Consumer Insights Data Analytics Externship of Beats by Dre

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Table of Contents

1. Introduction
1.1. Project Overview

This project focuses on harnessing the power of consumer feedback to drive strategic business decisions for Beats by Dr Dre, a leading audio brand. Data science techniques are leveraged to analyze a wealth of consumer reviews to extract actionable insights that can shape product strategies and enhance brand perception.

Key Objectives:

- **Sentiment Analysis:** Utilize Natural Language Processing (NLP) tools to gauge the overall sentiment of customer reviews, identifying positive, negative, and neutral opinions.
- **Insight Extraction:** Delve deeper into review data to pinpoint key themes, trends, and pain points in customer experiences.
- **Data-Driven Recommendations:** Translate analysis findings into concrete recommendations for product development, marketing campaigns, and overall brand strategy.

1.2. Background

Beats by Dre, a prominent audio brand acquired by Apple in 2014, is known for its stylish headphones, earphones, and speakers. They have cultivated a strong brand image associated with premium sound quality, fashion, and celebrity endorsements. Consumer sentiment analysis is vital for Beats by Dre for several reasons:

- **Brand Perception and Reputation:** Understanding how consumers perceive the brand and its products is crucial for maintaining a positive image and addressing any negative sentiments that could impact sales or reputation.
- **Product Development and Improvement:** Analyzing customer feedback can reveal valuable insights into product strengths, weaknesses, and desired features, guiding product development and improvement efforts.
- **Marketing and Targeting:** Sentiment analysis can help identify key customer segments and their preferences, enabling targeted marketing campaigns that resonate with specific demographics and interests.
- **Customer Satisfaction and Loyalty:** By proactively addressing customer concerns and pain points identified through sentiment analysis, Beats can improve customer satisfaction and foster loyalty.
- **Competitive Advantage:** Tracking and understanding consumer sentiment allows Beats to stay ahead of competitors by identifying emerging trends and adjusting their strategies accordingly.

The tech industry, being fast-paced and driven by innovation, places a premium on understanding consumer sentiment. Here's why:

- **Rapid Product Life Cycles:** Tech products often have short life cycles, making it crucial to gather and act on customer feedback quickly to maintain relevance and address any issues early in the product's life.
- **High Competition:** The tech landscape is fiercely competitive, with companies constantly vying for consumer attention. Understanding consumer sentiment helps brands differentiate themselves and meet evolving customer needs.
- **Online Reviews and Social Media:** Tech products are often heavily reviewed and discussed online, providing a wealth of data for sentiment analysis and valuable insights into customer experiences.
- **Customer-Centricity:** In a crowded market, prioritizing customer needs and preferences is key to success. Sentiment analysis helps brands adopt a customer-centric approach by listening to their audience and responding effectively.
- **Brand Reputation Management:** Negative sentiment or product issues can quickly spread online and damage a tech brand's reputation. Proactive sentiment analysis allows companies to identify and address potential concerns before they escalate.

Overall, consumer sentiment analysis is a vital tool in the tech industry, helping brands like Beats by Dre understand their customers, improve their products, and make informed business decisions that lead to continued growth and success.

2. Data Description
2.1. Data Sources

The primary source of data for this project was Amazon product reviews, scraped directly from the Amazon website. This involved collecting both the review text ("content" column) and associated metadata such as product attributes ("product_attributes" column) and potentially other information like ratings, helpfulness votes, and reviewer information.

2.2. Data Collection

The initial plan was to use Oxylabs as the web scraping tool. However, issues with the tool arised and I ended up utilizing the reference dataset provided.

2.3. Data Cleaning

Missing Values

In the first step of the data preprocessing, I checked for any null values in the columns and handled them accordingly. The column 'content' contains crucial information that would be difficult to impute and since there are only a few rows of missing values, it is reasonable to delete them. The column 'author' also has only one row of missing value, which is deleted. For the column 'product_attributes,' I split each data into the various attributes that it contains, such as color, set, style, size, pattern, using regular expressions and filling in the missing values with NaN. I found that most of the attributes did not contain a lot of data and deleted them, keeping only the color attribute. To fill in the missing values of the 'color' column, I used the mode (most common) of the data, which in this case was the color black.

To convert the 'color' column to numerical data, I utilized one-hot encoding. The colors are grouped into major colors (black, gray, silver, white, blue, red, green) and the remaining colors are placed in the 'other' category.

Outliers
To detect outliers on the quantitative data, which are the columns 'rating' and 'helpful_count,' I visualized the data using a box plot and histogram. There are a few anomalies in the 'helpful_count' column, particularly on the high end, where a certain review is marked as helpful a high number of times. Since these reviews are deemed helpful and contain useful information, they will be retained. There are no anomalies in the 'rating' column as all of the data are in the range 1-5.

3. Exploratory Data Analysis (EDA)
3.1. Data Overview

The dataset contains 3000 rows and columns that represent the features of each Amazon review, such as review_id, product_id, author, rating, content. For the quantitative data columns, the following are the descriptive statistics:
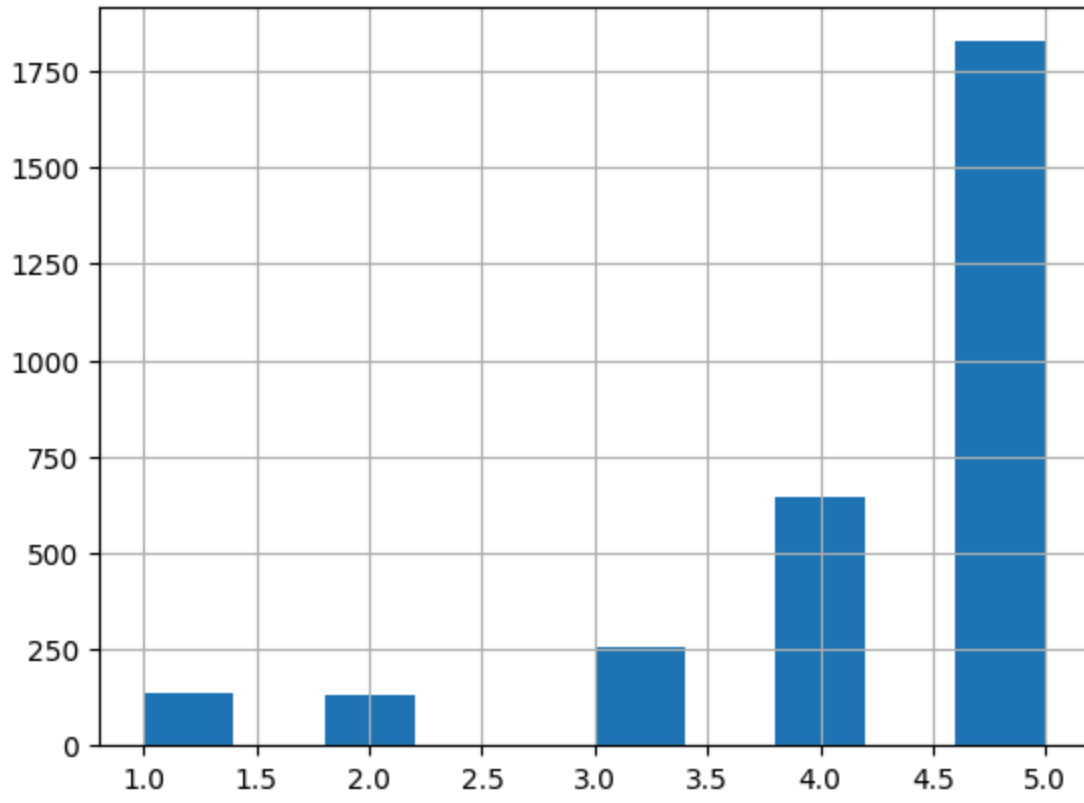
|	rating	is_verified	helpful_count
Mean	4.30	0.94	6.72
Standard deviation	1.09	0.25	74.32
Min-Max	1-5	1-1	0-2284

3.2. Visualizations

Box plot and histogram of the 'rating' column, which shows the rating a reviewer gives a product from the scale of 1-5 stars. We can see that the data are all within range and do not contain any outliers.
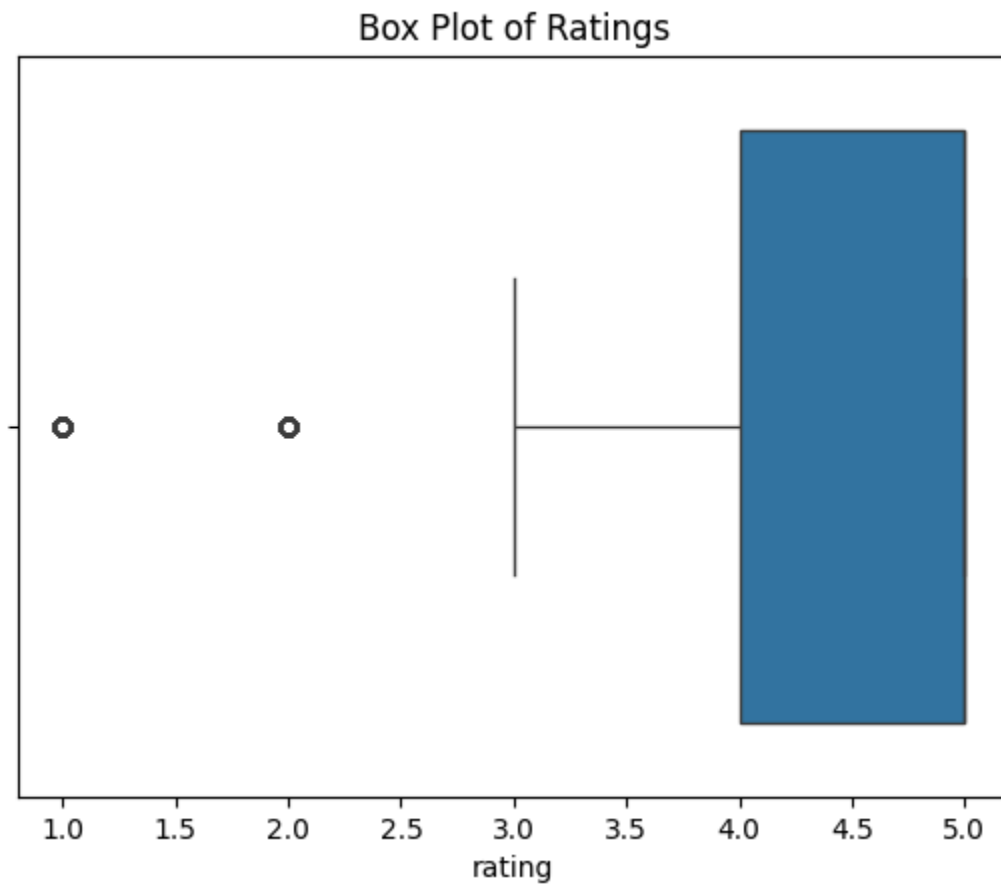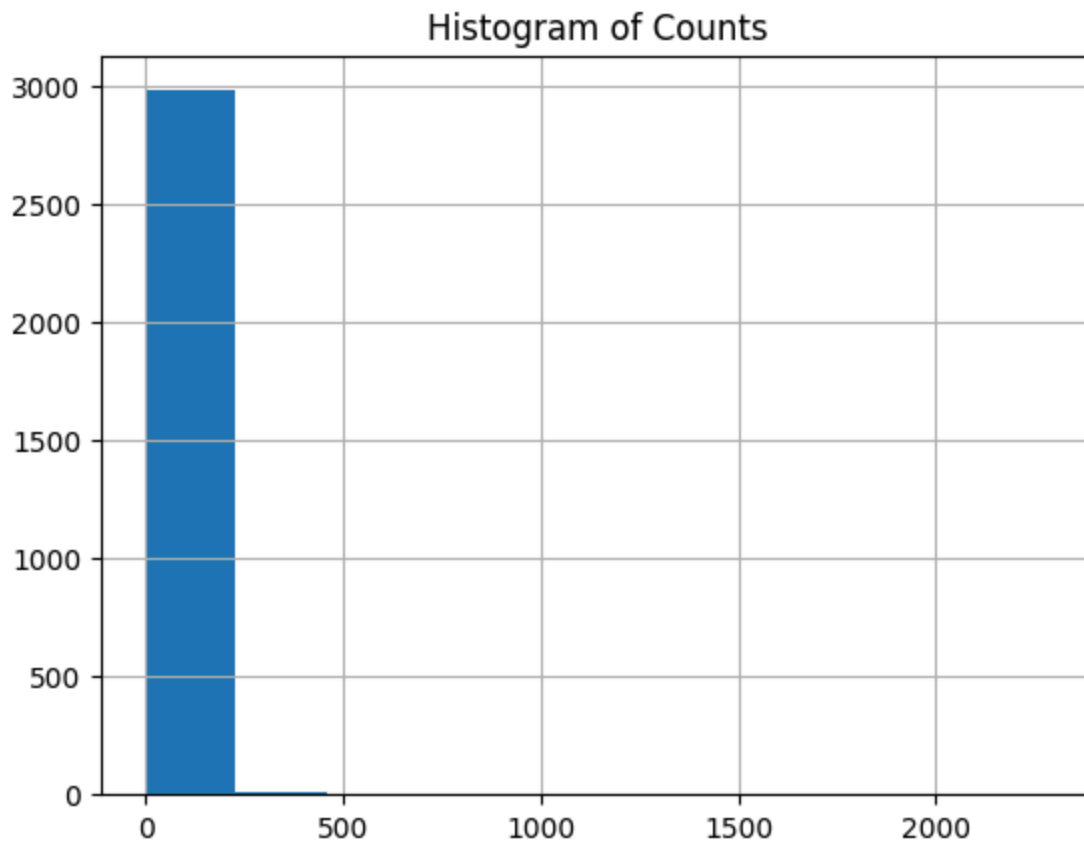
Box Plot of Ratings

Histogram of Ratings

Box plot and histogram of the 'helpful_count' column, which represents how many users marked a certain review as helpful.. We can see that most reviews are marked as helpful a few hundred times. However, there are a few anomalies where a review is marked as helpful more than 1000 times.

Box Plot of Helpful Counts
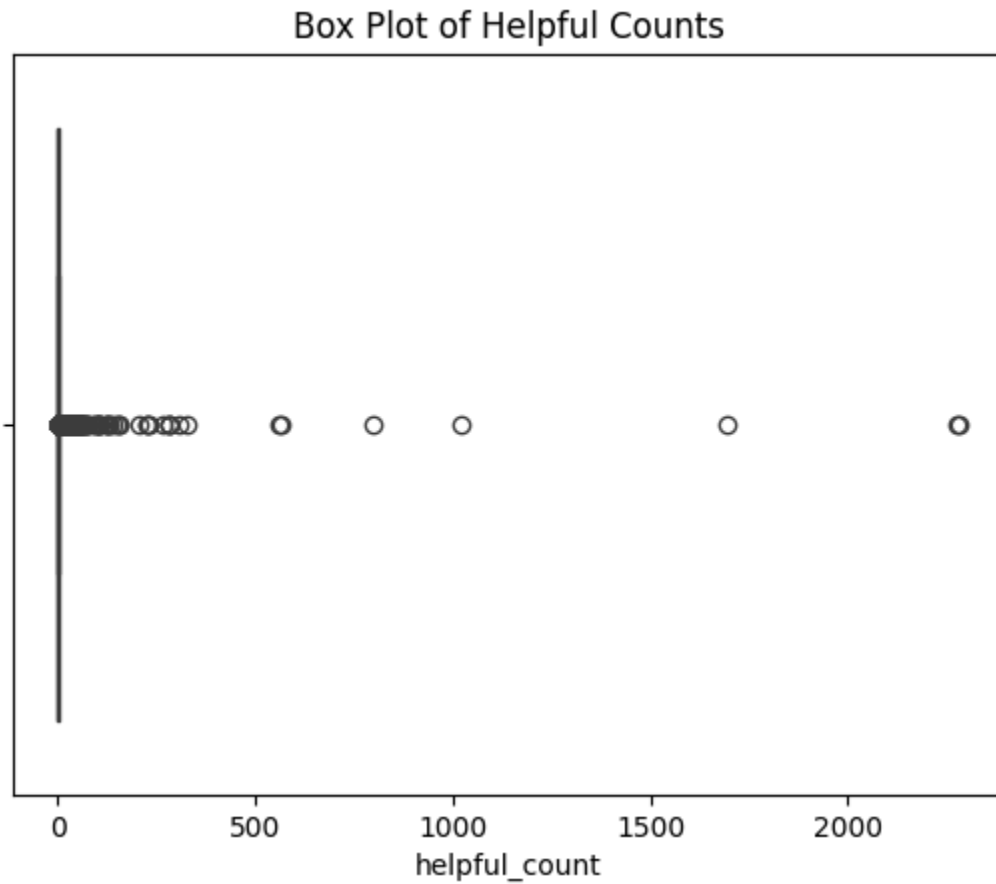
3.3. Descriptive Statistics

I created a correlation matrix of the columns and discovered a few interesting relationships among the features.

Correlation Matrix Heatmap
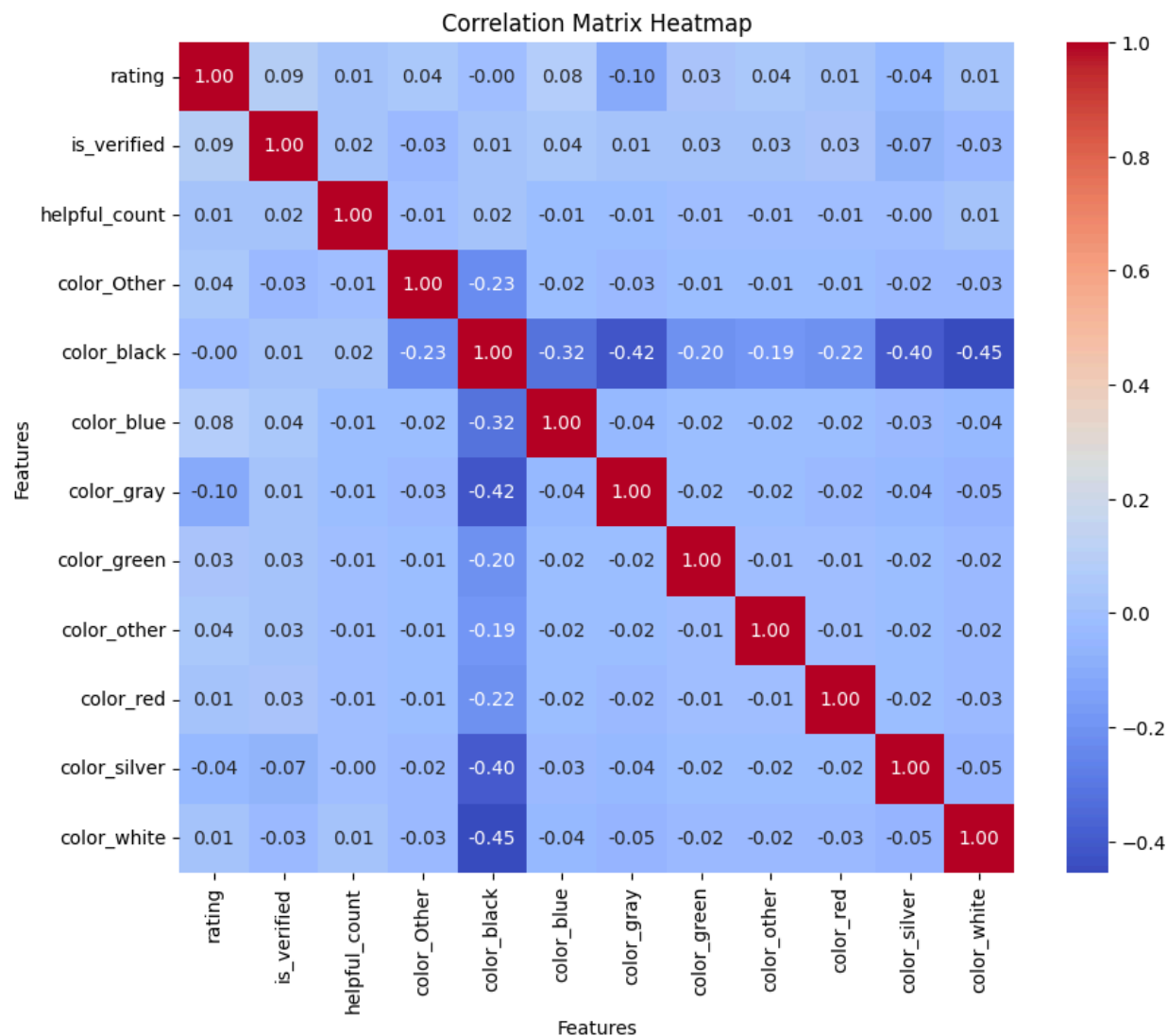
Positive Correlation (closer to 1):
A positive correlation indicates that the two variables tend to increase or decrease together. In the context of one-hot encoded color columns, a strong positive correlation between two colors might suggest they often appear together in product descriptions.

Negative Correlation (closer to -1):
A negative correlation implies that one variable increases as the other decreases. For one-hot encoded colors, a strong negative correlation could mean those colors are rarely seen together in the same product.

No Correlation (close to 0):
A correlation near 0 suggests little to no linear relationship between the variables.

There is a -0.45 correlation between the color black and white, suggesting that black and white are rarely seen together in the same product. The case is similar to black and the colors gray and silver.

4. Sentiment Analysis
4.1. Methodology

I used the Python library TextBlob to perform sentiment analysis on the column 'content,' which contains the actual review. The following is the code:

```python
def get_sentiment(text):
    analysis = TextBlob(text)
    sentiment = analysis.sentiment.polarity

    if sentiment > 0:
        return 'Positive'
    elif sentiment < 0:
        return 'Negative'
    else:
        return 'Neutral'

data['sentiment'] = data['content'].astype(str).apply(get_sentiment)

# Aggregate sentiment scores to assess overall consumer sentiment
sentiment_counts = data['sentiment'].value_counts()

# Calculate percentages
total_reviews = len(data)
sentiment_percentages = (sentiment_counts / total_reviews) * 100

print("Sentiment Counts:\n", sentiment_counts.to_markdown(numalign="left",
stralign="left"))
print("\nSentiment Percentages:\n",
sentiment_percentages.to_markdown(numalign="left", stralign="left"))
```

4.2. Results

Sentiment	Count	Percentage (%)
Positive	2635	88.10

| Neutral | 214 | 7.15 |
| Negative | 142 | 4.75 |

Overwhelmingly Positive: The sentiment analysis reveals a predominantly positive sentiment towards Beats products, with approximately 88% of reviews classified as positive.
Limited Negativity: Only 4.7% of reviews were classified as negative, indicating a generally favorable customer perception.

5. AI-Generated Insights
5.1. Using Gemini AI

After integrating Gemini AI to the dataset using an API, I ran a function that takes in a prompt as the input and outputs the AI generated response.

```python
# This is the dataset that has been preprocessed and is based on the
reference dataset
df = pd.read_csv('/content/drive/My Drive/reviews_data.csv')


api_key = "AIzaSyCPq0O-t9_EKGa8QpDC5MqH8V5WVfstFm0"


# Function to analyze reviews using Gemini AI
def analyze_reviews(reviews, api_key,prompt_message):
    genai.configure(api_key=api_key)

    model = genai.GenerativeModel(
        model_name="gemini-1.5-flash",
        generation_config={
            "temperature": 1,
            "top_p": 0.95,
            "top_k": 64,
            "max_output_tokens": 8192,
            "response_mime_type": "text/plain",
        },
    )

    chat_session = model.start_chat(history=[])

    prompt = prompt_message + "\n\n".join(reviews)
    response = chat_session.send_message(prompt)
```

```
    return response.text
```

```
reviews_column_name = 'content'
reviews = df[reviews_column_name.tolist()

# Send prompts
prompt_message = "Analyze the following reviews and summarize the key
insights:"
insights = analyze_reviews(reviews, api_key, prompt_message)
print(insights)
```

5.2. Key Insights
Prompt: "Analyze the following reviews and summarize the key insights:"

Pros:
- **Incredibly small and lightweight:** This is the defining feature, praised by many for comfort and discretion, especially for sleeping and side sleepers.
- **Good sound quality:** Many reviewers find the sound quality to be surprisingly good for such small earbuds, with decent bass and clarity.
- **Decent ANC:** The ANC is not top-tier, but it's effective enough for blocking out everyday noises and wind, with specific modes for wind reduction.
- **Comfortable fit:** Users with smaller ears find them incredibly comfortable, even for extended wear.
- **Solid battery life:** Battery life is decent considering the size, lasting for about 4-5 hours with ANC on.
- **Compact charging case:** The case is small and conveniently shaped for pocket carry.
- **Good value for price:** Many reviewers highlight the price-performance ratio, finding them to be a good option for their features.

Cons:
- **Quality control issues:** Several reviewers reported earbuds failing within weeks or months, with issues like reduced volume, buzzing/squealing noises, and connection problems. This seems to be a recurring issue, with 1More offering replacements but the process taking time.
- **Limited app functionality:** The app lacks a proper equalizer, relying on Sound ID which many users found ineffective. There's also limited customization of tap controls and no multipoint connectivity.
- **Ear tip fit:** Some reviewers found the included ear tips uncomfortable or not fitting well, requiring aftermarket options.

- **No single-tap functionality:** The small size makes single-tap controls difficult, limiting touch control options.
- **ANC issues:** While generally praised, some reviewers reported ANC issues like buzzing noises and poor performance.
- **Occasional connection issues:** Some users experienced random disconnections and Bluetooth issues.

Overall, the 1More ComfoBuds Mini offers a unique selling point with their incredibly small size, which is a huge advantage for many users, especially those with smaller ears or who prioritize comfort. However, the product is plagued by recurring quality control issues, which significantly impact the user experience. The app is also lacking in functionality and customization, hindering the overall usability.

Prompt: "Analyze the negative reviews and summarize the key pain points:"

While many users praise the 1More ComfoBuds Mini for their small size, comfort, and decent sound quality, several recurring negative experiences emerge from the reviews:

Quality Control Issues:
- **Earbud Failure:** The most significant pain point is the alarmingly high number of reviews mentioning one or both earbuds suddenly losing sound, experiencing a high-pitched squealing noise, or failing to charge after only a few weeks or months of use. This points to a potential manufacturing flaw or poor component quality.
- **Case Problems:** Some users reported problems with the charging case, including the inability to charge the earbuds properly.
- **Misaligned Components:** Reviews mention misaligned LED lights on the earbuds, suggesting a potential for inconsistent assembly.

App Limitations and Software Glitches:
- **Limited Customization:** Users find the app's Sound ID system for EQ adjustments frustrating, preferring a traditional manual equalizer.
- **App Instability:** The app is reported to crash frequently, disconnecting earbuds or causing random issues.
- **Limited Touch Controls:** While appreciated for their small size, the lack of single tap functionality and limited customization for other touch controls is a recurring gripe.

Other Complaints:
- **Uncomfortable Fit:** While designed for small ears, some users find the earbuds uncomfortable or difficult to fit securely, leading to frequent adjustments.

- **Poor Call Quality:** Call clarity is reported to be inconsistent, with the microphone sometimes failing to pick up the user's voice clearly.
- **Battery Life Concerns:** While battery life is generally considered acceptable, users find it underwhelming compared to other earbuds in the market.

Overall, while the 1More ComfoBuds Mini offer a unique selling point with their small size and comfort, they are marred by persistent quality control issues and software limitations. Addressing these concerns would significantly improve the user experience and make them a truly compelling option in the competitive earbud market.

6. Comparative Analysis
6.1. Competitor Overview

Sony: Known for their strong audio quality and noise cancellation, particularly in higher-end models. However, reviewers note that their noise cancellation isn't as good as Bose, and their battery life can be subpar.

Samsung: Reviewers praise Samsung for their seamless integration with their own devices, good sound quality, and affordability. They also note that some Samsung models have better noise cancellation than Sony.

Bose: Recognized for their excellent noise cancellation and comfortable fit. Reviewers, however, have encountered quality control issues with some Bose products.

Soundcore: Praised for their value for money, good sound quality, and impressive battery life. Reviewers prefer the Soundcore Liberty 3 Pro for its overall comfort and sound.

Jabra: Known for their comfort, good noise cancellation, and decent sound quality. However, reviewers have experienced reliability issues with some Jabra models.

Airpods: Apple's popular earbuds, known for their seamless integration with Apple devices. While reviewers like the sound quality and convenience, they find them overpriced and lacking in noise cancellation.

Skullcandy: A more budget-friendly brand known for its good sound quality and durability. Reviewers have had a mixed experience with Skullcandy, with some models lasting for years and others failing quickly.

Earfun: A less known brand that often offers surprisingly good value for money, particularly in the budget category. Reviewers found their Air Pro 3 model to be impressive, but noted issues with the Air Free Mini.

The reviewers' overall experience suggests that they prioritize sound quality, comfort, and battery life. They are also price-conscious and value products that deliver good performance without breaking the bank.

6.2. SWOT Analysis

Strengths:
- **Strong Brand Recognition:** Beats by Dre is a highly recognizable brand known for its emphasis on style, celebrity endorsements, and a youthful appeal.
- **Premium Quality Products:** Beats by Dre products are known for their high-quality materials and build, offering a premium experience.
- **Focus on Bass and Sound Experience:** Beats by Dre products are specifically engineered for a powerful and immersive bass experience, catering to a specific segment of music lovers.
- **Apple Ecosystem Integration:** Being part of the Apple ecosystem provides Beats by Dre with a seamless integration with iPhones, iPads, and Macs, which is a major advantage for Apple users.
- **Marketing and Promotion:** Beats by Dre excels at marketing and promotion, utilizing strong brand ambassadors and effective advertising campaigns.

Weaknesses:
- **Price Premium:** Beats by Dre products often come with a premium price tag compared to other brands offering similar features.
- **Limited Customization:** Customization options for sound and features are limited, compared to competitors with more comprehensive EQ settings and control options.
- **Sound Quality Criticism:** While the focus on bass is appreciated by some, others criticize the overall sound quality, arguing it lacks clarity and detail for a wide range of genres.
- **Reliability Issues:** Some users have reported issues with Beats by Dre products malfunctioning or breaking down prematurely, leading to concerns about reliability.

Opportunities:
- **Expand into New Markets:** Explore new product categories beyond headphones, such as smart speakers or home audio systems, leveraging their brand recognition.
- **Improve Sound Quality:** Enhance overall sound clarity and detail, making them more appealing to a broader audience and addressing criticisms.
- **Increased Customization:** Introduce more advanced EQ settings and feature customizations to enhance user control and cater to a wider range of audio preferences.
- **Focus on Sustainability:** Adopt more sustainable practices in production and packaging, aligning with growing consumer awareness and demand for eco-friendly products.

Threats:
- **Competition:** The market for audio products is highly competitive, with emerging brands offering innovative features and value-driven pricing.

- **Shifting Consumer Preferences:** Consumers are increasingly demanding higher sound quality, more advanced features, and lower prices.
- **Technological Advancements:** Rapid advancements in audio technology can quickly render existing products outdated, requiring constant innovation and updates.
- **Negative Press and Brand Perception:** Any negative press or customer dissatisfaction with product quality or performance can erode brand reputation and customer loyalty.

Overall, Beats by Dre has a strong brand and enjoys a loyal customer base. However, the company needs to address its weaknesses, such as high pricing, limited customization, and reliability concerns, to remain competitive in the dynamic audio market. By focusing on these areas and capitalizing on emerging trends and opportunities, Beats by Dre can solidify its position and appeal to a wider audience.

7. Strategic Recommendations
7.1. Product Improvements

The 1More ComfoBuds Mini are praised for their small size, comfort, and decent sound quality, but they also face consistent criticism. Here's a breakdown of potential improvements based on user feedback:

Quality Control:
- **Issue:** Numerous reports of earbud failure (loss of sound, buzzing/squealing), particularly in the left earbud, within a short time frame. Some users report this happening with multiple replacements.
- **Suggestion:** Invest in more rigorous quality control processes to address the recurring issues. This could involve improved component selection, assembly procedures, or enhanced testing.

App & Customization:
- **Issue:** Users dislike the "Sound ID" method for EQ adjustment, preferring a more traditional manual equalizer. Limited tap control options are also criticized.
- **Suggestion:** Add a manual equalizer in the app. Consider offering more customizable tap control options, including single-tap functionality. This would greatly enhance user control and address a common complaint.

Ear Tip Options:
- **Issue:** The stock ear tips are often deemed uncomfortable or ill-fitting. The case's shallow ear tip wells limit compatible options.

-   **Suggestion:** Offer a wider range of ear tip sizes and materials to accommodate different ear shapes and preferences. Consider redesigning the case to accommodate more aftermarket ear tip types.

Additional Features:
-   **Suggestion:** Consider adding features like multipoint connectivity for seamless switching between devices. Improve call quality and add a dedicated volume control function.

Minor Issues:
-   **Case Magnets:** While some appreciate the strong magnets, others find them too strong, making it difficult to remove the earbuds. Consider adjusting the magnet strength.
-   **Transparency Mode:** Some users find the transparency mode less natural and prefer a more accurate representation of their surroundings.
-   **Battery Life:** While the battery life is considered decent for the size, some users would appreciate longer endurance, particularly for sleep use.

Overall, 1More has a great product in the ComfoBuds Mini, but addressing the key issues will make it truly outstanding. By focusing on quality control, app improvement, and user feedback, they can create an even more compelling product.

7.2. Marketing Strategies

The company can run marketing campaigns that highlight the unique selling points of the product.

Unique selling points of the 1More ComfoBuds Mini:
-   **Extremely small size:** Many users highlight how comfortable and discreet these earbuds are, especially for those with smaller ears.
-   **Lightweight:** Users appreciate the lightweight design, which makes them comfortable to wear for extended periods.
-   **Good sound quality:** While not considered audiophile-grade, the sound quality is generally praised as good for the price, especially after using the Sound ID feature to personalize the sound profile.
-   **Decent active noise cancellation (ANC):** The ANC is effective at blocking out moderate noise levels, but not as impressive as some higher-priced competitors.
-   **Good transparency mode:** Many users like the transparency mode for being able to hear their surroundings naturally.
-   **Good battery life:** The battery life is reported to be decent, lasting around 4-5 hours with ANC on.

- **Small and compact charging case:** Users appreciate the small size of the case, which is easy to carry around.
- **Affordable price:** The ComfoBuds Mini are priced competitively compared to other earbuds with similar features.

8. Conclusion

Conducting sentiment analysis provides a direct lens to what consumers think about the product. The compilation of reviews reveals a mixed bag of experiences with Beats by Dre earbuds, highlighting both strengths and weaknesses. Users enjoy the sound quality, comfort and fit, battery life and app functionality while areas for improvement include quality control, ANC performance, limited customization and compatibility issues. From this data, Beats can further promote the features that consumers enjoy and allocate more resources to improving the aspects that consumers had a negative experience with.