



## FASHION FORWARD: FORECASTING VISUAL STYLE IN FASHION

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### ABSTRACT

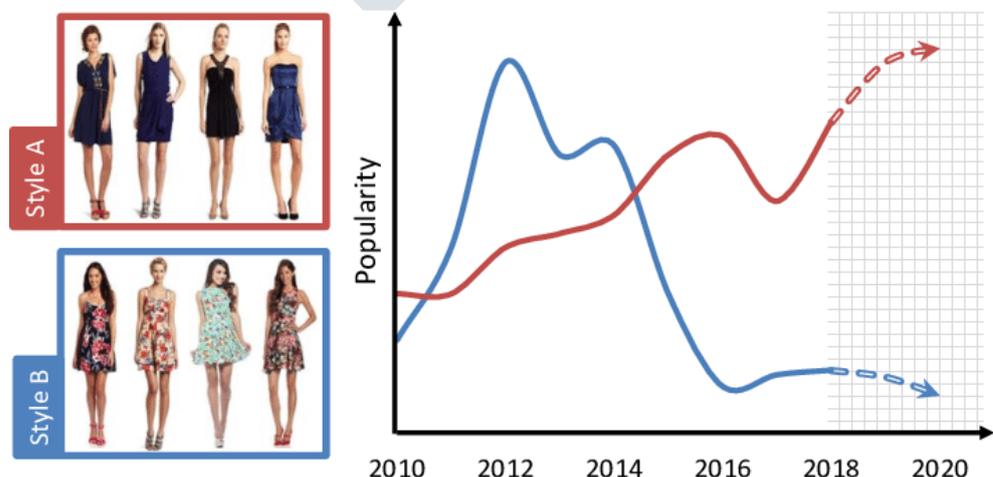
Fashion trend forecasting is of great research significance in providing useful suggestions for both fashion companies and fashion lovers. Although various studies have been devoted to tackling this challenging task, they only studied limited fashion elements with highly seasonal or simple patterns, which could hardly reveal the real complex fashion trends. We propose to forecast visual style trends before they occur. We introduce the first approach to predict the future popularity of styles discovered from fashion images in an unsupervised manner. Using these styles as a basis, we train a forecasting model to represent their trends over time. The resulting model can hypothesize new mixtures of styles that will become popular in the future, discover style dynamics (trendy vs. classic), and name the key visual attributes that will dominate tomorrow's fashion. We demonstrate our idea applied to three datasets encapsulating 80,000 fashion products sold across six years on Amazon. Results indicate that fashion forecasting benefits greatly from visual analysis, much more than textual or meta-data cues surrounding products.

**KEYWORDS-** Fast fashion, Visual style, Fashion Forecasting, Style prediction, Trend analysis, Fashion dataset

### INTRODUCTION

Fashion is a fascinating domain for visual styles. Not only does it offer a challenging testbed for fundamental vision problems human body parsing, cross-domain image matching, and recognition but it also inspires new problems that can drive a research agenda, such as modeling visual compatibility interactive fine-grained retrieval or reading social cues from what people choose to wear. It is increasingly entwined with online shopping, social media, and mobile computing—all arenas where automated visual analysis should be synergetic.

In this work, we consider the problem of visual fashion forecasting. The goal is to predict the future popularity of fine-grained fashion styles.



For example, having observed the purchase statistics for all women's dresses sold on Amazon over the last N years, can we predict what salient visual properties the bestselling dresses will have 12 months from now? Given a list of trending garments, can we predict which will remain stylish in the future? Which old trends are primed to resurface, independent of seasonality? Computational models able to make such forecasts would be critically valuable to the fashion industry, in terms of portraying large-scale trends of what people will be buying months or years from now. They would also benefit individuals who strive to stay ahead of the curve in their public persona, e.g., stylists to the stars. However, fashion forecasting is interesting even to those of us unexcited by haute couture, money, and glamour. This is because wrapped up in everyday fashion trends are the effects of shifting cultural attitudes, economic factors, social sharing, and even the political climate.

fashion forecasting demands looking at the products. Thus, a key technical challenge in forecasting fashion is how to represent visual style. Unlike articles of clothing and their attributes (e.g., sweater, vest, striped), which are well-defined categories handled readily by today's sophisticated visual recognition pipelines, styles are more difficult to pin down and even subjective in their definition. Two garments that are superficially different may nonetheless share a style.

**Retrieval and recommendation** - There is a strong practical interest in matching clothing seen on the street to an online catalog, prompting methods to overcome the street-to-shop domain shift.

**Attributes in fashion** - Descriptive visual attributes are naturally amenable to fashion tasks, since garments are often described by their materials, fit, and patterns (denim, polka-dotted, tight). Attributes are used to recognize articles of clothing, retrieve products, and describe clothing. Relative attributes are explored for interactive image search with applications for shoe shopping

**Learning styles**- Limited work explores representations of visual style. Different from recognizing an article of clothing (sweater, dress) or its attributes (blue, floral), styles entail the higher-level concept of how clothing comes together to signal a trend. Early methods explore supervised learning to classify people into style categories, e.g., biker, preppy, and Goth. Since identity is linked to how a person chooses to dress, clothing can be predictive of occupation or one's social "urban tribe". Other work uses weak supervision from meta-data or co-purchase data to learn a latent space imbued with style cues. In contrast to prior work, we pursue an unsupervised approach for discovering visual styles from data, which has the advantages of i) facilitating large-scale style analysis, ii) avoiding the manual definition of style categories, iii) allowing the representation of finer-grained styles, and iv) allowing a single outfit to exhibit multiple styles. Unlike concurrent work which learns styles of outfits, we discover styles for individual garments and, more importantly, predict their popularity in the future.

**Discovering trends** - Beyond categorizing styles, a few initial studies analyze fashion trends. Preliminary experiment plots the frequency of attributes (floral, pastel, neon) observed over time. Similarly, a visualization shows the frequency of garment meta-data over time in two cities. The system predicts when an object was made. The collaborative filtering recommendation system is enhanced by accounting for the temporal dynamics of fashion, with qualitative evidence it can capture popularity changes of items in the past (i.e., Hawaiian shirts gained popularity after 2009). A study looks for a correlation between attributes popular in New York fashion shows versus what is seen later on the street.

## LITERATURE REVIEW

### 1. Forecasting the visual popularity of new fashion products

Fashion is a primarily visually driven domain. As a result, computer vision has successfully been utilized to assist fashion recommendations and trend forecasting [6]. Recent studies have utilized visual features—extracted by computer vision models—to identify fashion styles [2] or attributes [19] and then detect and analyze trends in fashion. However, such approaches are limited to detecting coarse-level trends and cannot work for specific garment designs. They can forecast whether “chunky trainers” will be trending this season, but all “chunky trainers” will receive the same popularity score. Specific visual differences in individual garments are not taken into consideration. Autoregressive (AR) neural networks have been used for forecasting the popularity of specific garments based on their past popularity [16]. However, new products lack historical data, which renders the use of conventional AR networks impracticable. Few recent research works have addressed sales forecasting of new garments, by utilizing KNN-based (nearest neighbors) [7], autoregressive networks with auxiliary features (images, fashion attributes, and events) [8] or non-AR Transformers modeling images and fashion attributes along with the “target” time series of those attributes collected from Google Trends [25]. However, fashion attributes are not always independent of each other. Trends in certain attributes may affect other interdependent attributes. If, for example, “warm minimalism” was trending in fashion, a series of light, neutral, and pastel colors would show an increase in popularity while bold graphics and patterns would decrease. (Stefanos-Iordanis et al. 2022)

### 2. Fashion Trend and Forecasting: Branding for a New Trend Name

People all over the world are very much concerned about fashion and they are following the flowing trend, because of fast fashion. It is possible for easy access to review fashion of the world, even though the people of Bangladesh go ahead day by day and to complete the demand open a massive number of fashion houses or boutique houses for many fashion groups. For this reason, individually various fashion designer opens their own brand like fashion houses, and they are doing an outstanding job for Bangladeshi people. Aarong, Yellow, Sailor, Rong, Shada-Kalo, decal, etc. are the famous fashion houses in Bangladesh, maximum is founded in Dhaka city. They are constantly trying to give new trendy and fashionable dresses to the consumer. “Fashion is not something that exists in dresses only. Fashion is in the sky, in the street, fashion has to do with ideas, the way we live, what is happening”- Coco Chanel (Fashion icon). Asymmetrical design, or clothes in which one side is not the same as the other. Although asymmetry has been around for a while in the arena of novelty fashion. Eventually, it is showing up not only in clothing but also in everyday items like eyeglasses, shoes, ornaments, automobiles, etc. There are so many silhouettes in dresses. Asymmetrical patterns,

cuts, and designs are no innovation for the fashion world. Although the ramps are full of asymmetrical designs from various designers, the concept is not new and can be traced back to the time the Grecian mythologies represent. The modern innovations are many, yet the basic idea is the same. The entire geometry and symmetrical involved in the design of dresses experiment complete freedom and break away from the rigid lines of the symmetric design. The asymmetry is bohemian yet sophisticated. It represents the human desire or interest to break free from the traditional or regular lines that creep like monotony into our lives. The asymmetry is bold, experimental, free, classic, and timeless. (Afroza Akter Rita et al.)

### 3. Context-Aware Visual Compatibility Prediction

Predicting fashion compatibility refers to the task of determining whether a set of fashion items go well together. In its ideal form, it involves understanding the visual styles of garments, being cognizant of social and cultural attitudes, and making sure that when worn together the outfit is aesthetically pleasing. The task is fundamental to a variety of industrial applications such as personalized fashion design outfit composition wardrobe creation item recommendation and fashion trend forecasting. Fashion compatibility, however, is a complex task that depends on subjective notions of style, context, and trend – all properties that may vary from one individual to another and evolve over time. (Guillem Cucurull Element AI gcucurul et al.)

### 4. What Makes a Style: Experimental Analysis of Fashion Prediction

Due to the high level of variability and subjectivity, fashion understanding remains a complicated problem for computer vision. Unlike traditional problems which have consistent and specific definitions, fashion does not depend greatly on individual taste, but also has an important temporal component: outfits and garments are constantly falling in and out of style. To be able to design computer vision algorithms to solve fashion understanding, it is first important to understand not only how algorithms see the style, but also how different individuals see the style. Recent fashion research has been focusing on using weakly labeled and readily available downloaded from the internet. However, even when learning with weak data and annotations, the different approaches must be evaluated on strongly annotated datasets [15, 7]. Given the subjectivity and diversity of fashion, creating high-quality datasets proves to be a challenge. (Moeko Takagi Edgar Simo-Serra Satoshi)

### 5. A STUDY ON FASHION-FORWARD AND CONCEPTUAL ANALYSIS OF TREND

Fashion and trend analysis play a vital role in the fashion industry and in brand development. The business is continually looking ahead for forecasting about identifying, evaluating, and predicting growth in the industry target markets as well as developing brands through promotion and retail. Forecasting skills are used in a diverse range of activities, such as seasonal change, newly launched products, displays, garments, agencies, or store concessions. Analysis of developments and trends in markets will enable you to influence the future direction of fashion and style-based products through your understanding of the mechanics of the fashion cycle and its application to the fashion industry. (Madhu Shalini et al.)

## RESEARCH OBJECTIVES

1. Undertake research and analysis by identifying and tracking fashion trends
2. To apply knowledge of fashion forecasting to understand how trends evolve and are interpreted by the industry.
3. To predict the future popularity of fine-grained fashion styles.
4. To demonstrate its potential power for providing interpretable forecasts, analyzing style dynamics, and forecasting individual fashion elements.

## RESEARCH METHODOLOGY

In this work, we propose a new expert-curated dataset for the prediction of fashion styles formed by 13,126 images, each one corresponding to one of 14 modern fashion styles. An overview of the different classes can be seen in Fig. 1. We focus on images with full outfits visible and representing a wide diversity of scenes. We evaluate our dataset by establishing benchmarks with Convolutional Neural Network (CNN) models commonly used for image classification and perform an in-depth user study with both fashion-savvy and fashion-naïve users. Our results indicate that CNN models are still far from human-level performance on the fashion style prediction task, although recent models do show a significant increase in performance.

We propose a new dataset for evaluation which is based on expert annotations of fashion style. We focus on natural images in which the garments are worn, and the outfit is visible. A comparison with existing datasets is shown in Table 1. While there exists larger datasets such as Deep Fashion [11], Paper doll [21], Runway [19], and Fashion144k [14], these lack curated style annotations and rely on either crowd-sourced annotations or weak labels. The Fashionista dataset [22] provides per-pixel garment labels, but no information about the fashion style. The closest dataset to the one we propose is that of Hipster Wars [10], however, instead of relying on user annotations for a small number of very dissimilar classes, we focus on more complicated classes with large variability, and rely on expert-curated annotations. Furthermore, we provide an extensive analysis of our dataset evaluating both expert and non-expert human performance, as well as the performance of state-of-the-art machine learning techniques for classification

**Fashion Style Dataset** - We have collected a new expert-curated dataset, which we denote as Fashion Style that consists of various fashion style classes: conservative, dressy, ethnic, fairy, feminine, gal, girlish, casual, Lolita, mode, natural, retro, rock, and street. These classes were chosen by an expert as being representative of modern fashion trends and covering a large diversity of fashion styles. The general procedure of obtaining the images was to use a search engine in combination with fashion styles as

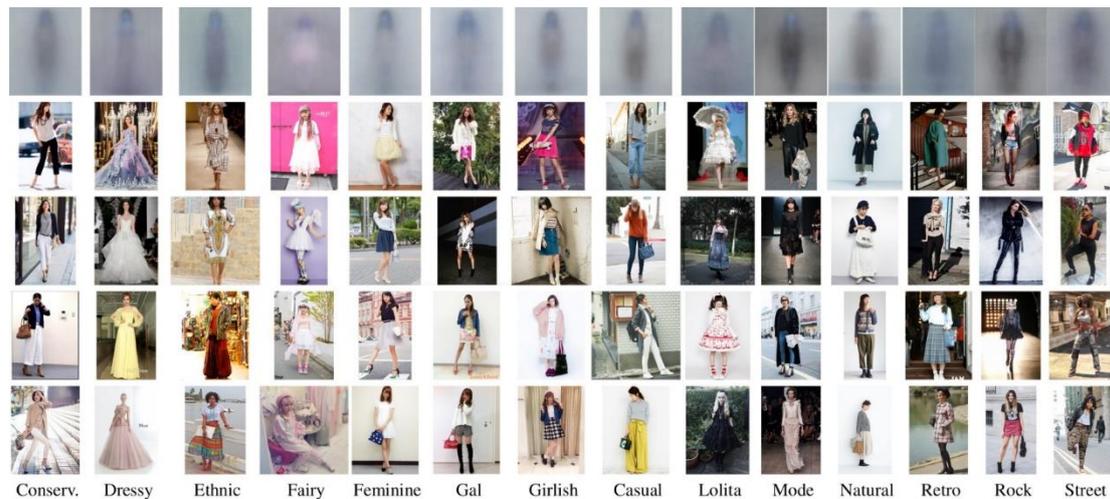


Fig-1

## SCOPE OF THE STUDY

Fashion forecasting is focused on the prediction of the mood, behavior, and buying habits of the consumer. It is no longer a question of identifying your customers by age, geography, or income, but looking into how and why they buy, based on their mood, beliefs, and the occasion.

Fashion is a style that is popular in the present or a set of trends that have been accepted by a wide audience. But fashion itself is far from simple. Fashion is a complex phenomenon from a psychological, sociological, cultural, or commercial point of view. Fashion trends are the styling ideas that major collections have in common. They indicate the direction in which the fashion is moving. Fashion forecasters look for styles they think are prophetic, ideas that capture the mood of the times and signal a new fashion trend. Trend forecasting in fashion aims to create a story using shapes, design elements, colors, fabrics, and trims. Trend forecasters make reports and mood boards that designers use to create new clothing and accessories for brands.

## SIGNIFICANCE OF THE STUDY

Fashion has played a crucial role in defining one's social status. One's personality can be perceived from their style sense. Fashion trends indicate shifting cultural attitudes and trends argued that fashionable behavior reflects human psychological functioning and receptivity to novel ideas adopted perpetually at points of social stability. Fashion trends are cyclical - they appear and reappear in the fashion landscape. By isolating and analyzing these recurrent dress patterns, which carry slightly different meanings in each rendition, one can predict their use in the future. Fashion prediction, or fashion trend forecasting, is critical to attracting consumers and helping retail businesses and designers sell their brands while keeping ahead of the trends among consumers. Eminent e-commerce lines are increasing their commitment and investment in automated fashion. Better knowledge of users' unique preferences for product recommendations has become a crucial task for retail businesses.

## RESEARCH ANALYSIS

Fashion Forecasting is focused on upcoming trends. There is a cycle of forecasting and trend analysis which happens sometimes at least 2 years before the product lines appear. According to the market survey and customer response, our people are following fashion trends, and for this reason, our current trend is changing frequently. Now there are many styles running in women's wear, namely - Hijab, jeans, Vallejo (bell-bottom), and tops but the most significant style is asymmetric silhouette dresses, and, in this research, we are forecasting this trend and that will be more updated and refreshed for 18/19, based on our coverage of the latest catwalks, street style, trade shows, retail, and editorials.



## WORK DONE ANALYSIS

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Dataset	Worn Items Only	Style Annotations	Number of Styles	Number of Images
DeepFashion [11]	No	Weak	-	<b>800,000</b>
Fashionista [22]	<b>Yes</b>	No	-	685
Paperdoll [21]	<b>Yes</b>	No	-	339,797
Runway [19]	<b>Yes</b>	No	-	348,598
Fashion144k [14]	<b>Yes</b>	Weak	-	144,169
HipsterWars [10]	<b>Yes</b>	<b>Yes</b>	5	1,893 <sup>2</sup>
FashionStyle14	<b>Yes</b>	<b>Yes</b>	<b>14</b>	13,126

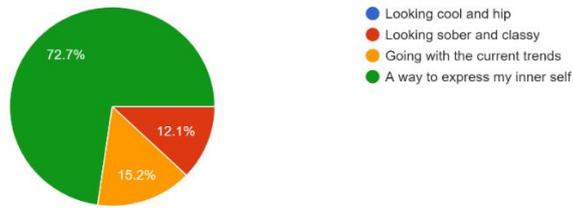
**Fashion style dataset**

## RESEARCH METHODOLOGY ANALYSIS

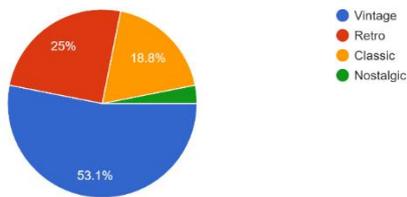
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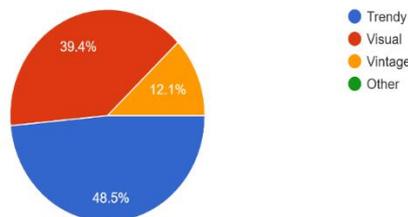
Fashion to you is:  
33 responses



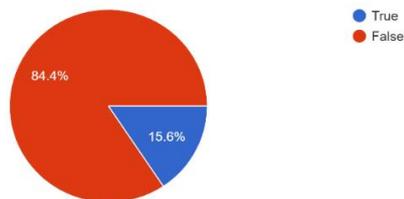
What is the term for new clothing that resembles styles from at least 20 years ago?  
32 responses



How would you describe your style?  
33 responses

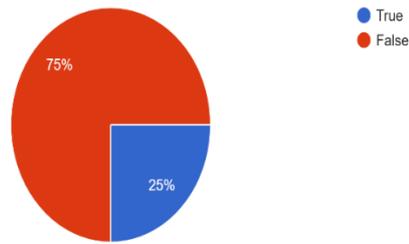


Once a fashion has come and gone, it never returns  
32 responses



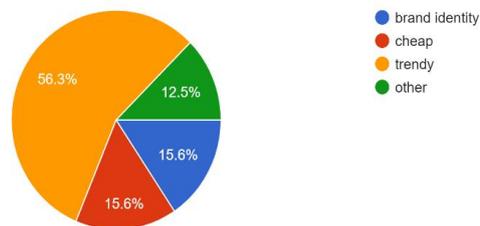
A fashion trend usually lasts for just one year?

32 responses



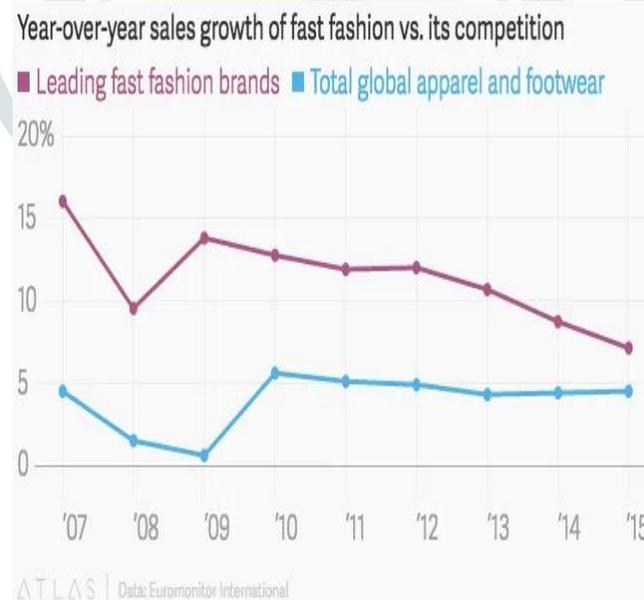
Comparing with other fashion brands, what makes you choose fast fashion brands?

32 responses



### Tabulation and Graphical Representation

To get a sense of the immense pressure that fast fashion has put on the global apparel and footwear industry, all you need to do is look at this chart. It shows average year-over-year sales growth for a group of fast-fashion leaders, including H&M, Zara, Primark, and Forever 21, compared to the rest of the apparel industry.



Concept	Company-owned	Franchised	Total
Zara	1,944	218	2,162
Pull&Bear	803	133	936
Massimo Dutti	638	102	740
Bershka	895	149	1,044
Stradivarius	777	173	950
Oysho	542	65	607
Zara Home	449	53	502
Uterqüe	57	15	72
Total	6,105	908	7,013

Table 1 Number of stores of Inditex per concept and owner

## CONCLUSION

In the fashion industry, predicting trends, due to their complexity, is frequently compared to weather forecasting: sometimes you get it right and sometimes you get it wrong. In this work, we show that using our vision-based fashion forecasting model we get it right often. We propose a model that discovers fine-grained visual styles from large-scale fashion data in an unsupervised manner. Our model identifies unique style signatures and provides a semantic description for each based on key visual attributes. Furthermore, based on user consumption behavior, our model predicts the future popularity of the styles and reveals their life cycle and status (e.g., in or out of fashion). We show that vision is essential for reliable forecasts, outperforming textual-based representations. Finally, fashion is not restricted to apparel; it is present in accessories, automobiles, and even house furniture.

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