2022b). Glossary of human-centric artificial intelligence. Publications Office. https://data.europa.eu/doi/10.2760/860665

Floridi, L. (2022). Etica dell'intelligenza artificiale. Sviluppi, opportunit', sfide. Raffaello Cortina Editore.

Giri, C., Jain, S., Zeng, X., & Bruniaux, P. (2019). A Detailed Review of Artificial Intelligence Applied in the Fashion and Apparel Industry. IEEE Access, 7, 95376–95396. https://doi.org/10.1109/ACCESS.2019.2928979

Herm, L.-V., Steinbach, T., Wanner, J., & Janiesch, C. (2022). A nascent design theory for explainable intelligent systems. Electronic Markets, 32(4), 2185–2205. https://doi.org/10.1007/s12525-022-00606-3

Lee, H.-K. (2022). Rethinking creativity: Creative industries, AI and everyday creativity. Media, Culture & Society, 44(3), 601–612. https://doi.org/10.1177/01634437221077009

Mohiuddin Babu, M., Akter, S., Rahman, M., Billah, M. M., & Hack-Polay, D. (2022). The role of artificial intelligence in shaping the future of Agile fashion industry. Production Planning & Control, 1–15. https://doi.org/10.1080/09537287.2022.2060858

Nayak, R., & Padhye, R. (2018). Artificial intelligence and its application in the apparel industry. In Automation in Garment Manufacturing (pp. 109–138). Elsevier. https://doi.org/10.1016/B978-0-08-101211-6.00005-7

Negnevitsky, M. (2002). Artificial intelligence: A guide to intelligent systems (2. ed., [Nachdr.]). Addison-Wesley.

Noor, A., Saeed, M. A., Ullah, T., Uddin, Z., & Ullah Khan, R. M. W. (2022). A review of artificial intelligence applications in apparel industry. The Journal of The Textile Institute, 113(3), 505–514. https://doi.org/10.1080/00405000.2021.1880088

Rathore, Dr. B. (2023). Future of Textile: Sustainable Manufacturing & Prediction via ChatGPT. Eduzone : International Peer Reviewed/Refereed Academic Multidisciplinary Journal, 12(01), 52–62. https://doi.org/10.56614/eiprmj.v12i1y23.253

Rizzi, G., & Vandi, A. (2023). Artificial Intelligence in Fashion Design Education: Redefining Creative Processes towards Designer-AI Co-Creation. ICERI2023 - International Education Conference. http://arxiv.org/abs/2105.03050

Russell, S., & Norvig, P. (2010). Artificial Intelligence A Modern Approach. Pearson, London.

Samoili, S., Lopez Cobo, L. C., Gomez Gutierrez, G. G., De Prato, D. P., Fernando, F., & Blagoj, B.(2020). AI WATCH. Defining Artificial Intelligence. Publications Office of the European Union. https://doi.org/10.2760/382730

Saranya, A., & Subhashini, R. (2023). A systematic review of Explainable Artificial Intelligence models and applications: Recent developments and future trends. Decision Analytics Journal, 7, 100230. https://doi.org/10.1016/j.dajour.2023.100230

Sareen, D. S. (2022). The AI Couturiers: Redefining Fashion with Artificial Intelligence.

Särmäkari, N., & Vänskä, A. (2022). 'Just hit a button!' – fashion 4.0 designers as cyborgs, experimenting and designing with generative algorithms. International Journal of Fashion Design, Technology and Education, 15(2), 211–220. https://doi.org/10.1080/17543266.2021.1991005

Sikka, M. P., Sarkar, A., & Garg, S. (2022). Artificial intelligence (AI) in textile industry operational modernization. Research Journal of Textile and Apparel. https://doi.org/10.1108/RJTA-04-2021-0046

Taulli, T. (2019). Artificial Intelligence Basics: A Non-Technical Introduction. Apress. https://doi.org/10.1007/978-1-4842-5028-0

Varshney, S. (2021). Design and Development of an Intelligent Tool to Assist Textile Designers. Synopsis submitted in the partial fulfillment for the requirement of Doctor of Philosophy. Dept. Physics and Computer Science, Dayalbagh Educational Institute

Xu, Y., Zhi, C., Guo, H., Zhang, M., Wu, H., Sun, R., Dong, Z., & Yu, L. (2023). ChatGPT for textile science and materials: A perspective. Materials Today Communications, 37, 107101. https://doi.org/10.1016/j.mtcomm.2023.107101

Yüksel, N., Börklü, H. R., Sezer, H. K., & Canyurt, O. E. (2023). Review of artificial intelligence applications in engineering design perspective. Engineering Applications of Artificial Intelligence, 118, 105697. https://doi.org/10.1016/j.engappai.2022.105697

Zou, X., & Wong, W. (2021). fAshIon after fashion: A Report of AI in Fashion

(arXiv:2105.03050). arXiv. http://arxiv.org/abs/2105.03050