**Smart Fashion: A Review of AI Applications in Virtual Try-On & Fashion Synthesis**:

**Seyed Omid Mohammadi1 , Ahmad Kalhor2**

The rapid progress of computer vision, machine learning, and artificial intelligence combined with the current growing urge for online shopping systems opened an excellent opportunity for the fashion industry. As a result, many studies worldwide are dedicated to modern fashionrelated applications such as virtual try-on and fashion synthesis. However, the accelerated evolution speed of the field makes it hard to track these many research branches in a structured framework. This paper presents an overview of the matter, categorizing 110 relevant articles into multiple sub-categories and varieties of these tasks. An easy-to-use yet informative tabular format is used for this purpose. Such hierarchical application-based multi-label classification of studies increases the visibility of current research, promotes the field, provides research directions, and facilitates access to related studies. Keywords: Smart Fashion, Virtual Try-on, Fashion Synthesis, 3D Modeling.

**DESIGNING PRODUCT RECOMMENDATION**

**SYSTEMS FOR FASHION STORES:**

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Retailers worldwide have started deploying smart service innovations in their stores to regain market share lost to online competitors. Against this backdrop, this paper focuses on the design of product recommendation systems for fashion stores. Our research particularly aims at answering the issues of whether and to what extent (i) the sensing capabilities of smart fashion retail environments and (ii) the integration of contextual information can improve the quality of such recommendations. To this end, we consider smart fitting rooms with the ability to detect products and customers as a showcase; a transaction dataset from a leading German fashion retailer; and contextual information about the time of purchase, the store type, and the weather conditions. Our preliminary analyses indicate that sensor information regarding garment and user identification, as well as further context data help to improve product recommendations in fashion stores. Keywords: Smart Service Systems, Recommendation Systems, Context Awareness, Internet of Things, Retail Industry, Predictive Analytics, Cyberphysical Systems, Smart Fitting Rooms.

**Fashion Recommender Systems**

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The increasing popularity of online fashion and online retail platforms is having a visible impact on the shopping experience of billions of customers, making millions of products available in online catalogs thus eliminating the need for physical visits to various stores and for waiting in long queues or trying on clothes in dressing rooms by providing personalized and affordable deliveries. This in turn has created novel challenges for platform providers, within which proper understanding of fashion choices of shoppers plays a crucial role. Shoppers tend to feel overwhelmed by the sheer choice of the assortment and brands, not being able to receive effective suggestions matching their style preferences as well as not being able to spot the right size and fit during the shopping experience. As a result, recommender systems are gaining momentum by mining through large and diverse silos of product catalogs as well as customer datasets in order to provide personalized recommendations of outfits, complimenting the shopping session with similar and relevant products, understanding and suggesting the correct size and fit for shoppers, recommending with personalized styles and leveraging the social influence affecting the choice of style and buying behavior of new generations of shoppers. To this end, within this chapter we aim to present a state of the art view of the advancements within the field of recommendation systems in the domain of fashion. We discuss in detail the open challenges and provide an outlook on current and future work in this exciting multidisciplinary field.

# Personalized fashion recommender system with image based neural networks:

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With an increase in the standard of living, peoples' attention gradually moved towards fashion that is concerned to be a popular aesthetic expression. Humans are inevitably drawn towards something that is visually more attractive. This tendency of humans has led to development of fashion industry over the course of time. However, given too many options of garments on the e-commerce websites, has presented new challenges to the customers in identifying their correct outfit. Thus, in this paper, we proposed a personalized Fashion Recommender system that generates recommendations for the user based on an input given. Unlike the conventional systems that rely on user's previous purchases and history, this project aims at using an image of a product given as input by the user to generate recommendations since many-a-time people see something that they are interested in and tend to look for products that are similar to that. We use neural networks to process the images from DeepFashion dataset and a nearest neighbour backed recommender to generate the final recommendations.

# Determining Your ‘Fashion Identity’ in Fashion Recommender Systems and Issues Surrounding the Right to Privacy:

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Algorithmic personalisation in the fashion domain illustrates the illusion of reality. This paper offers an outlook on the implications of artificial intelligence (AI) techniques on autonomy and informational privacy focusing on recommender engines in fashion e-commerce. Fashion recommender systems support the optimisation of social processes that are based on implementing ‘fashion narratives’ on style and emotional attributes on clothing in the algorithmic process.

Whilst fashion recommender systems illustrate incomplete semblance of individual behaviour, it bases the operation on the responsiveness of individual behaviour, impacting an individual’s autonomy. In this respect, algorithmic processes engage in a process of interactive value creation based on the creation of an imaginary that affects the individual’s subjective experience of self, and a person’s identification of the self in a social context. We need a deeper understanding of conditions that shape an individual’s expression of inter-personal values regarding fashion recommender systems. An analysis of the so-called ‘right to explanation’ in the General Data Protection Regulation reveals that solving issues of interpretability and explainability in fashion recommender systems offers a starting point to assess the parameters of informational privacy in algorithmic personalisation systems.

# The performance implications of leveraging internal innovation through social media networks: An empirical verification of the smart fashion industry:

Despite rigorous empirical research exploring the changes in innovation dynamics triggered by Social Media Networks (SMNs), the benefits coming from the use of these digital platforms for knowledge search in innovative activities for small to medium enterprises (SMEs) are still unexplored. Customers become the new trailblazers. Thus, by adopting a customer led innovation perspective, this paper seeks to measure the effect on return on investment (ROI) of the use of SMNs as external drivers for supporting internal innovation search processes. On the basis of the extant literature on information system and social network analysis, the research describes and evaluates the multidimensional activities interwoven into the open innovation process, driven by integrating the five constructs of structural dimension, relational behaviour, cognitive dimension, knowledge transfer, and legitimization into our hypothesised conceptual model.

Empirical research was conducted via the Classification Regression Tree (CART) on a sample of 2548 SMEs belonging to the fashion industry and based in Italy and in the United Kingdom. This study is of importance to academics and practitioners due to the increasing significance taken on by the adoption of social media networks in the fashion industry to improve innovation search. Recommendations are made to fashion managers and social media experts to support the planning and development of new products and services. New contributions are offered to the innovation and knowledge management literature. In addition, theoretical implications and avenues for future research are also considered.

**Smart Fashion: A Review of AI Applications in the Fashion & Apparel Industry:**

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The fashion industry is on the verge of an unprecedented change. The implementation of machine learning, computer vision, and artificial intelligence (AI) in fashion applications is opening lots of new opportunities for this industry. This paper provides a comprehensive survey on this matter, categorizing more than 580 related articles into 22 well-defined fashion-related tasks. Such structured task-based multi-label classification of fashion research articles provides researchers with explicit research directions and facilitates their access to the related studies, improving the visibility of studies simultaneously. For each task, a time chart is provided to analyze the progress through the years. Furthermore, we provide a list of 86 public fashion datasets accompanied by a list of suggested applications and additional information for each.

# A Semantic Approach for Fashion Recommendation Using Logistic Regression and Ontologies:

[D Naga Yethindra](https://ieeexplore.ieee.org/author/37089197261); [Gerard Deepak](https://ieeexplore.ieee.org/author/37085873650)

# Due to the increased prevalence of web recommendation systems after years of research, it has unarguably become the ultimate solution for efficient functioning of any e-commerce or user supportive digital domain. Though a variety of algorithms have been tested to meet the expectations of users in order to be decision supportive, this paper proposes a potential framework for recommendation of men's clothing. The focus of the system is to improve the efficiency of the recommendation to cope up to the speed of the user's thought process and expectations at the same time generate only those options that have been validated closely to the user's style hunt trajectory. In the presented approach the user's historical click data and searches is preprocessed and converted into query words. The features are extracted from the on ontology of fashion with the help of query words. The ontology used in this paper is highly domain specific. External sources such as fashion reviews, fashion e-magazines, fashion blogs and fashion trends from e-commerce websites are converted into query words and used for feature enrichment. The dataset is provided for classification using logistic regression, and only the top 50% of results from the classification undergoes semantic similarity computation. Normalized google distance and SemantoSim measure are the methods used for emantic similarity computation, this happens mainly for the relevance of the results. The recommendations of fashion items and fashion brands are suggested to the user based on the results gotten from semantic similarity. The accuracy of the Onto infused recommendation system is 97.14% and average precision is 96.31%.

**Interactive knowledge-based recommender system for fashion product design in the big data environment:**

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In this paper, we originally propose an interactive, knowledge-based design [recommender system](https://www.sciencedirect.com/topics/computer-science/recommender-systems) (IKDRS) for relevant personalised fashion product design schemes with their virtual demonstrations for a specific consumer. This system enables the iterative interaction between virtual product demonstration and the designer’s professional knowledge and perception in order to find the best existing design solution, i.e. combination of basic garment elements. To develop this system, the [anthropometric data](https://www.sciencedirect.com/topics/engineering/anthropometric-data) and designer’s perception of body shapes are first acquired by using a 3D body scanning system and a [sensory evaluation](https://www.sciencedirect.com/topics/engineering/sensory-analysis) procedure. Next, an instrumental experiment is realised for measuring the technical parameters of fabrics and five sensory experiments are carried out in order to acquire design knowledge. The acquired data are used to classify body shapes and model the relations between human bodies, fashion themes and design factors by using fuzzy techniques. From these models, we set up an ontology-based [design knowledge base](https://www.sciencedirect.com/topics/engineering/design-knowledge-base), including key data and relevant relation models. This knowledge base can be updated in a [big data environment](https://www.sciencedirect.com/topics/computer-science/big-data-environment) by progressively learning from new design cases. On this basis, we propose an interactive, personalised design [recommender system](https://www.sciencedirect.com/topics/computer-science/recommender-systems). This system works through a newly proposed design process: consumers’ emotional requirement identification – design schemes generation – recommender – 3D [virtual prototype](https://www.sciencedirect.com/topics/computer-science/virtual-prototype) display and evaluation – design factors adjustment. This process can be performed repeatedly until the designer is satisfied. The proposed system has been validated through a number of successful real design cases.

# Finding Similar Clothes Based on Semantic Description for the Purpose of Fashion Recommender System:

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 [Piotr Czapiewski](https://link.springer.com/chapter/10.1007/978-3-662-49381-6_2#auth-Piotr-Czapiewski) &

#  [Radosław Hofman](https://link.springer.com/chapter/10.1007/978-3-662-49381-6_2#auth-Rados_aw-Hofman)

The fashion domain has been one of the most growing areas of e-commerce, hence the issue of facilitating cloth searching in fashion-related websites becomes an important topic of research. The paper deals with measuring the similarity between items of clothing and between complete outfits, based on the semantic description prepared by users and experts according to a previously developed fashion ontology. Proposed approach deals with different types of attributes describing clothes and allows for calculating similarity between the whole outfits in a domain-aware manner. Exemplary results of experiments performed on real clothing datasets are presented.

### **Keywords**

* **Clothes similarity**
* **Object retrieval**
* **Recommender systems**