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AI IN FASHION INDUSTRY

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INVESTOR IN PEOPLE

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ABSTRACT

Fashion is a fabulous industry. It is perceived with glamour, vibrance, beauty, money, fame and massive profits from the outside. However, from the inside, it is a wounded industry. An industry with a size of 3 billion USD, 150 billion units of products per year, and annual growth of 3–4% CAGR, the fashion industry is characterized by low shelf-life products, wrong forecasts, low inventory turnovers, frequent discounts, low realized margins and operating profits, and ever-increasing competition. Best of the fashion retailers make operating profits of 10–12%, making it extremely difficult for most fashion businesses to sustain. An investigation into the existing literature enabled us to conclude that most of the fashion industry's challenges point out wrong forecasts. On the periphery, technology is rapidly invading fashion industry with the most emerging forms such as Artificial Intelligence, Machine Learning, Deep Learning, Artificial Neural Networks, Human-Robot Interface and a list of others, already making their way into this industry in recent years. The field of fashion forecasting in light of data-driven intelligence does not remain untouched by these new developments in the practitioners' world; however, very little has been documented in this area's academic literature.

In this piece of work, we address some of these issues. We start with an exhaustive literature review in the fashion industry and narrow it down to the fashion forecasting industry. We discuss some recent works in fashion forecasting, thereby developing a 'framework of AI-based fashion forecasting' and empirically validate the framework with a qualitative case study of the world's first fashion intelligence company based in Bengaluru, India. We observe that the internet and particularly social media have a lot to offer in terms of data and especially photographs or images of consumers that carry information on what they wear. We attempt to study the relationship between fashion and social media engagement of fashion consumers and reveal that 'fashion identity' is the connecting element between fashion motivations and social media motivations. We create a 'conceptual model of fashion identity' from existing

literature to answer one of our research questions, 'Why Social-media-based information can reveal fashion forecasts?'. From here, we create a 'framework of short-range fashion forecasting' and argue on how internet may assist in fashion forecasting. Subsequently, we move to our primary objective to create a 'conceptual framework of fashion e-forecasting'. As the name suggests, this framework may create forecasts based on data from social media, e-commerce, and other web data. After conceptually developing this framework based on previous frameworks present in this area and available literature, we validate this empirically through a case study. The case study chosen for this purpose addresses forecasting based business problem of a family owned fashion retail business. We collect data in the form of photographs of consumers on their social media pages using a popular and emerging research method called 'Netnography' and convert this into attributes and labels using numeric binary coding. A total of 176 photographs were picked from 634 interested participants for further study. Using hierarchical clustering followed by k-means clustering on software SPSS, 7 clusters or popular combinations of attributes and labels were retrieved, giving rise to 20 popular styles of the chosen product that consumers are wearing now. We finally made illustrations of these 20 popular styles as an output of the research. The case study validates our hypothesis that fashion forecasting or 'nowcasting' in the present context may be done by using data from the internet.

The present study is unique in multiple ways. First, it suggests a novel method of fashion product development in the light of data-driven intelligence; second, it documents some of the rapid developments in the field with the onset of technology. It also addresses some of the fundamental questions that are becoming more relevant in the recent years.

1

INTRODUCTION

1.1 CONCEPTUAL BACKGROUND

Globally, the fashion industry represents 14–15% of the consumer spendings (Technopak, 2017) and growing at a pace of 3–4% annually. Fashion is a 3 trillion USD industry today (Fashionunited, 2019), with 150 billion units of garments manufactured in 2018 alone (Apurba, 2019). From the outside, it looks like a very glamorous, high-profit and high-margin industry. However, the best of the fashion retailers makes only 10–11% operating profits. Fashion is a wounded industry; often, brands and retailers bleed on margins. Half of what is manufactured is never sold or sold on discounts. Fashion is a challenging business to sustain and making profits in the fashion business is a herculean task in this competitive era. Year after year, fashion retailers face the same challenge of unsold inventory being diluted at deep discounts. Deep discounting is a common practice in the fashion industry in the name of inventory dilution and adding freshness to stores and product categories; however, it burns the retailers' potential profits. Some authors have even compared investment in the fashion industry with betting on horses on a racecourse, where nobody knows which products will click till the race is over or the selling season hits.

This industry is characterized by low shelf life products (just a few weeks to few months), a constant challenge from consumers' side for newness, ever-changing consumer tastes and preferences, aggressive competition from domestic and international brands, extended supply chains, and lead times, and many more. Nevertheless, the biggest challenge is lost profits due to wrong forecasts (Subramanian, 2014). In the fashion business, the product is the central element of the marketing mix (Easey, 2009). If consumers do not like the product itself in the first place, no amount of marketing can help. Fashion

consumers perceive the fashion product as an extension of their fashion identities and not willing to compromise with it (Cranes, 2012). Hence, having the right product itself in the first place may provide a solution to one of the fundamental challenges of this industry. To forecast the right products, fashion brands and designers rely on fashion forecasters and related services.

Fashion forecasting is all about scanning the environment to spot upcoming trends, colours, fabrics, cuts, silhouettes and designs. Forecasters are people who pick upcoming and prevailing trends from available resources (Popcorn, 1991). However, it is compared with chasing the future with a butterfly net (Gardener, 1995). Fashion trends change like the weather. What was selling in the previous season may vanish from the scene entirely. The conventional apparatus of fashion forecasting included trawling art exhibitions, restaurants, concerts, events and even scientific journals, photographing trendy people, travelling to fashion cities, following catwalk shows and celebrities and spotting vintage as well as upcoming trends. Fashion magazines such as *Elle, Vogue, Glamour, Instyle, GQ* and *Harper's Bazaar* also play a significant role in providing inputs on various styles from fashion forwards to the masses. Other tools include scanning past sales data, supplier communication, competition mapping, environment scanning, consumer scanning and fashion predictive scanning. However, irrespective of having the best resources and forecasting tools, fashion brands continue to face the heat of wrong forecasts. Few authors even compared the post-mortem-based forecasting approach after the season is over for the next season as a bad practice.

Every season, fashion forecasters are haunted with this same question 'What will sell?'

Few authors highlighted the role of some emerging developments like data on the internet, social media, e-commerce and other web 2.0 applications. They apprehended that these might assist in forecasting. However, in the existing fashion forecasting literature, such evidence is not firm. Though scattered pieces of evidence exist, the authors in this work felt there is a need to develop a framework in the light of these new developments.

On the other side, some new-age companies such as EDITED, StyleSight, Stylumia, WGSN+ and Promostyl use data from the internet to arrive at fashion decisions and provide intelligence inputs on product decisions to their customers. Their clients include the who is who of the fashion brands. Even mainstream technology companies such as Google, Microsoft and IBM are researching these new developments and creating fashion clients' applications.

Some of these new developments also include technologies like Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), Human–Robot Interface (HRI), Artificial Neural Networks (ANN) and Natural

Language Processing (NLP), which are surprisingly used by the fashion industry now. We also felt there is a need to document these events in the academic literature.

Lastly, we felt that social media have a lot to offer in fashion forecasting, particularly with applications like Facebook, Instagram, Twitter, Tumblr and Pinterest. These are the warehouse of fashion data in the form of images. When users upload their pictures on these sites, they also offer a sneak peek into their clothing choices. Hence, we felt the need for a framework to analyze these pieces of information to create intelligence on fashion products in real time.

The present work addresses all these issues. In contrast, this work's central objective has been towards creating a framework of e-forecasting for the fashion industry. The peripheral objectives also cover emerging areas such as AI usage by fashion companies and a framework for this, internet-based fashion forecasting or short-term forecasting or 'nowcasting fashion', connecting elements such as fashion identity, which justifies why data on the internet and particularly social media can be purposeful for forecasting fashion. We discussed how identity is the connecting element between fashion consumption and social media. Users reveal their identity through social media and fashion consumers through their products. Hence, when social media users are also fashion consumers, decoding their communications may better understand their consumption. The issue has been deliberated well and investigated through a case study in the present work.

The concept of fusion or 'Fused Business' is getting much prominence in the present era. Companies, but preferably regions, are also exploring growth possibilities in the post-industrialized, competitive marketplaces. On an academic front, many developed countries are broadening their focus from STEMM (Science, Technology, Engineering, Mathematics and Medicine) to CDIT (Creative, Digital and Information Technology) fields, assuming that these industries will form the new growth engines of the world in future. Our present work is a work of fusion. It brings prominence to these emerging academic disciplines where we have proposed new methods of using 'technology for creative problem-solving' and decoding the 'designers dilemma'.

This work may be of significance to both industries and academics as we tell why and how fashion forecasting can be done through internet data. We attempt to create a paradigm shift from forecasting to nowcasting. The frameworks developed by us may invite future research and industrial engagement in this area. Some of the frameworks developed by us may have far-reaching consequences. For example, 'the framework of fashion identity' can explain masses' fashion behaviour and differentiate 'self-identity' from

'social identity'. It may explain the relationship between them. Our e-fashion forecasting framework provides researchers with the necessary tools to validate this framework with a host of data from e-commerce, social media and other web applications. We aim to solve the biggest problem of the fashion industry through this work.

Our work may significantly add to the previous literature on fashion forecasting. It may provide necessary directions to future researchers to add case studies, create new theories and broaden the existing propositions.

Lastly, 'today's research is tomorrow's classroom', hence we argue that in the future, data-driven and intelligence-driven forecasting will be the call of the fashion industry so as will be in academics. We thereby add content to the future classrooms of fashion forecasting.

1.2 RESEARCH GAPS

A snapshot of the research gaps identified in the existing literature is briefly given below:

(1) There is a dearth of good literature in the area of fashion identity. We explored it as a connecting element between users' fashion behaviour and consumption. Revealing information on social media and e-commerce through reviews, comments, likes, photographs and videos has been explained in various social media motivation theories. From a theoretical perspective, fashion theories do not address this area. Novel theory may be required to explain consumers' fashion motivations for seeking and expressing their fashion behaviour, especially on social media. Hence more literature would have certainly enlarged the scope and applicability of this area.

(2) Constructs of self-identity and social identity, which we explored in this work as the predecessors of fashion identity, would have required more attention in the existing literature.

(3) Systematic documentation of emerging digital tools in fashion forecasting was not available in the existing literature.

(4) Existing literature was found to be satisfactory in long-term fashion forecasting; however, with emerging digital tools, the field of short-term fashion forecasting has also evolved. Hence, there is an observed gap in the literature of short-term forecasting.

(5) E-forecasting as an area has not at all been discussed in the previous literature. A framework based approach was found to be missing.

(6) Very few works were found where e-commerce or social media-based data has been used for fashion product development. Even if some works were cited in this dissertation, the area of image analysis and machine vision for fashion product development features poorly in the existing literature. Tools and techniques and a framework would have certainly been a remarkable contribution in this emerging field.

(7) An explanation of how social media could predict fashion was something that was not observed in any of the previous works.

We discussed a few more gaps and elaborated on them in detail in Section 3.3 of this dissertation.

1.3 RESEARCH OBJECTIVES

Based on the four research questions presented in the previous section, we developed our objectives. The first objective is the primary objective of this dissertation; however, in attaining our primary objective, we attained a few more objectives taken as secondary objectives in this dissertation. They are as follows:

In the section titled Research Objectives (3.4), we have explained them in detail

1.4 RESEARCH QUESTIONS

We tried to address some of the gaps observed in the existing literature by framing the following research questions.

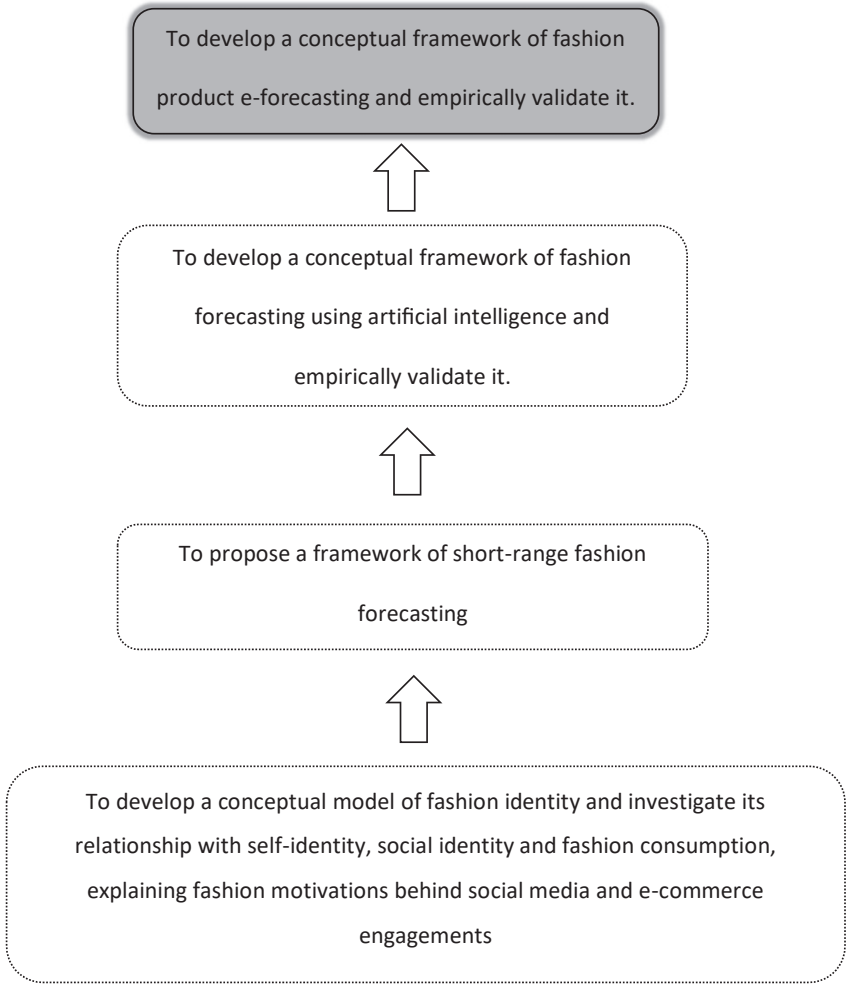
RQ1. How data from the internet, social media and e-commerce websites may be used to guide fashion forecasts?

RQ2. What is the effect of emerging technologies like AI on fashion forecasting?

RQ3. How to forecast fashion trends in the short range? What factors/tools constitute short-range or short-term fashion forecasting?

RQ4. What constitutes the fashion identity of a person? Why a person consumes fashion? What are the fashion motivations behind engaging in social media and e-commerce? Why a person's online behaviour may be able to explain his choice of fashion products?

These research questions are explained in detail in Section 3.5 of this dissertation, and subsequently, research objectives have been derived.



1.5 PROPOSED IMPLICATIONS

1.5.1 Theoretical Contributions

The present work may have specific theoretical contributions, which are discussed below:

(1) Theory in fashion identity leads to an in-depth understanding of individuals' self- and social identity. The framework proposed is capable of explaining people's fashion behaviour and elaborates their motivations

behind fashion consumptions and social media as well as e-commerce engagements.

(2) Theory in fashion forecasting is an update to the existing literature of fashion forecasting with the onset of web 2.0 applications. We have suggested digital forecasting to the classical literature of fashion forecasting to make it more contemporary and apt for the present-day digital world. The frameworks may enrich this area for teaching and learning purposes in these subjects' courses/modules.

(3) Theory in the area of AI, ML and DL and how they are creating a paradigm shift in the fashion industry has been documented well in the present work. These developments may have permanent implications in this area. The framework proposed by us is novel and hence may enrich the literature in this area. The case study used for validating our framework may be used for teaching/learning purposes as well.

(4) The process of nowcasting in forecasting using data from social media to create fashion products is a novel work and validated with a case study in this dissertation. The systematic investigation of variables and tools that led to product development in the next stage and creating a new theory in this area may find a place in academic literature in the future.

1.5.2 Methodological Contributions

We have proposed a novel fashion forecasting method and named it as fashion 'nowcasting' in the present work. From social media posted photographs of consumers, we attempted to create a fashion product. Binary coding of attributes and labels and then processing the data through a hierarchical clustering algorithm to generate clusters of popular product attributes and then reverse coding it to illustrate real-time and consumer-loving products is a work. The method can be used in the fashion industry for fashion product development purposes. The methodology proposed by us may be useful in the field of fashion product research. In addition to this, we have also proposed a new data collection and coding technique and proved the importance of widely available social media-based data as the new gold mine of data for fashion forecasters.

1.5.3 Practical Implications

We have extensively argued in the present work about the changing nature of the fashion industry with the onset of technologies related to advanced data

analytics, emerging technologies such as IoT, AR and VR, AI, DL, ML, NLP, HRI, HCI, ANN and cloud platforms. These tools not only store, analyze and predict but build actionable insights, nowcast and facilitate seamless and real-time flow of critical information for accurate business decision-making and overall enhancement of the consumer experience. The frameworks developed in this dissertation may have managerial significance in the below mentioned areas in the fashion industry:

(1) Higher sell-through rates: It will aid fashion retailers to sell greater number of products at full prices and improve full price sell-through rates.

(2) Better Margins: As the full price sale will increase the gap between planned margin and realized margin will decrease. Overall, fashion organizations will be able to extract higher margins from more accurate products.

(3) Reduced Inventory: They will be dealing in more accurate inventory which consumers are likely to buy. Hence, stores and warehouses will have to store less unnecessary products. This will release the pressure on fashion supply chains making it more agile and quick responsive.

(4) Correct Pricing: Fashion companies will be able to scan the competition, variety, fast movers, price points and many more factors which might impact their sales through e-data, which we have extensively argued in the present work. Hence, they may be able to offer the consumer with better prices in the first attempt itself, reducing the scope of unnecessary markdowns in the later stage.

(5) Reduced forecast errors: The given work presents many arguments in the light of existing literature, proposed frameworks and empirical evidences on how the fashion industry has always been a victim of wrong forecasts by using the traditional apparatus of forecasting. It documents the nature of change in the fashion forecasting industry with the onset of internet data and argues as well as proves that how forecasts may be better minimizing the scope of errors.

(6) Reduction in markdowns: The present work documents how fashion retailers are reducing the volume as well as value of the markdowns by creating better and consumer-loving products at the first place.

(7) Better promotional planning: The fashion industry is shifting from price-based promotions to experience based promotions. Product accuracy and decreased dependence on markdowns may further aid fashion retailers to