A Review: Pros and Cons of Using Data-Mining in Fashion Styling

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Abstract— Online shopping is still in its medium level stage in India but growing at a fast pace. To continue its growth, it is significant to understand the user's preferences. Analysis of consumer's behavior with respect to online shopping consists of detailed information about consumers past purchases as well as prediction of future purchases. This growing need for refined information can't be met with simple database software. Data Mining is used for finding the hidden information from the database of data. It has also been called as data analysis, knowledge discovery and deductive learning. The ability to recognize and track patterns in data help businesses sift through layers of seemingly unrelated data for meaningful relationships. Through this analysis it becomes easy for the online retailers to determine the dimensions that influence the uptake of online shopping and plan effective marketing strategies. The aim of this paper is to understand the role of data mining in growth of fashion styling. The major factors that affect the consumer's online buying behavior are convenience, ease of use and perceived benefits. Security is also a major consideration when opting to conduct shopping activities online. This study will help in further analyzing the consumer online buying behavior towards Online shopping which will help the retailers to design appropriate marketing strategies for selling their products online which will further help in development of the country.

Indexed Terms-- Fashion industry, data mining techniques, data mining strategies, software used.

I. INTRODUCTION

In fashion websites, popular or high-quality fashion outfits are usually designed by fashion experts and followed by large audiences. In this paper, we propose a machine learning system to compose fashion outfits automatically. The core of the proposed automatic composition system is to score fashion outfit candidates based on the appearances and meta-data. We propose to leverage outfit popularity on fashion-oriented websites to supervise the scoring component. The scoring component is a multi-modal multi-instance deep learning system that evaluates instance aesthetics and set compatibility simultaneously.

- The dynamic of fashion industry drives a challenge in analyzing massive amount of data using machine learning. Data mining describes as an automated data analysis process that extracts patterns from data through supervised or unsupervised learning. The goal of this study is to compare the performance of classification algorithm in selecting the fashion model
- Big data and progressed investigation are affecting the elements of the style business, yet flow design analysts enjoy not adequately taken benefit of huge scope datasets and information science. Step by step instructions to interpret that innovativeness or instinct into an information driven construction is a difficult issue for both design researchers and professionals. In view of this, another arising called "design informatics," which alludes to the examination of huge measures of information through AI, interpersonal organization investigation, and PC vision procedures designated toward the style business. With the approach of current intellectual processing advancements, style large information can be utilized in pattern estimating, powerhouse investigation, store network the board, and customized proposals—that is, in pretty much all aspects of the design item cycle.
- The consumer or buyer is the person or group of persons, who decide what to buy, when to buy and what not to buy. In competitive environment one

cannot thrust a product on consumer. He has to produce what is demanded or what can be demanded. The marketing personnel study consumer behaviour to find out what can be sold and what goods or services are likely to be rejected. Before launching a new product survey of consumer behaviour is necessary to find-out whether a particular product will sell or not so that accordingly investment decision is taken. The more important function and purpose is to influ¬ence the behaviour of consumers through advertisements, incentives and other methods so that consumer behaviour is studied by marketing personnel to influence the behaviour of consumers after studying what factors decides the behaviour for a particular product, persons, groups or regions.

1.1 HOW DATA MINING IS USEFUL FOR FASHION STYLING

- The Data mining, big data and Vision API framework is helpful to Business house to discover the relationship of the clients with various items. Also, how clients are switching from one brand then onto the next in order to fulfill their need on the grounds that their prior purchasing propensities are legitimately contemplated by the Data Mining System. Data mining (DM) and Vision API is a process of discovering useful patterns of data for identifying current and predicting future trends through recognition of face, color, trend list.
- Almost all of the operational data of an online system is stored in the data warehouses for further use. Such data is then analyzed either regularly (large organizations) or whenever there is a probability that in the coming days, sales would likely be growing. Through DM it can be analyzed how different products are contributing in the total sales and how they are affecting the shopping habits of customers.
- Fashion styling refers to the typical way in which consumers would buy goods or avail services considering the frequency, quantity, duration, timing etc. In simple words, buying patterns indicate or may predict how consumers purchase goods or services but are highly susceptible to change. This is an important concept from the perspective of a marketer in predicting the consumer behavior and making sure that the product or a service is available when the customer needs it.
- In impulse buying, there may or may not be a clear pattern. It can be bought immediately without lot of decisioning when the opportunity presents itself. From marketer's perspective, they need to be available at the points where customer can consider the products quickly and buy them e.g., near point of sales (POS) terminals.
- The frequency of purchase is very important in determining a customer's buying pattern. A customer may buy the product daily e.g., Milk or once every month like a subscription to a service. Marketers can use this trend to better price the product or launch more SKU (stock keeping unit) for the products.

II. SOFT COMPUTING FOR CLOUD DATABASE DEVELOPMENT

- Increasingly exercises are style organizations are no exemption. With the improvement of cell phones, the Internet, long range interpersonal communication administrations (SNS), and various other new innovations that can make. For instance, clients' possible advantages and requests and clients' opinions towards brands and items can be used for future item plan, deals gauging, trendspotting, item suggestions, customized administration plan, and dynamic. To expand intensity and prevail in an information filled climate, organizations should be exceptionally equipped for removing significant experiences from existing information and applying these bits of knowledge to noteworthy the design business is evolving quickly, especially because of the short life pattern of style things and whimsical client requests.
- Additionally, these old-style strategies ordinarily have severe necessities for the size and conveyance of the informational collection. At the point when the informational index is somewhat little, like one for anticipating new item deals, which is an absence of chronicled deals information, or when the informational index is very enormous, it is trying to utilize customary methodologies for exhaustive investigation. Moreover, information incorporation and investigation have generally

been done at a customary stretch (e.g., every day, week after week, month to month), yet those spans can presently don't fulfill the interest for ongoing information bits of knowledge. Because of the enormous volume of information produced each second, if an organization can't use this information in an ongoing way, the information will lose some worth.

- To well explore data to find insights, it is crucial to go over necessary details of past and current data. With internet going hand in hand with social media and fashion industry, the fashion industry can get their hands on data of multitude of angles, which includes click through rates of a website, feedback and comments on social media pages and even browsing history. The catch that the fashion industry gets from analyzing the data are interests, demands and sentiments that an individual or a group has towards a product or a brand. This helps the fashionists to get a perspective of fashion as perceived by the clients and celebrities as well.
- This intrinsically helps the brands to extract insights and to try and be ahead of the pack. Especially, in forecasting trends and recommending products to clients. Since the law of the nature states that every good thing comes to an end so does every fashion and trend. Trends are so short-lived. The trick in staying ahead of the pack lies in the verity that the brands will have to be lightening paced in updating their strategies and meeting the demands and interests to match the short lives of the trends.
- Software building is characterized as a procedure of investigating client necessities and afterward planning, building, and testing programming application which will fulfil those prerequisites.
- Complexities of software projects expanded at whatever point its equipment ability expanded. Demand for new software expanded quicker contrasted with the capacity with creates new software.

III. LITERATURE REVIEW

- S Jain et al (2017) [1] the creators have headed out with the examination to get a point of view of how huge information plays in design industry. It is the idea of large information to manage volume, speed, assortment and veracity that had made it a colossal piece of style industry. Quick design has tremendous measure of new information coming in which requires quick handling of assortment of patterns. The cycle starts from tracking down the right material, plan, example and shading. Body information is gathered in 3D or 2D configuration utilizing body scanners.
- The information that is gathered from the client, for example, self-perception and favoured kind of dress, the site or application suggests the client equips that are bound to suit and adapt the client. Xue et al (2018) [2], with different sorts of information going from text to picture exemplary translation devices are outdates. The vintage apparatuses need capacity to be exhaustive over colossal information and authentic information.
- These devices define the boundaries over measurements like conveyance and volume of the information. Acharya et al (2018) [3], the four Vs that characterize huge information apparently catches information and reacts well to the colossal measure of an information. This assists the activities with being adaptable and is labor-saving. Considering the outstandingly critical pieces of information that can be isolated from huge data, it enables configuration firms to get innovative in dealing with various troubles and getting the power. Liu et al (2018) [4], with the improvement of figuring headways, various automated thinking (AI) based procedures are winding up being more versatile, capable, and exact than some pure real systems at getting significant pieces of information from data. These AI-based methodologies are adept at dealing with coordinated, semi-coordinated, and unstructured data; can suitably deal with nonlinear issues and uproarious data; unequivocally unravel data; and have requirements for size and apportionment of an information base that are not demanding.

IV. SOFTWARE USED IN FASHION INDUSTRY

4.1 ECHO LOOK

- Echo Look from Amazon has gone up a notch in the scale of providing solutions for their clients by mining the data. The app supposedly collects data

about the user in dimensions that fashion and styling would need. The app has been built by the help of group of fashionists. The app has a feature in which the user can upload two pictures of themselves wearing different attires in both pictures. The app would decide which is better than the other. The trick lies in the fact that the photo which the user uploads shouldn't be a headshot. The app would display its decisions by words as such - Definitely pick this one, We like this better, It was a close call. The app apparently, has a depth sensing camera with features to blur the background and style check software. After quite sometime of analyzing the style and taste of the user, the app can recommend attires for the users from Amazon. The recommendations are based on weather and type of occasion. The app collects data from users to better understand and manufacture its own brand of clothing according to the preferences of the consumers. The app is a necessity for the users who would like to upgrade their wardrobe or just their sense of style.

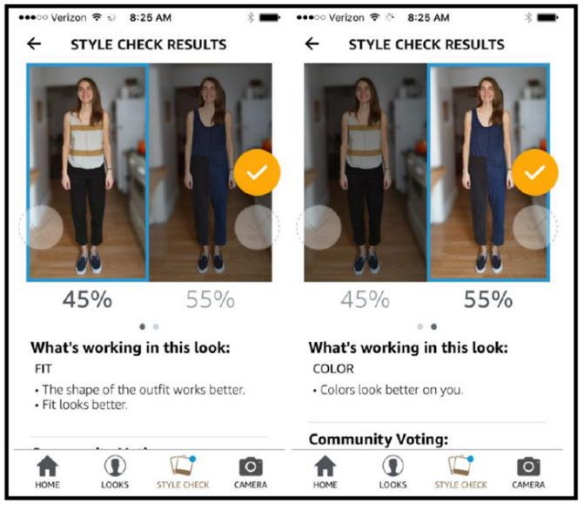

Figure 1. Example set in percentage of Style Check results (Pagano, 2018).

- To get more applicable and exact ideas, clients need to continue to give criticism. The outcomes are introduced in the arrangement of a rate probability of each outfit looks better on the client in addition to concise notes from a beautician clarifying the explanation. Be that as it may, subsequent to surveying all the writing, it shows up there is likewise no nitty gritty data unveiled with regards to precisely how the design experts help a superior shape and fit. Consequently, it appears to be that shading makes a more noteworthy commitment to building a decent look for this situation. In any case, there are no subtleties clarifying how Style Check gauges each design trait of outfits.
- Check programming can offer clients close to continuous guidance on which of two outfits looks better, utilizing AI calculations and beauticians' ideas dependent on fit, shading, styling, and latest things. To begin the Style Check, clients just need to submit two photographs of themselves wearing the outfits to the Echo Look; no other data should be given. Despite the fact that there is no data obviously laying out how Amazon fostered the AI calculations to decide which outfit looks better when the application is first utilized, after the client offers criticism to Style Check results, the criticism will be contribution to streamline the calculations to offer the client a seriously fulfilling Style Check administration. In this way, the investigation precision of Echo Look is worked on over the long run with more client input information.

4.2 STYLE SNAP

- Style Snap is again from Amazon. Style Snap solves problems for consumers as such struggling to find an outfit for a certain occasion or for someone with not much of style sense or brand knowledge. The app permits clients to transfer an image or screenshot of a design they desire, and the app suggests comparable things that are accessible from Amazon. The app also has features that display suggestions based on brand, cost and permits users to read customer reviews. Other clothing apps such like Myntra, Alibaba has similar feature inbuilt camera that suggests the clothes according to the picture that the user uploads. The cosmetic app Nykaa has taken the game to the next level by allowing users to try on lipsticks virtually which is indispensable for various skin tones and users who are novice to cosmetic shopping.
- To tackle the issue of clients trusting Style Snap can further develop client commitment by assisting them with getting design motivation continuously (Krishnan, 2019). Style Snap, which is accessible

on the Amazon application, permits clients to transfer an image or screen capture of a design look they like and get quick proposals of comparative things accessible from Amazon (Krishnan, 2019). The interaction is displayed in Figure 2. Backend upgraded PC vision and profound learning models empower Style Snap to offer clients suggestions dependent on brand, value reach, and client audits.

Figure 2. The working process of Style Snap (Zhang, Pan, Zheng, Zhao, Zhang, Ren, & Jin, 2018).

- The application confines the image and debilitates the impact of any meddling variables in the picture, like something behind the scenes of the photograph. The neural organizations are prepared to identify distinctive design attire through contributing of enormous volumes of pictures of each sort of style attire, which are utilized to gain proficiency with the provisions of the class of dress dependent on shading, design, fit, style, and the sky is the limit from to precisely distinguish. In any case, when a specific, disappearing or detonating slope can occur in forward-spread neural which will prompt more broad preparing mistakes. Consequently, Amazon uses remaining organizations to take care of this issue, and the exactness of leftover organizations will increment with expansions in network profundity.
- In this sense, remaining organizations are the profound organizations that execute alternate way associations with permit some sign spread to skirt a few layers and the organization to recognize pictures through essential ideas organizations can recollect highlights it has as of now scholarly and furthermore learn new elements simultaneously, which empowers Style Snap to adequately measure and examine an enormous volume of information.
- A comparative application gotten brilliant criticism, and the normal every day dynamic clients expanded to in excess of 17 million out of 2017, and the quantity of day-by-day dynamic clients almost multiplied are then re-positioned thinking about deals volumes, change rates, praise from different utilizations, and client pictures to work on the nature of results offers this assistance for a wide range of item types Pinterest, Google, and eBay have comparable visual pursuit administrations to further develop client commitment, however Amazon was quick to utilize visual inquiry explicitly for style clothing retailing.

4.3 WEARABLE TECHNOLOGY

- It is safe to say that wearable technology has its own buzz in fashion and sports. They come with micro sensors that read real-time biometric data to ameliorate health by being a constant reminder of wearer's activities. Ralph Lauren had upped the level of the wearables to another level by incorporating the wearable in Polo Shirts. These shirts have sensors that read the heartrate and other physical data and suggest he wearer workout plans.

4.4 STITCH FIX

- Stitch Fix – an American online based company supposedly collects dimensions of data needed for clothing and also preferences of the consumer. The consumers apparently will have to fill out a style profile which can be quite protractive. Information as such body measurements, occupation, whether they have kids, colour, fit and adornments preferences are collected. The consumer will receive a package which includes shoes, clothing as well as adornments which would be picked out both by data analytics and designers. The consumers after receiving the package pays for the items that they desire and return the other items. One of the compelling features of Stich Fix is that it encourages consumers to interlink their style profile to Pinterest profile to get more of insight on the style that the consumer prefers.

V. STRUCTURE DEVELOPMENT RELATED TO DATA MINING INDUSTRY

A. AMAZON

- Amazon is an American innovation organization established in 1994 by Jeff Bezos that is centred around internet business, computerized reasoning, media web based, and distributed computing. It started with selling books online then extended to selling hardware, furniture, computer games, attire, food, Amazon gadgets, for example, the Amazon Echo and Kindle E-peruser, and the sky is the limit from there. Amazon turned into the biggest online business organization in the United States in 2008, and the organization's income stretched around $233 billion out of 2018. Amazon has additionally turned into the head of the world's distributed computing administrations.
- The market worth of worldwide attire and frill benefits of clothing and embellishments are more prominent than those of different classes of items, like gadgets or food. Along these lines, putting resources into attire and frill will procure Amazon the assets to accomplish other driven money growth strategies. Amazon has consistently been considered as just an online essential design item retailer (Nicolaou and Hook, 2018).
- Notwithstanding, as of late, Amazon has put forth critical attempts to take an interest in the design business to earn more piece of the pie, for example, by dispatching private mark style marks and presenting Prime Wardrobe, there are as of now in excess of 180 private name and selective attire, shoes, and adornments brands on Amazon, and they Amazon dispatched its "attempt before you purchase" program, Prime Wardrobe, solely for US Prime clients. This drive furnishes clients with time for testing to take a stab at design things and track down their #1 styles a purchase. This program is expected to some degree take care of the issue of clients being not able to take a stab at attire when shopping on the web.

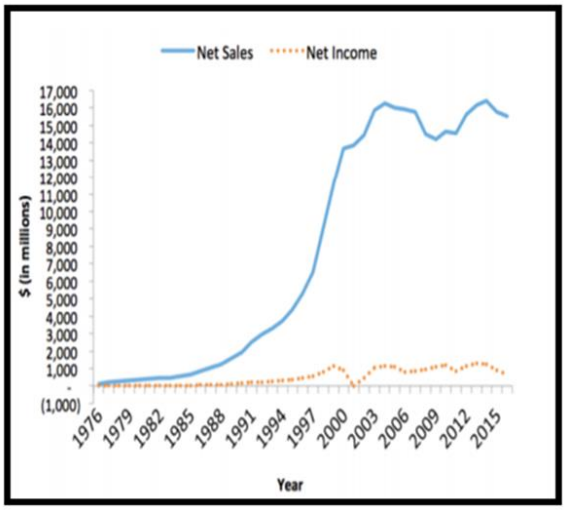

Figure 3. Amazon sales and net income (in millions), 1976–2015 (Israeli & Avery, 2018).

- Amazon is likewise known for its capacity in executing AI innovation to assist with further developing client shopping encounters. Expected for style clients, Amazon's Echo Look is a gadget dependent on information investigation that proposals close to constant design experiences. The accessible provisions incorporate Style Check, to assist clients with choosing arranges a client's closet; and ideas for new parts of supplement the client's current It uses profound figuring out how to examine clients' transferred picture information and suggest comparative apparel accessible on the Amazon site.

B. GAP INC.

- Around then, the whole organization and every one of the brands relied upon Drexler, who likewise functioned as Gap's inventive chief, (Israeli and Avery, 2018). When he was off pattern, it harmed the organization's business (Israeli and Avery, 2018). Simultaneously, shoppers' always changing preferences and the ascent of quick style likewise gave Gap Inc. a genuine test due to quick mild's fast reaction, 2016)., the Spanish global apparel organization, has become perhaps the greatest contender to following two years of income decay, which is ascribed to an inability to react to clients and the market rapidly and precisely
- For a similar explanation, and with attire showcases, the center business sectors of Gap's deals, alongside the ascent of web-based shopping

transformed Gap's enormous number of actual stores organization's presentation even subsequent to changing chiefs a few times where magnificence are truly hard to outperform. Hole Inc. today is as yet a $16 billion organization, so plainly perform not that incredible is relative, but rather deals are as yet dropping and something must be done to assist the organization with remaking its previous magnificence (Israeli and Avery, 2018; Kenny, 2018).

Figure 4. Comparison of the market values of Gap Inc. and Inditex (Safdar, 2016).

- On the positive side, to accomplish a speedy and precise reaction framework to acquire ability, deal with separate the market pattern for the following season's assortments as opposed to depending entirely on one Creative chief make some helpful fashioners and dealers to settle on choices on the plan of different items. It normally requires 10 months to close to 12 months to see the new items show up very nearly 50 years

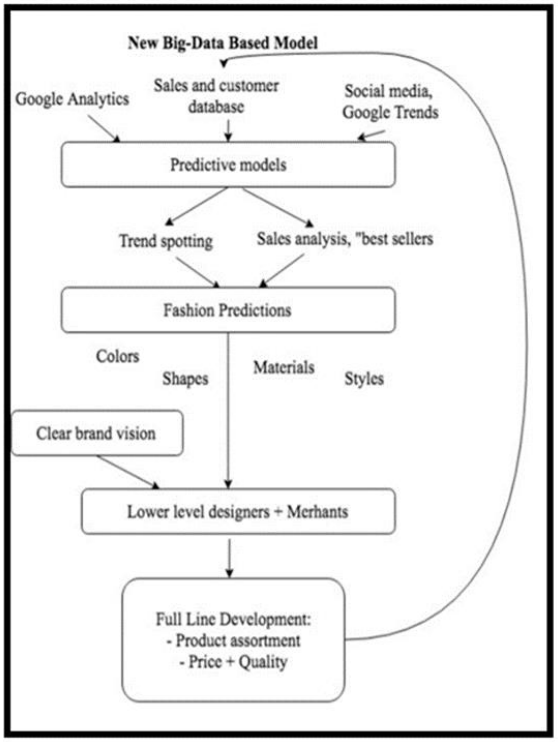

Figure 5. Gap Inc. Brands design process (Israeli & Avery, 2018).

- The initial segment of RTR's information investigation is coordination's information examination quick development of are something else and more actual should be coordinated, scaling workers as well as actual spaces and cycles (Dunn, 2018). Due to its remarkable working mode, it is significant for the organization things are and what amount of time every interaction will require. Hence, information examination is used to facilitate rental things at different stockroom, out with clients, getting back from clients, and sitting tight or fixes Gutierrez, to make the entire rental interaction more proficient.
- The more limited season of rental turnover, the more 2015), so it is basic to make each shipment on schedule. There are many credits that should be considered for each shipment, fix times. A few things are well known, so they need to move quicker, and some might ("Never rehash clothing", 2018). The information group utilizes a calculation to arrangement their stock dependent on these properties to ensure a unit can be transported to the client, returned, and sent to the following client on time ("Never rehash clothing", 2018).

VI. DATA MINING TECHNICS FOR FASION STYLING

TABLE-1 Data mining in fashion styling as per research

Data Mining Technics	Fashion styling	Online buying behavior	Fashion clothing composition	Functions
Classification	Yes	Yes	NO	This classification based on the data model involved. For example. Object-oriented database, transactional database, relational database, and so on..
Clustering	Yes	No	Yes	Clustering is a division of information into groups of connected objects. Describing the data by a few clusters mainly loses certain confine details, but accomplishes improvement. It models data by its clusters.
Regression	No	Yes	Yes	Regression analysis is the data mining process is used to identify and analyze the relationship between variables because of the presence of the other factor.
Association Rule learning	Yes	No	NO	This data mining technique helps to discover a link between two or more items. It finds a hidden pattern in the data set.
Predictive analytic:	Yes	Yes	No	Prediction used a combination of other data mining techniques such as trends, clustering, classification, etc. It analyzes past events or instances in the right sequence to predict a future event.

The primary function of data mining is to assist in the analysis of collections of observations of behaviour Knowledge Discovery in Databases is used to describe the process of finding interesting, useful data. Data mining commonly involves five classes of tasks:

- Classification: to arrange the data into predefined groups. Common algorithm includes Decision Tree Learning, nearest neighbor, naïve Bayesian classification and neural network.
- Clustering: to classify the groups while the groups are not predefined. The algorithm should try to group similar items together.

- Regression: to find a function which models the data with the least error. Regression: to find a function which models the data with the least error.
- Association rule learning: to searches for relationships between variables.
- Predictive analytic: to exploit patterns found in historical and transaction data to identify risks and opportunities, and analyze current and historical facts to make predictions about future events.

VII. ADVANTAGE AND DISADVANTAGE OF DATA MINING FOR FASHION STYLING

Data Mining Technics	Advantage	Disadvantage
Classification	Probabilistic Approach, gives information about statistical significance of features. Simple to understand, fast and efficient. High performance on non – linear problems, not biased by outliers, not sensitive to overfitting.	1. The assumptions of logistic regression. 2. Need to manually choose the number of neighbours 'k'. 3. Not the best choice for large number of features, more complex.
Clustering	It is a cheap option as it helps to cut down the cost of preparing the sampling frame or any other administrative factors. There is no need for special scales of measurement. With the help of visual graphics, one can have a clear understanding and comprehension of different clusters.	The main point of disadvantage is that the cluster formed are usually not on the basis of any theoretical part. The clusters are rather formed at random. Moreover, in a few cases, the process of determining these clusters is very difficult in order to come to a decision.
Regression	Regression models are easy to understand as they are built upon basic statistical principles, such as correlation and least-square error. the output of regression models is an algebraic equation that is easy to understand and use to predict.	Regression models cannot work properly if the input data has errors (that is poor quality data). If the data preprocessing is not performed well to remove missing values or redundant data or outliers or imbalanced data distribution, the validity of the regression model suffers.
Association Rule learning	Association rules are useful for analyzing and predicting customer behavior. They play an important part in customer analytics, market basket analysis, product clustering, catalog design and store layout	While most algorithms focus on the explicit discovery of all rules that satisfy minimal support and confidence constraints for a given dataset,

Predictive analytic	In its multiple forms predictive modeling, decision analysis and optimization, transaction profiling, and predictive search predictive analytics can be applied to a range of business strategies and has been a key player in search advertising and recommendation engines	A company that wishes to utilize data-driven decision-making needs to have access to substantial relevant data from a range of activities, and sometimes big data sets are hard to come by.

CONCLUSION

Every technology will face its downfall either because of its disadvantage or by its successor or competitor. The above reviewed each technology has its own disadvantage. Echo Look has been criticized for privacy issues and accumulating data. T actually has capabilities to record all the photos in the consumer's device. The primary concern stated by the users who have used Style Snap is that the app works well for pictures that have simple patterned clothing with bright colours but doesn't work as anticipated for composite patterns. Burberry has the similar issue to Echo Look.

The company's 2018 annual report has stated that there has been some damage to the data and that they are working to fix it. The wearable biometric physiological measuring Polo T-shirt is compatible only with iOS system and further it is designed only for men. Though Stitch Fix is a could fix styling problems for most people, it still doesn't work up to the elevated expectations of some people and even some users have stated that the app doesn't even come close to their expectation of styling. Though data mining helps generate valuable insights which helps in decision making and ameliorating the business. The above discussed cases uncover a few gainful results from the use of information investigation in the design business, including profoundly important help, enhanced coordination, opportune pattern spotting, and exact client related forecasts and proposals.

Generally speaking, the inspected organizations have profited by data mining. It will require some investment to decide if data mining will impact organizations' advancement over the long haul. The fashion market is everchanging and has procedures and techniques ought to be constantly refreshed to accomplish better business execution; notwithstanding, as we probably are aware, only one out of every odd design firm actualizes these new data mining techniques. In light of this investigation, it tends to expert data professionals, which little and medium-sized style firms for the most part need. Hence, before putting resources into data mining related procedures, an organization must decide if its advantages and capacities can bear the cost of the speculation.

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