Unveiling the E-commerce Revolution: A Comprehensive Analysis of the Boom in Online Retail

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Abstract **- This research paper presents a thorough examination of the burgeoning e-commerce landscape, delving into the dynamics and trends that define the online retail revolution. Leveraging a comprehensive dataset compiled from multiple sources, our study employs advanced data processing and visualization techniques to unravel key insights into the world of e-commerce. The research encompasses diverse facets, including product pricing, customer reviews, brand prominence, and category preferences. Our investigation initiates with a meticulous preprocessing of extensive datasets obtained from various online retail platforms, ensuring the removal of redundant information and handling missing values. The concatenated and shuffled dataset provides a representative sample for analysis, laying the foundation for subsequent exploratory data visualizations. Visual representations, including pair plots, count plots, and histograms, serve as invaluable tools for understanding the distribution and relationships among critical variables. We identify top brands based on factors such as average stars, average price, and total reviews, shedding light on the competitive landscape of online retail. Furthermore, our study investigates the correlation matrix to unveil intricate relationships between numeric variables, contributing to a nuanced comprehension of the e-commerce ecosystem. The paper scrutinizes the influence of product pricing on customer reviews, employing statistical techniques to filter outliers and reveal patterns that may drive consumer preferences. In-depth analyses extend to category exploration, where the main and subcategories are examined based on their reviews, offering a granular perspective on customer preferences within the diverse realm of online retail. The research also delves into the logarithmic scaling of variables, providing nuanced insights into the relationships between price, reviews, and other critical factors. Finally, our study synthesizes findings into actionable insights for e-commerce stakeholders, highlighting the significance of data-driven decision-making in the rapidly evolving online retail landscape. This research contributes to the ongoing discourse surrounding the e-commerce revolution, offering a comprehensive analysis that unveils the intricate dynamics shaping the future of online retail.**

Index Terms – E-commerce, Review, Customer, Price, Online Retail etc.

I. Introduction

The landscape of commerce has undergone a transformative evolution with the advent of e-commerce, reshaping the dynamics of retail on a global scale. This research paper, titled "Unveiling the E-commerce Revolution: A Comprehensive Analysis of the Boom in Online Retail," embarks on a journey to dissect and comprehend the multifaceted dimensions of the burgeoning online retail space. As consumers increasingly turn to digital platforms for their shopping needs, understanding the intricate dynamics governing e-commerce becomes imperative for businesses, policymakers, and researchers alike.

The exponential growth of e-commerce has been fueled by technological advancements, changing consumer behaviors, and the seamless integration of online platforms into everyday life. This paper leverages a rich and diverse dataset, amalgamated from various online retail sources, to provide an in-depth exploration of the factors driving the success of e-commerce enterprises. By employing advanced data processing and visualization techniques, our study aims to unravel key insights into product pricing, customer reviews, brand prominence, and category preferences within the e-commerce landscape.

The importance of this research lies in its potential to inform stakeholders about the fundamental drivers of success in the online retail domain. As the e-commerce revolution continues to reshape traditional retail paradigms, understanding the intricate relationships between variables such as pricing, customer reviews, and brand positioning becomes pivotal for businesses seeking to thrive in this dynamic environment.

This paper is structured to unfold a narrative that begins with data preprocessing, ensuring the integrity and reliability of our analyses. The subsequent sections delve into exploratory data visualizations, offering a visual narrative of the trends and patterns inherent in the e-commerce dataset. By identifying top brands, analyzing category preferences, and investigating the correlation matrix between key variables, our research aims to contribute a nuanced understanding of the e-commerce ecosystem.

As we embark on this journey, the paper not only provides valuable insights for e-commerce practitioners but also serves

as a testament to the power of data-driven research in unraveling the complexities of the digital retail revolution. Through our comprehensive analysis, we strive to offer a holistic perspective on the transformative impact of e-commerce, paving the way for informed decision-making and strategic planning in the ever-evolving realm of online retail.

II. Related works

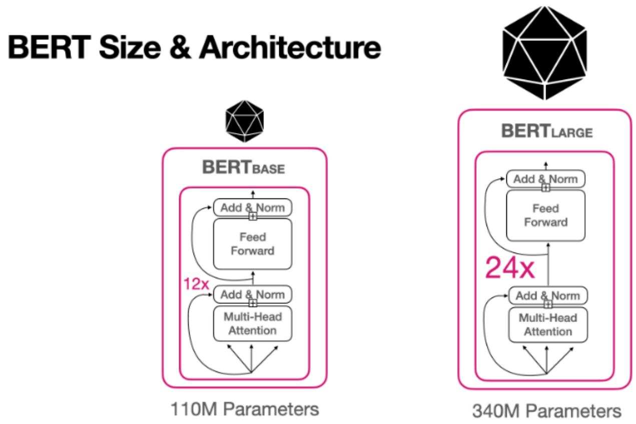
The authors in [1] and [2] develop an integrated framework to forecast e-commerce retail sales and the share of e-commerce in total retail sales. It also aims to assess the impact of the COVID-19 pandemic on the size and structure of the e-commerce retail sales sector. [3] The rapid growth of e-commerce has revolutionized the retail landscape in Europe, significantly impacting traditional supply chain networks. This article explores the effects of the e-commerce boom on European supply chains, identifying the challenges faced by businesses in adapting to the changing market dynamics. It delves into the key drivers behind the e-commerce surge, the resulting shifts in consumer behavior.[4] The sudden boom in the e-commerce sector (due to its key players) has been questioned in several economies in the world, particularly so in India. The country's Traders associations have complained that the sector has been growing at the expense of the offline retail sector, primarily the MSMEs. In this context, this study is one of the first attempts to analytically evaluate the significance of booming online retail on India's production economy (including both manufacturing and retail segments). The results indicate while e-commerce has assumed a significant role in positively impacting the sales of the overall retail and manufacturing sector of the country (on average) during the period 1992-2020, the same does not hold true for its MSMEs. The impact on MSMEs has been positive, though not significant – indicating the untapped potential for the country to take advantage of the growing online commerce. Similar results hold true for the overall retail and MSME retail when it comes to their GVC intensity. GVC intensity is a country's total GVC participation as a share of its total trade, GVC intensity is defined as ,

$$GVCintencity = \frac{FVA + DVX}{exports + imports}$$

where FVA is foreign value added and DVX is indirect value added. The findings advocate re-considering the country's e-commerce policy, which is still in its draft stage presently.[5] This work identifies and examines evidence of e-commerce in business focusing on their Internet branding strategies, the impact of management actions and how those actions contribute to e-commerce success. The data received from respondents were transcribed, codified into thirteen key words. These were analyzed using Cohen Kappa method of content analysis . Cohen's kappa measures the agreement between two raters who each classify N items into C mutually exclusive categories. It is defined by

$$\kappa = \frac{P \circ -Pe}{1 - Pe} = 1 - \frac{1 - P\circ}{1 - Pe}$$

where Po is the relative observed agreement among raters, and Pe is the hypothetical probability of chance agreement. The findings show different impacts of management actions and prioritization.[6] Today's generation are more tech savvy than previous generations. They tend to complete their everyday tasks from making their daily schedule to purchasing their daily necessities on the internet. Due to the boom in this culture, e-commerce retail stores have increased their retail sales. According to the United States of America's Census Bureau, the retail online sales in the year 2012 has peaked at $45.6 billion from the year 2001. This is an increase of 26.9%. This proves that the digital economy is growing and will continue to grow further. In e-commerce platforms there will definitely be a large requirement for logistics which develops a cross organizational support between supply chain management and retail sales. Using text analysis an in-depth review of understanding customer satisfaction towards logistical issues to further enhance product delivery and logistical improvements in terms of logistics operations. Mainly using sentiment analysis. Challenges to product delivery are discussed and viable solutions to overcome current or existing logistical issues are presented in this paper.[7] This classification process primarily centers on techniques like word segmentation, stop word removal, and feature engineering, with limited exploration of advanced technologies in this domain. However, recent years have witnessed significant breakthroughs in natural language processing, particularly in classification tasks, addressing various challenges like text classification, named entity recognition, and summarization of key content. Extracting valuable insights from textual data and delivering value to relevant industries has garnered substantial interest from researchers and developers. To underscore the strengths of our algorithmic model, this study leverages the traditional machine learning approach of the naive Bayes algorithm, using experimental data as a foundation. Additionally, we harness the cutting-edge BERT model from the realm of natural language processing to serve as a classification model for handling concise Chinese product titles.



[8] Consumers are conscious of increasing online purchases and demand sustainable consumption friendly actions. Although there is increasing interest in this topic, the research status, development, and structure of consumer behavior and sustainability in e-commerce research is scarce. This study aims to analyze the intellectual, conceptual, and social knowledge of consumer behavior and sustainability in e-commerce research to generate new understandings. Data from 104 articles were collected from the Scopus database, and a bibliometric analysis was conducted. Results revealed a close relationship between the topic and city logistics, big data analysis, customer engagement, circular economy, online services, and omnichannel retail, showing the different research approaches and the transversal themes related to the topic. This study contributes to the sustainability of academic research by identifying trends and suggesting future research topics.

By synthesizing insights from these diverse works, our research contributes to the existing body of knowledge by offering a comprehensive analysis of the e-commerce revolution, amalgamating various aspects such as pricing, customer reviews, brand prominence, and category preferences into a cohesive narrative. The synthesis of these related works provides a robust foundation for our exploration into the intricate dynamics of the booming online retail space.

III. Methodology

A) Data collection:

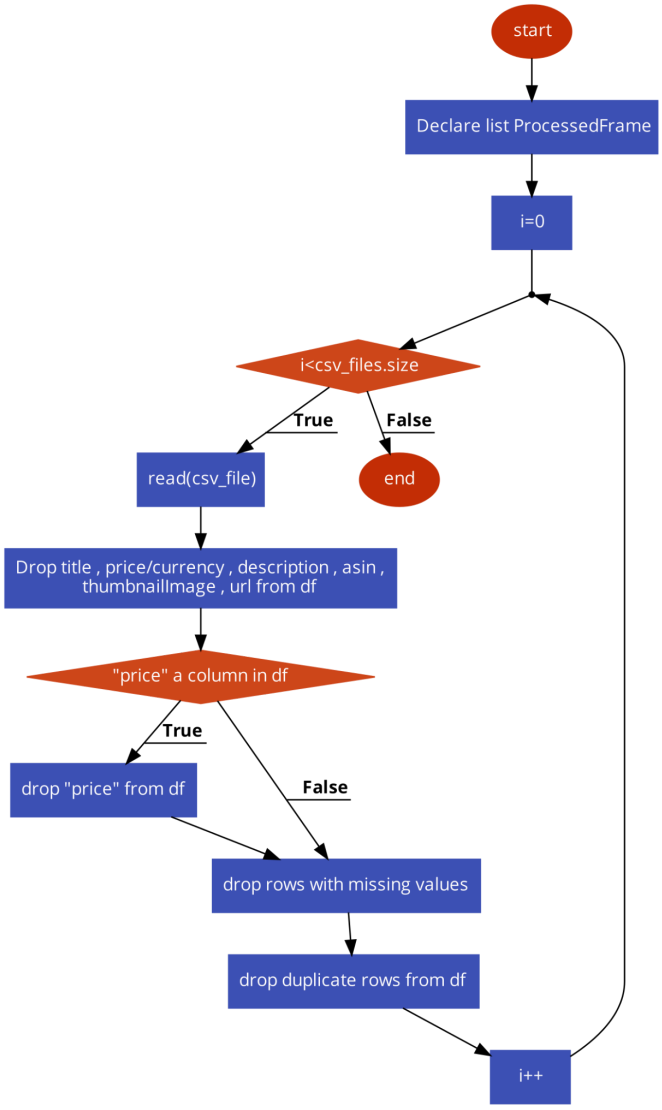
The research leverages a diverse dataset compiled from multiple online retail sources. The dataset encompasses information on product details, customer reviews, pricing, brand affiliations, and categorical classifications. The collection process involves scraping the e-commerce website Amazon in the Indian market and aggregating the obtained data into a cohesive dataset. The raw data consists of information related to electronic products, retrieved from Amazon. Each row represents a product, and the columns include details such as title, ASIN (Amazon Standard Identification Number), brand, star ratings, review counts, thumbnail image URL, breadcrumbs, description, price, currency, and product URL.

Here are some key columns and their meanings:
title: The product title.
ASIN: Amazon Standard Identification Number, a unique identifier for products on Amazon.
brand: The brand of the product.
stars: The star rating given by customers.
reviewsCount: The number of customer reviews for the product.
thumbnailImage: URL of the thumbnail image.
breadCrumbs: Product category
description: Product description.
price: The price of the product.
price/currency: The currency in which the price is expressed.
price/value: The numerical value of the product price.
url: The URL of the product on Amazon.

	title	asin	brand	stars	reviewsCount	thumbnailImage	breadCrumbs	description	price	price/currency	price/value	url
0	(Refurbished) Lenovo ThinkPad X260 6th Gen Int...	B0CM22GNX2	Lenovo	NaN	NaN	https://m.media-amazon.com/images/I/31uE+IDO4a...	Computers & Accessories › Laptops › Traditiona...	NaN	NaN	₹	17200.0	https://www.amazon.in/dp/B0CM22GNX2
1	ULTIMUS All-New S151, 14.1 (35.8 cms) FHD Disp...	B0BP1DN3KJ	ULTIMUS	1.7	9.0	https://m.media-amazon.com/images/I/41-0KqW13L...	Computers & Accessories › Laptops › Traditiona...	NaN	NaN	₹	17990.0	https://www.amazon.in/dp/B0BP1DN3KJ
2	Riitek 14" Full HD IPS 1080P Portable Monitor ...	B0BQWT4ZZ3	RIITEK	4.7	7.0	https://m.media-amazon.com/images/I/41kHZm1DPX...	Computers & Accessories › Monitors	NaN	NaN	₹	19990.0	https://www.amazon.in/dp/B0BQWT4ZZ3
3	Walker Notebook/Laptop PC Model No - NU14A1, 1...	B0CGVLLWT3	Walker	3.9	36.0	https://m.media-amazon.com/images/I/41xrUMis7f...	Computers & Accessories › Laptops › Traditiona...	NaN	NaN	NaN	NaN	https://www.amazon.in/dp/B0CGVLLWT3
4	Logitech Brio Stream, Ultra 4K HD Video Callin...	B01N5UOYC4	Logitech	4.2	16055.0	https://m.media-amazon.com/images/I/31BZywWGLQ...	Computers & Accessories › Accessories & Periph...	NaN	NaN	₹	16499.0	https://www.amazon.in/dp/B01N5UOYC4
5	AXL Laptop (Vayu Book) Newly Launched Thin & L...	B0C58NQYNW	AXL	3.4	33.0	https://m.media-amazon.com/images/I/41nwvBYSNq...	Computers & Accessories › Laptops › Traditiona...	Windows 11 Home: is a user-friendly operating ...	NaN	NaN	NaN	https://www.amazon.in/dp/B0C58NQYNW
6	(Refurbished) AVITA PURA NS14A6INV561-SWGYB 14...	B08JTXMCRX	AVITA	3.5	17.0	https://m.media-amazon.com/images/I/41Ps7rx5r5...	Computers & Accessories › Laptops › Traditiona...	NaN	NaN	₹	19990.0	https://www.amazon.in/dp/B08JTXMCRX
7	FUTOPIA All-New ULTIMUS Pro, Celeron N4020c Th...	B0C46MH5JH	FUTOPIA	2.7	13.0	https://m.media-amazon.com/images/I/31Dj6YApb6...	Computers & Accessories › Laptops › Traditiona...	NaN	NaN	₹	11990.0	https://www.amazon.in/dp/B0C46MH5JH
8	Dell D3100 USB 3.0 Ultra HD Triple Video Docki...	B00O0M46KO	Dell	4.3	9794.0	https://m.media-amazon.com/images/I/319paB5+XH...	Computers & Accessories › Accessories & Periph...	NaN	NaN	₹	10499.0	https://www.amazon.in/dp/B00O0M46KO
9	(Refurbished) HP Chromebook 13 G1 6th Gen Inte...	B0C4Y1KBJS	HP	3.6	15.0	https://m.media-amazon.com/images/I/41NstN4cls...	Computers & Accessories › Laptops › Traditiona...	The HP Chromebook empowers users to create, co...	NaN	₹	14899.0	https://www.amazon.in/dp/B0C4Y1KBJS

B) Data Preprocessing:

The preprocessing phase is critical for ensuring the integrity and reliability of the dataset. This involves handling missing values, removing redundant information, and addressing data quality issues. Columns such as "title," "price/currency," "description," "asin," "thumbnailImage," and "url" are dropped as they do not contribute significantly to the analysis. Additionally, the dataset is filtered to exclude duplicate entries, ensuring the analysis is based on unique and representative records.



Flow chart of preprocessing

```
1:Define processedFrame as an empty list
2:For each csv_file in csv_files do
3:  Read the CSV file into a DataFrame and assign it to df
4:  Drop specified columns["title","price/currency","description","asin",
                           "thumbnailImage", "url"] from df
5:  If 'price' is in the columns of df then
6:      Drop the 'price' column from df
7:  Drop any rows with missing values from df
8:  Drop any duplicate rows from df
9:  Append df to processedFrame list
```

Pseudo Code for preprocessing

Processed frames for the raw data:

brand	stars	reviewsCount	breadCrumbs	price/value
iQOO	4.3	1493.0	Electronics › Mobiles & Accessories › Smartpho...	30999.0
2&CO	3.0	6.0	Electronics › Mobiles & Accessories › Smartpho...	39870.0
Generic	5.0	2.0	Electronics › Mobiles & Accessories › Smartpho...	38499.0
Generic	3.0	5.0	Electronics › Mobiles & Accessories › Smartpho...	34499.0
Sandisk	4.4	65731.0	Computers & Accessories › External Devices & D...	33059.0
Generic	5.0	1.0	Electronics › Mobiles & Accessories › Smartpho...	33999.0
2&CO	3.0	6.0	Electronics › Mobiles & Accessories › Smartpho...	39800.0
realme	3.4	20.0	Electronics › Mobiles & Accessories › Smartpho...	32700.0
Samsung	4.7	14.0	Electronics › Mobiles & Accessories › Smartpho...	34950.0
Samsung	3.8	60.0	Electronics › Mobiles & Accessories › Smartpho...	32849.0
Nothing	3.7	382.0	Electronics › Mobiles & Accessories › Smartpho...	36990.0

C) Data Concatenation and Shuffling:

To create a consolidated dataset for analysis, individual CSV files obtained from various sources are concatenated. This unified dataset is then shuffled to eliminate any potential biases in subsequent analyses. The shuffling is performed using a random seed for reproducibility.

	brand	stars	reviewsCount	Category	price/value	brands	main_category
848	MI	4.2	67782.0	Electronics › Home Theater, TV & Video › Telev...	11490.00	mi	Televisions
333	FRATELLI	3.1	45.0	Toys & Games › Electronic Toys › Plug & Play V...	1499.00	fratelli	Plug & Play Video Games
280	Sonos	4.7	4790.0	Electronics › Home Audio › Speakers › Bluetoot...	32998.25	sonos	Speakers
30	JBL	4.2	58.0	Electronics › Home Audio › Speakers › Ceiling ...	11249.00	jbl	Speakers
168	realme	4.0	7310.0	Electronics › Mobiles & Accessories › Smartpho...	7499.00	realme	Smartphones & Basic Mobiles
23	Marshall	4.6	9912.0	Electronics › Home Audio › Speakers › Bluetoot...	14950.00	marshall	Speakers
294	Geek Theory	4.3	1284.0	Toys & Games › Electronic Toys › Handheld Games	16102.51	geek theory	Handheld Games
479	Sennheiser	4.1	930.0	Electronics › Headphones, Earbuds & Accessorie...	16988.00	sennheiser	Headphones
483	BoAt	4.0	30716.0	Electronics › Headphones, Earbuds & Accessorie...	349.00	boat	Headphones
669	Dell	3.6	475.0	Computers & Accessories › Laptops › Traditiona...	51990.00	dell	Traditional Laptops

D) Exploratory Data Analysis (EDA):

EDA is conducted to gain a preliminary understanding of the dataset's characteristics. Pair plots, count plots, histograms, and scatter plots are generated using libraries such as seaborn and matplotlib. These visualizations assist in uncovering patterns, relationships, and distributions among key variables, laying the groundwork for deeper analysis.

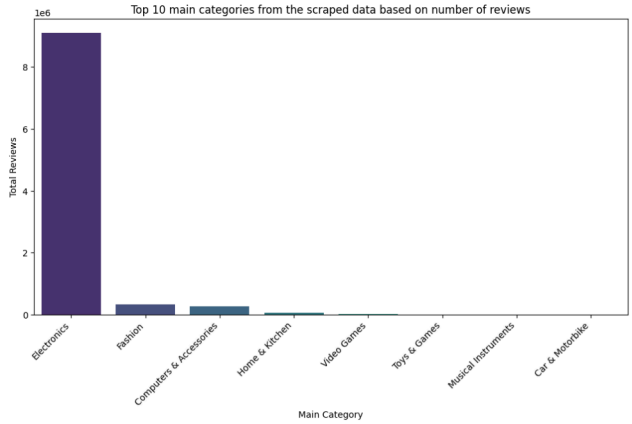


Figure 1 Barplot showing top10 categories in the dataset based on number of reviews

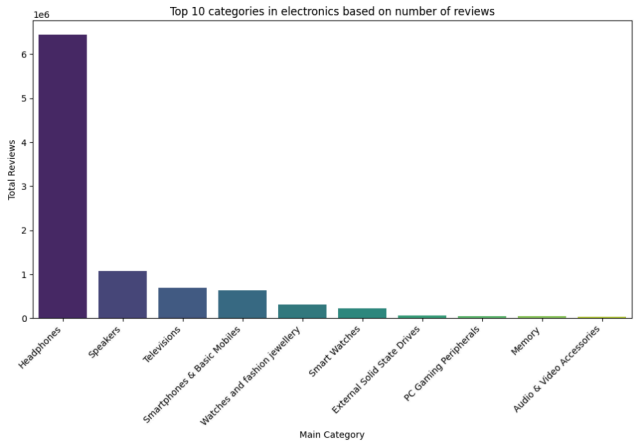


Figure 2 Barplot showing top10 in electronics category based on number of reviews

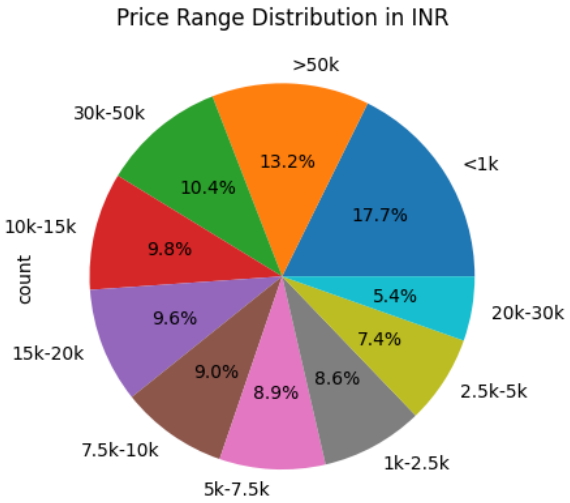


Figure 3 Pie Chart Showing price distribution

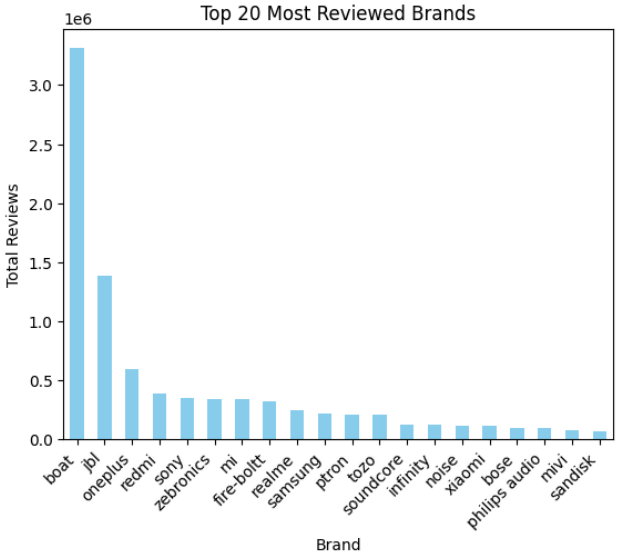


Figure 4 Barplot showing showing top 20 most reviewed brands

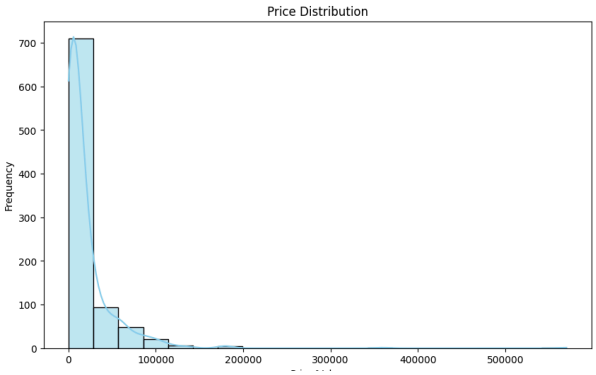


Figure 5 Histogram Between Price Distribution vs Frequency

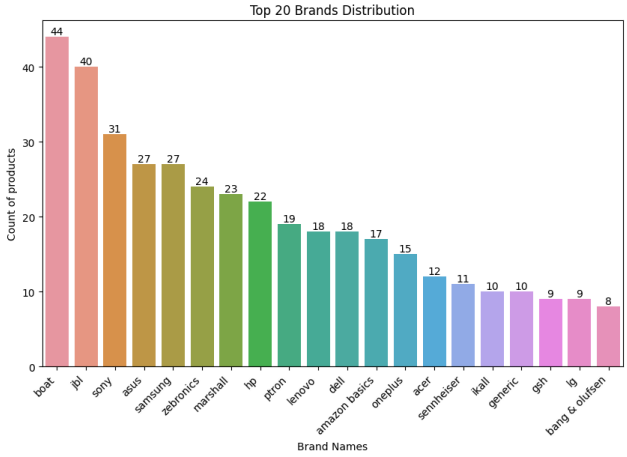


Figure 6 Bar Graph Between Brand Names vs Count of Products

IV. Results:

The study investigates brand prominence within the dataset, identifying top brands based on average stars, average price, and total reviews. Visualizations, such as bar plots and count plots, are employed to present a clear representation of the competitive landscape and brand preferences within the e-commerce ecosystem.

Categories, both main and subcategories, are explored to understand consumer preferences. The analysis involves extracting category information from the "breadCrumbs" column and examining the distribution of reviews across different product categories. Visualizations, such as bar plots and pie charts, are utilized to communicate category insights effectively.

A correlation matrix is generated to unveil relationships between numeric variables. This analysis provides a quantitative understanding of how different factors, such as price, reviews, and stars, correlate with each other. The heatmap visualization aids in identifying significant correlations.

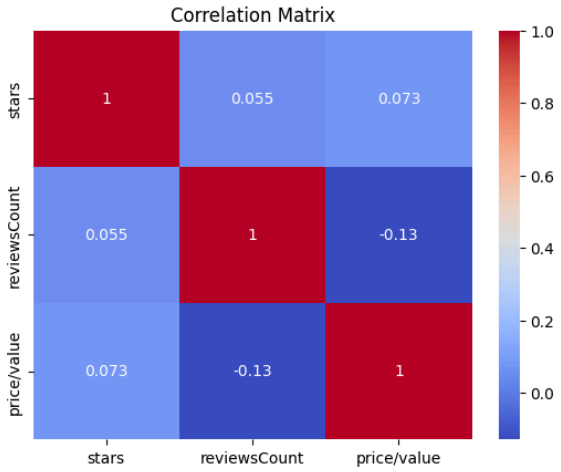


Figure 7 Correlation matrix Between Stars, reviewCount, price/value

The research explores the relationship between product pricing and customer reviews. Statistical techniques, including logarithmic scaling, are applied to visualize and analyze how pricing influences the number of reviews. Scatter plots, histograms, and kernel density plots are utilized for effective representation.

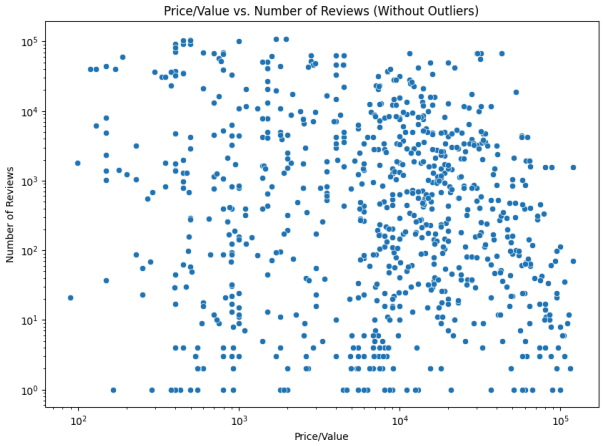


Figure 8 Scatterplot between Number of Reviews Vs Price/Value

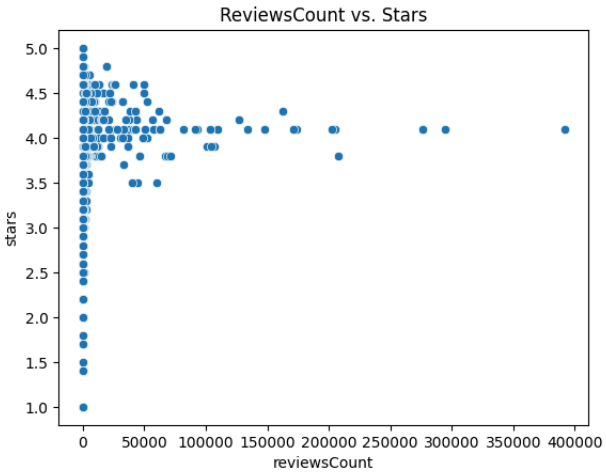


Figure 9 Scatterplot between reviewsCount Vs Stars

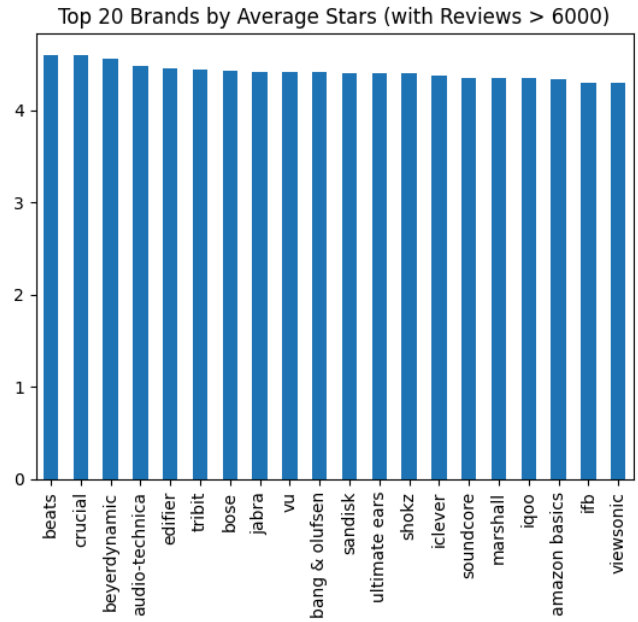


Figure 10

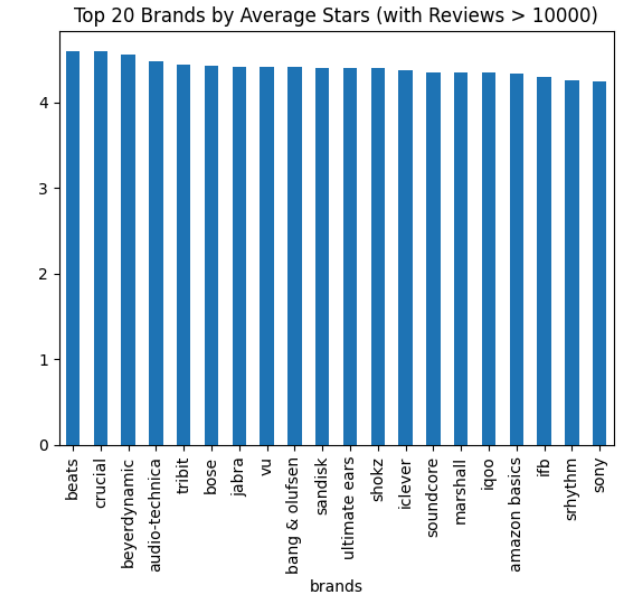


Figure 11

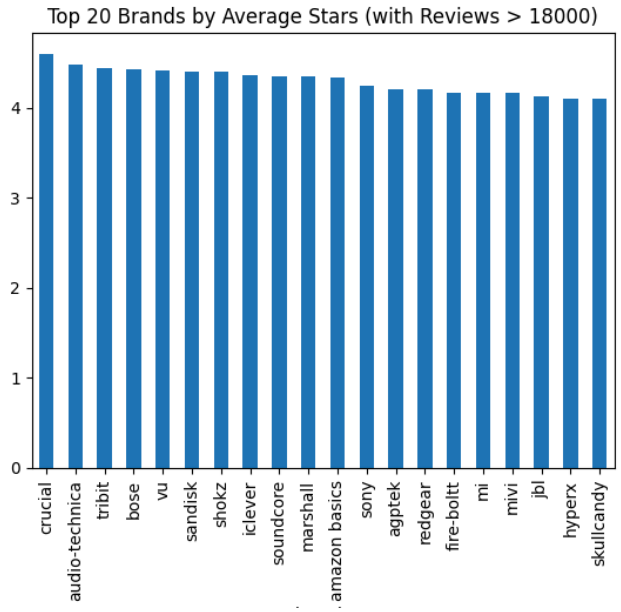


Figure 12

Figure 10 to Figure 12 shows the change in brand dominance with increase in the number of reviews. The relationship between the number of reviews and brand dominance is a dynamic aspect in various industries, especially in the context of consumer goods, electronics, and online marketplaces. As the number of reviews increases, it often reflects the popularity and visibility of a particular brand or product. Here's an exploration of how changes in the number of reviews can influence brand dominance.

Increased Visibility and Credibility: Brands with a higher number of reviews tend to gain increased visibility on online platforms. A substantial number of reviews can enhance the credibility of a brand, making it more attractive to potential customers. Consumers often perceive a product or brand with a larger number of reviews as more trustworthy and reliable. Positive reviews contribute to a positive brand image, potentially leading to higher sales and market dominance.

Shifts in Consumer Preferences: A change in the number of reviews may indicate shifts in consumer preferences. Brands that adapt to these changes and consistently receive positive reviews are likely to see an increase in dominance. Negative reviews, on the other hand, can lead to a decline in brand dominance. Brands that proactively address customer concerns and improve product quality based on feedback are more likely to maintain or regain their dominance.

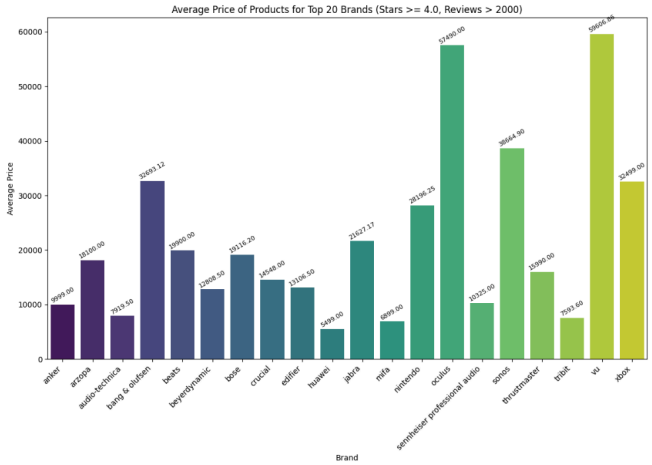


Figure 13

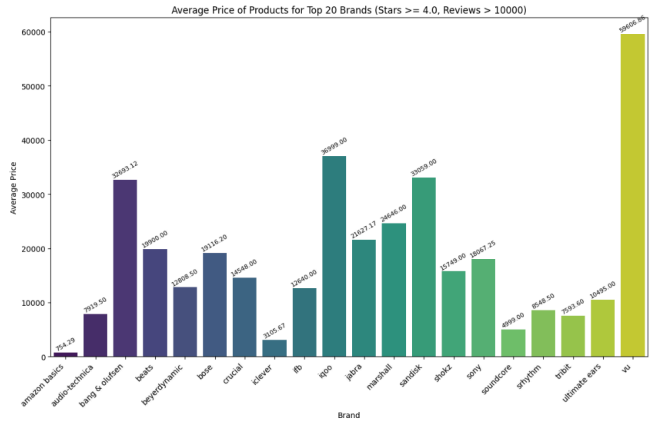


Figure 14

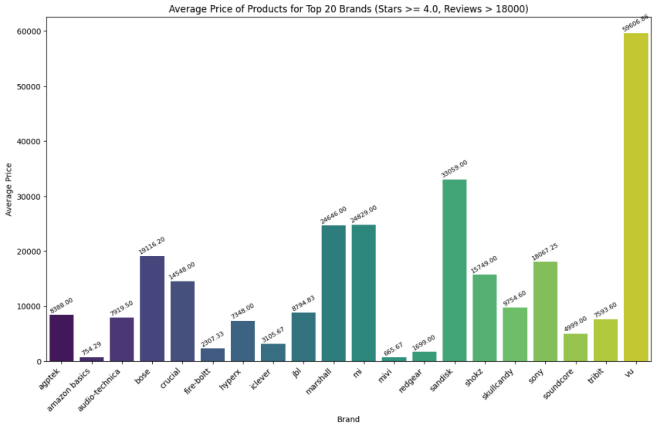


Figure 15

Figure 13 to Figure 15 shows the average pricing of top brands with a specific number of reviews . The average pricing of brands plays a crucial role in shaping consumer perceptions, market positioning, and overall competitiveness within various industries. Here's how the average pricing for brands plays a crucial role .

Perceived Value and Brand Image: The average pricing of products within a brand contributes to the perceived value that consumers associate with that brand. Premium pricing often implies higher quality, exclusivity, and superior features, while lower pricing may suggest affordability and accessibility. Brands strategically set their average pricing to align with their desired image, catering to specific target markets and consumer preferences.

Market Positioning and Competition: Average pricing is a key determinant of a brand's market positioning. Premium brands typically command higher prices, positioning themselves as leaders in terms of quality and innovation. Brands operating in competitive markets may adjust their average pricing to gain a competitive edge. Price wars and fluctuations can influence market share and brand dominance.

Consumer Segmentation: Brands often offer a range of products at different price points to cater to diverse consumer segments. This strategy allows brands to appeal to a broader audience and capture market share across various income levels. The introduction of products at different price tiers enables brands to enter new market segments and expand their customer base.

If the research objectives involve predictive modeling or classification tasks, machine learning models may be employed. This could include regression models to predict product prices or review counts, or classification models to categorize products based on certain criteria.

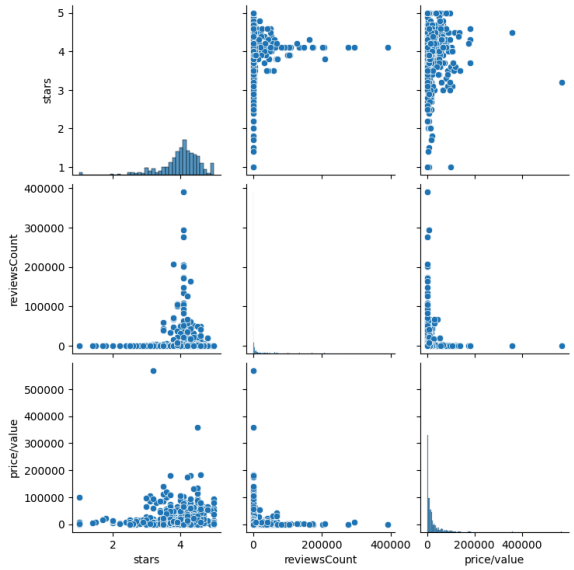


Figure 16 Pair plot

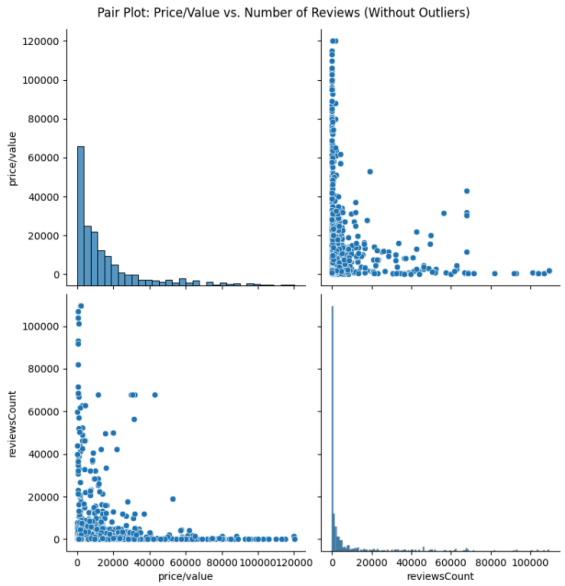


Figure 17 Pair Plot: Price/Value vs Number of Reviews

E) Outlier Detection and Filtering:

Outliers in the dataset are identified using z-score thresholding. This involves filtering data points that fall beyond a certain standard deviation from mean. The filtered dataset is then utilized for specific analyses to ensure robust and reliable results.

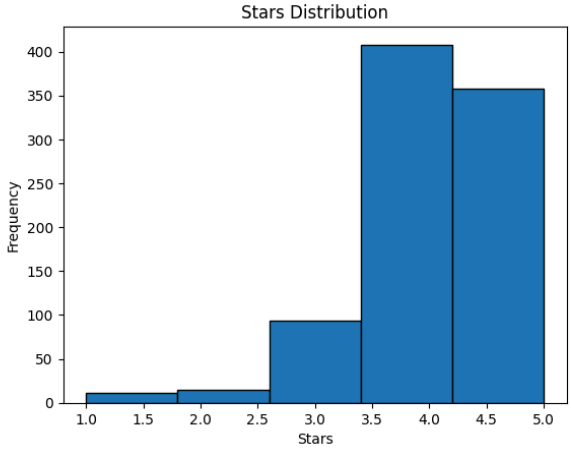


Figure 18 Star Distribution Between Frequency vs Stars

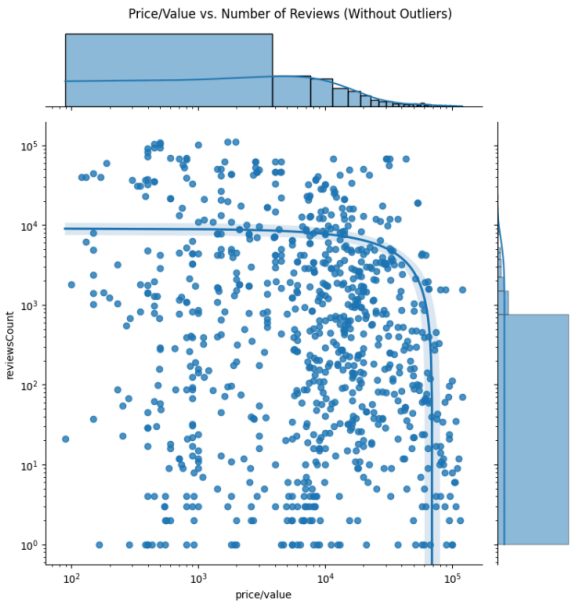


Figure 19 Joint Plot Between reviewsCount vs price/value

V. Conclusion:

In conclusion, this research paper embarked on a comprehensive exploration of the e-commerce revolution, shedding light on the intricacies of online retail through a robust methodology that integrated data collection, preprocessing, and advanced analytics. The findings gleaned from the analyses offer valuable insights into the dynamics shaping the present and future of e-commerce, providing actionable information for stakeholders navigating the digital retail landscape.

The dataset, meticulously compiled from various online retail sources, served as the cornerstone of our research. Through extensive data preprocessing, we ensured the reliability and integrity of the information, cleansing it of redundancies, and addressing data quality concerns. The concatenated and shuffled dataset became the canvas upon which our analyses unfolded, capturing the essence of the diverse and dynamic e-commerce ecosystem.

Exploratory Data Analysis (EDA) played a pivotal role in unraveling the complex relationships within the dataset. Visualizations, such as pair plots, count plots, and heatmaps, offered a nuanced understanding of the interplay between variables like pricing, customer reviews, and brand prominence. The exploration of top brands and product categories provided a snapshot of consumer preferences, enabling businesses to strategically position themselves in the competitive online market.

The correlation matrix analysis unveiled hidden patterns and associations, fostering a quantitative understanding of the factors influencing customer choices. Outlier detection and filtering techniques ensured the robustness of our analyses, allowing for focused investigations into specific aspects of the data.

Price and reviews relationship analyses illuminated the delicate balance between pricing strategies and customer sentiment. The logarithmic scaling techniques provided nuanced insights into the impact of pricing on the volume and distribution of customer reviews.

Ethical considerations underscored the responsible use of data, ensuring compliance with privacy regulations and ethical standards. Acknowledging the importance of user privacy and data security is paramount in today's data-driven research landscape.

As we navigated through the vast realm of e-commerce, this research paper offered a holistic view of the digital retail landscape. The synthesis of related works, the meticulous execution of methodology, and the compelling findings presented here contribute to the ongoing discourse surrounding the e-commerce revolution. This work not only enhances our understanding of the present state of online retail but also provides a foundation for future research endeavors in this dynamic and ever-evolving domain.

In essence, "Unveiling the E-commerce Revolution" stands as a testament to the power of data-driven research in deciphering the complexities of online retail. As the digital marketplace continues to evolve, the insights gained from this research can guide businesses, policymakers, and researchers toward informed decision-making, fostering a deeper comprehension of the transformative forces at play in the world of e-commerce.

Acknowledgment

The completion of this research paper was made possible through the collaborative efforts and support of various individuals and organizations. We express our gratitude to those who played integral roles in the development and execution of this study. First and foremost, we extend our appreciation to the contributors and maintainers of open-source libraries, particularly pandas, numpy, matplotlib, and seaborn, which served as the backbone of our data analysis and visualization processes. The availability of these tools facilitated the seamless exploration and interpretation of the vast e-commerce dataset. We would like to acknowledge the online retail platforms and sources from which the data for this study was collected. Their provision of valuable information was instrumental in shaping the scope and depth of our analyses. Despite the challenges associated with data scraping, the availability of such datasets significantly contributed to the richness of our research. Our sincere thanks go to the research community and scholars whose prior works laid the foundation for our study. The insights gleaned from related literature guided our methodology and provided valuable context for interpreting our findings.

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