

# **Leveraging GenAI for Transformative Product Image Generation from Customer Reviews**

**CMU-94844 Generative AI Lab**

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# Components of the Analysis

- **Web Scraping Amazon for product reviews**
- Product Analysis
  - Sentiment Analysis
  - Text Summarization
- Prompt Engineering and Generation
- Image Generation
- Creation of GenAI store



# Product Selection and Data Collection

## NIKE Men's Sneaker, Black Light Silver Faded Spruce

- Represents the fashion category.
- Sneakers are highly popular products, and the unique color scheme of this Nike sneaker provides ample visual cues for analysis.
- **Mixed international reviews** provide an interesting nuances for our analysis as they highlight areas of both satisfaction and dissatisfaction among customers.



## Stanley Quencher H2.0 FlowState Stainless Steel Vacuum Insulated Tumbler

- Represents the home goods category.
- Widely used and environmentally relevant product.
- Versatile Functionality and Distinct Features

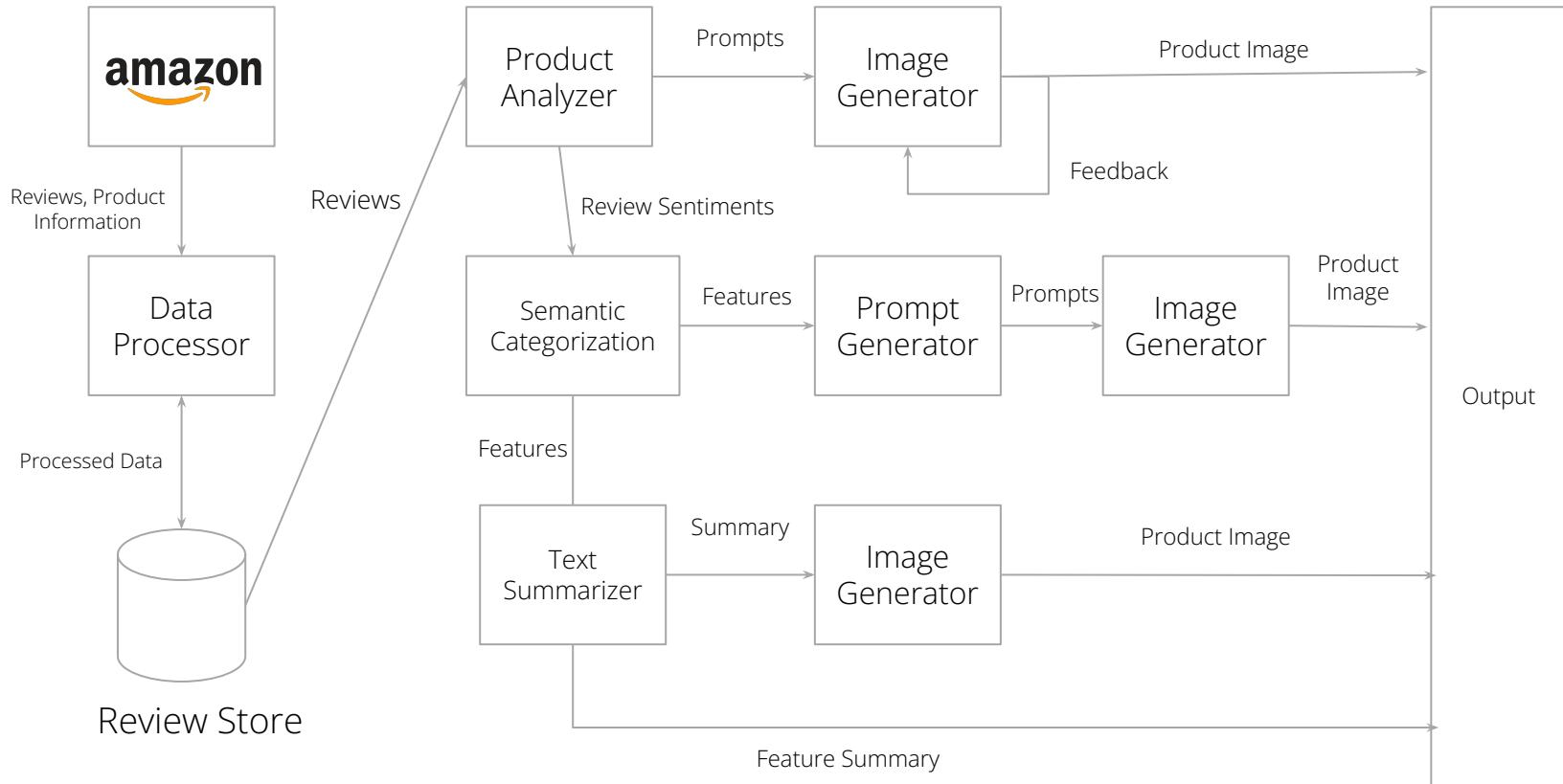


## Nintendo Switch - OLED Model: Mario Red Edition

- Represents the consumer electronics category.
- Perennial favorite gaming console.
- Special edition nature of the Mario Red Edition adds uniqueness to reviews



# System Architecture



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# Product Analysis Methodology

We used summarization, data extraction and sentiment analysis prompts with a zero-shot approach to identify the main characteristics in each product:

- "You are an expert product analyst for a marketing consulting company. Identify the **most loved features** for the '{product}' according to the real user reviews: {reviews}"
- "You are an expert product analyst for a marketing consulting company. Identify the **most hated features** for the '{product}' according to the real user reviews: {reviews}"
- "Summarize the **sentiment** for the following reviews: {reviews}"
- "What **product preferences** can be identified in the following product reviews: {reviews}"
- "What are the **product performance** features mentioned in the reviews: {reviews}"

# Product Analysis Insights - Nike Men Sneaker



Loved	Hated
<ul style="list-style-type: none"><li>1. Perfect fit</li><li>2. Comfortable</li><li>3. Great quality</li><li>4. Good price</li><li>5. True to size</li><li>6. Modern design</li><li>7. Lightweight</li><li>8. Comfortable for all-day wear</li><li>9. Excellent for walking long distances</li><li>10. Fast delivery and professional service</li></ul>	<ul style="list-style-type: none"><li>1. Sizing runs small and inconsistent</li><li>2. Some customers received the wrong color or style</li><li>3. Some customers received what they believed to be fake Nike products</li><li>4. Not comfortable for long-term wear</li><li>5. Not suitable for people with wide feet</li><li>6. Overpriced for the quality of the product</li><li>7. Narrow fit, causing discomfort for some users</li></ul>

# Product Analysis Insights - Nike Men Sneaker



- Overall, the sentiment of the reviews is **overwhelmingly positive**.
- Customers are satisfied with the **fit, comfort, quality, and style of the shoes**.
- Many mention how comfortable the shoes are for walking long distances, and some describe them as **feeling like walking on air**.
- There are a **few mentions of the shoes being a bit tight initially**, but overall, customers are happy with their purchase.
- Some customers also praise the **quick delivery and good service** they received.

# Product Analysis Insights - Stanley Tumbler



Loved	Hated
<ol style="list-style-type: none"><li>1. Keeps drinks cold for a long time</li><li>2. Great for staying hydrated</li><li>3. Reliable and well-made</li><li>4. Perfect size for travel</li><li>5. Good customer service</li><li>6. Lives up to the hype</li><li>7. Great for gifting</li><li>8. Maintains temperature as promised</li><li>9. Durable and sturdy</li><li>10. Fits in car cup holders</li></ol>	<ol style="list-style-type: none"><li>1. Poor quality and easily breaks</li><li>2. Unconcerned customer service</li><li>3. Contains lead</li><li>4. Handle breaks easily</li><li>5. Leaks</li><li>6. Arrives damaged</li><li>7. Overpriced for the quality</li><li>8. Difficult to open</li><li>9. Not dishwasher safe</li><li>10. Does not keep drinks cold</li></ol>

# Product Analysis Insights - Stanley Tumbler



- Overall, the sentiment of the reviews is **positive**.
- Customers are satisfied with the Stanley cup/tumbler, praising its **ability to keep drinks cold/hot for long periods of time, its durability, and functionality**.
- Some customers mention that the cup **exceeded their expectations** and that it is worth the hype.
- There are a few mentions of **minor issues such as dents, leaking, and the lid not fitting in cup holders**, but these do not seem to outweigh the positive aspects of the product. Customers also appreciate the customer service provided by the company.

# Product Analysis Insights - Nintendo Switch



Loved	Hated
<ol style="list-style-type: none"><li>1. Beautiful OLED screen</li><li>2. Great for handheld playing</li><li>3. Perfect for families, friends, and couples</li><li>4. Fast delivery</li><li>5. Excellent customer service</li><li>6. Great gift item</li><li>7. Easy to set up and use</li><li>8. Fun for all ages</li><li>9. Larger screen size</li><li>10. Versatile play options</li></ol>	<ol style="list-style-type: none"><li>1. Charging dock doesn't work</li><li>2. Out of country console (Japan)</li><li>3. Parts missing and generic replacement parts</li><li>4. Not a U.S. product</li><li>5. Cannot connect to Nintendo Switch Online</li><li>6. Missing parts</li><li>7. Not made for USA games</li><li>8. Defective item</li><li>9. Used item at new prices</li><li>10. Defective AC power adapter</li></ol>

# Product Analysis Insights - Nintendo Switch



- Overall, the sentiment of the reviews is **overwhelmingly positive**.
- Customers are thrilled with the Nintendo Switch OLED model, praising its **gaming capabilities, beautiful screen, and overall performance**.
- Many reviewers mention that it is a great product for both handheld and TV gaming, making it **versatile and enjoyable for all ages**.
- Some customers also appreciate the **fast delivery and excellent customer service** they received.
- There are a few **minor complaints about the price and some technical issues**, but these are outweighed by the positive feedback.

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# The Process

## 1. Prompt Engineering

- a. Used insights from our analysis of the product descriptions and customer reviews.
- b. These prompts captured the key visual attributes, features, and customer perceptions of each product.

## 2. Image Generation

- a. Leverage the power of the DALL-E 2 model to generate a range of product images for each of the selected items.
- b. Produce visually compelling and representative product illustrations that align with the textual information gathered.

## 3. Evaluation and Refinement

- a. Evaluate the quality and accuracy of generated images in capturing the essence of each product.
- b. Refine our prompts and repeat the image generation process to improve the final outputs.



# Initial version of the Image Generation Prompts

To generate the images we used a **chain-of-thought process**, first distilling the main features and then building the generative prompt.

"As an expert in AI prompt generation, your **task is to generate a text prompt** for the given product '{product}' based on the positive aspects of the product

Positive Aspects: {**positive\_response**}

and Negative Aspects given below

Negative aspects: {**negative\_response**}

Your prompt will be used to **generate images using dall-E** and make sure it's **good quality and colourful**"

# Improving Image Generation Prompts with LLM

We used a generative-led approach to improve the positive and negative aspects extraction

"Enhances the prompt based on several criteria:

1. **Clarity**: Ensures the prompt is clear and straightforward.
2. **Descriptiveness**: Enhances visual details to improve image generation.
3. **Relevance**: Makes sure the prompt closely aligns with the product's key features.
4. **Length**: Checks the length to maintain a balance between detail and conciseness."

if 'illustration of' in prompt and 'featuring' not in prompt:

    append("Consider specifying what is being **featured** or shown in the **illustration**.")

if 'color' not in prompt

    append("Include **color** descriptions to enhance visual appeal")

if 'happy' not in prompt and 'joyful' not in prompt:

    append("Include **emotional expressions** to connect better with the viewer.")

# Refined Prompt

As an expert in product design, your task is to generate a summary of the key features for the given product '{product}' based on the reviews provided below.

Please consider the following criteria to guide your feedback, ensuring that it can be used for image generation, product design, development, and branding of future products:

1. **Visual Appeal:** Assess the overall aesthetics and attractiveness of the product design.
2. **Color Palette:** Evaluate the choice of colors and their combinations used in the design.
3. **Iconography and Symbols:** Provide feedback on the clarity and relevance of any icons or symbols used.
4. **Typography:** Evaluate the readability and appropriateness of font styles and sizes.
5. **Layout and Composition:** Assess the organization, balance, and hierarchy of visual elements.
6. **Branding Elements:** Evaluate the effectiveness of branding elements in reinforcing brand identity.
7. **Imagery and Graphics:** Provide feedback on the quality and relevance of imagery and graphical elements.
8. **User Interface (UI) Elements:** Evaluate the clarity, intuitiveness, and usability of specific UI elements.
9. **Consistency and Cohesion:** Assess the consistency and cohesion of design elements throughout the product.
10. **Emotional Response:** Describe any emotional responses elicited by the product design.

You are given a set of negative feedback that will play a crucial role in shaping future iterations of the product design and enhancing its visual appeal. Please provide detailed insights based on the reviews below delimited by triple backticks:

```
```{negative_reviews}```
```

Make sure to also include any other insights from the reviews to better guide the next stage of business development

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# Stanley Tumbler - Original Amazon Images



# Stanley Tumbler - First Prompt Images



STANATEY  
Tag none or None

Share  
Sttanerly

ເລບພາລີ້າ ດັວງໂຫຍດ ວິໄລ

ເວັບໄວ້ ແກ້ໄຂ ສະຫຼຸບ ໂດຍມີມາ  
ກົດໃນອາຄານລົດ ໃຫຍໍ່ ຕົກຕໍ່ ເຊື່ອມີມາ  
ຄ່າທີ່ຈະ ດັວງໂຫຍດ ແລ້ວ ປົກໂຄໂຕ ສີ່ ອ່ານ  
ໃຫຍໍ່ ເຊື່ອມີມາ ພົມ ນີ້ແກ່ ທີ່ ດັວງໂຫຍດ  
ໜີ້ ມີ ໄກສອນ ເຊີ່ມີ ເພີ້ມີກົດ  
ແລ້ວ ສີ່ ດັວງໂຫຍດ ເຊື່ອມີມາ  
ໝາຍ ເຊີ່ມີ ພົມ ນີ້ແກ່ ທີ່ ດັວງໂຫຍດ  
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# Stanley Tumbler - Refined Final Prompt Images



# NIKE Men's Sneaker - Original Amazon Images



# NIKE Men's Sneaker - First Prompt Images



# NIKE Men's Sneaker - Refined Final Prompt Images



# Nintendo Switch - Original Amazon Images



# Nintendo Switch - First Prompt Images



# Nintendo Switch - Refined Final Prompt Images



# Image Generation Analysis & Observations

- In the initial prompt, we generated images from the extracted features & reviews from Product Analysis step.
- However, the first Prompt results were not as good.
- The refined prompts did end up enhancing the the images.
- The refined prompts were based on more granular analysis of the positive and negative reviews and the specific features.
- We also made sure to generate more features and use them to create unique prompts.
- The Stanley cup results were not as accurate, even after refinement. This might be due to the generalized nature of reviews dataset. There isn't much insight about the exact structure.
- Same goes for Nike shoes but the Nintendo results were really good after refinements.



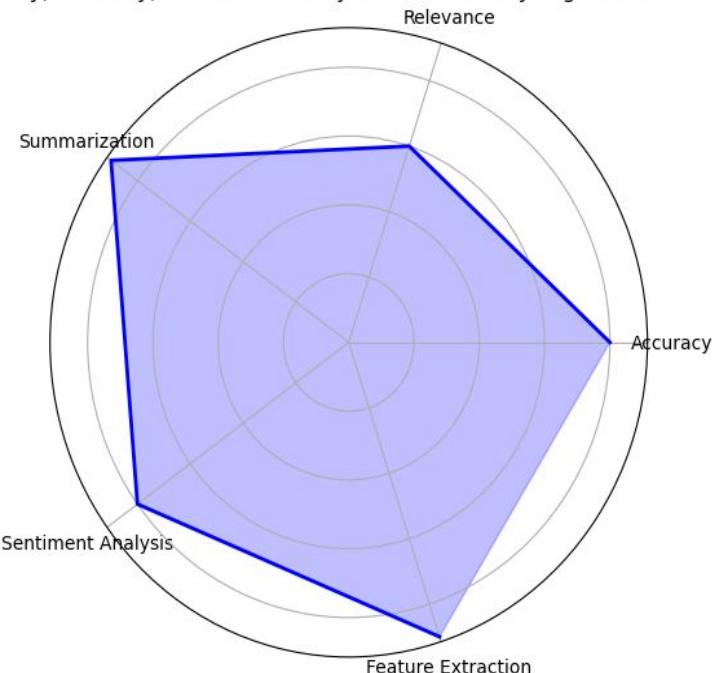
# The Case of Diversity and Representation

- Specifically, when analyzing lifestyle images for the NIKE shoe, approximately 6 to 7 out of 10 images featured athletes of colour.
- Conversely, in images generated for the Nintendo Switch, all representations depicted individuals who were white.
- When specifying parameters for diversity, such as lifestyle images for the NIKE shoe, only people of color were depicted, with individuals from other demographics notably absent.

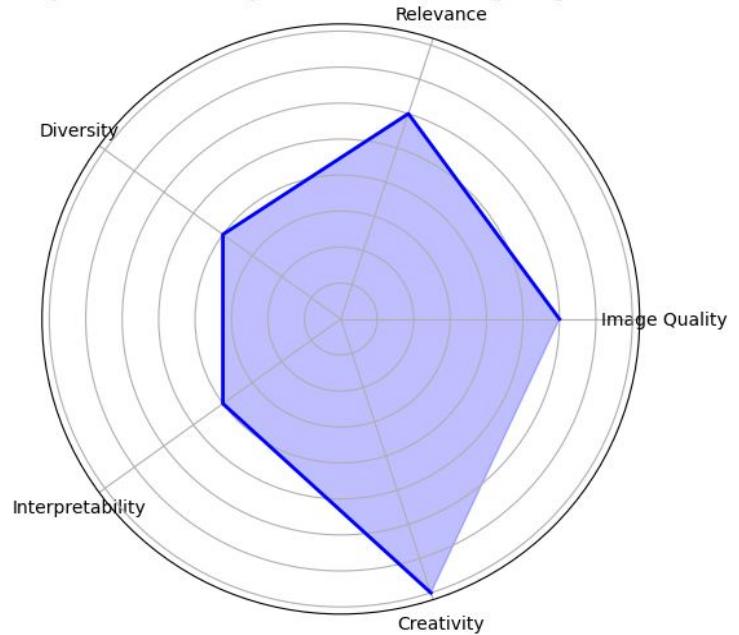


# Comparison between Review Analysis and Image Generation

Efficiency, Usability, and Functionality of LLMs in Analyzing Product Reviews



Efficiency, Usability, and Functionality of LLMs in Generating Images from Product Reviews



# Conclusions and Recommendations

## OpenAI Product Review Analysis

- Proficient in English-language product review analysis.
- Effective summarization and feature extraction.
- Limited performance in analyzing non-English reviews.
- Room for improvement in summarization relevance.

## DALL-E Image Generation

- Demonstrates creativity in image generation.
- Accurately represents some product features but very inconsistent and gibberish text.
- Lack of diversity in generated images.
- Challenges in interpretability and balancing creativity with specificity.

## Some practices which enabled better results

- Provide contextual information that helps the model understand the intended use or setting of the product. This could include information about the product's environment, intended audience, or usage scenarios.
- Experiment with Different Prompts and scenarios.
- Describe the product from multiple perspectives to ensure comprehensive coverage. Consider aspects such as front, side, and back views, as well as close-up shots of specific features.
- Iterative Refinement is important.
- Strike a balance between providing specific guidance to the model and allowing room for creativity.

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[Link](#)

## NIKE Men's Sneaker

Elevate your style with the NIKE Men's Sneaker in a striking color palette.

[Shop Now](#)

[Learn More](#)



**THANK YOU!**



# Stanley Tumbler

Positive Responses

handle convenient water cold color cup keeps straw  
lid leak quality fits temperature clean love ice  
easy durable spill

Negative Responses

Rust Discoloration失望 Scratches Warranty Lead  
Lid Broken service Leaks Handle Damaged  
Defective Customer Packaging Quality Stains Used  
Fake Scratched

# NIKE Men's Sneaker, Black Light Silver Faded Spruce

Positive Responses

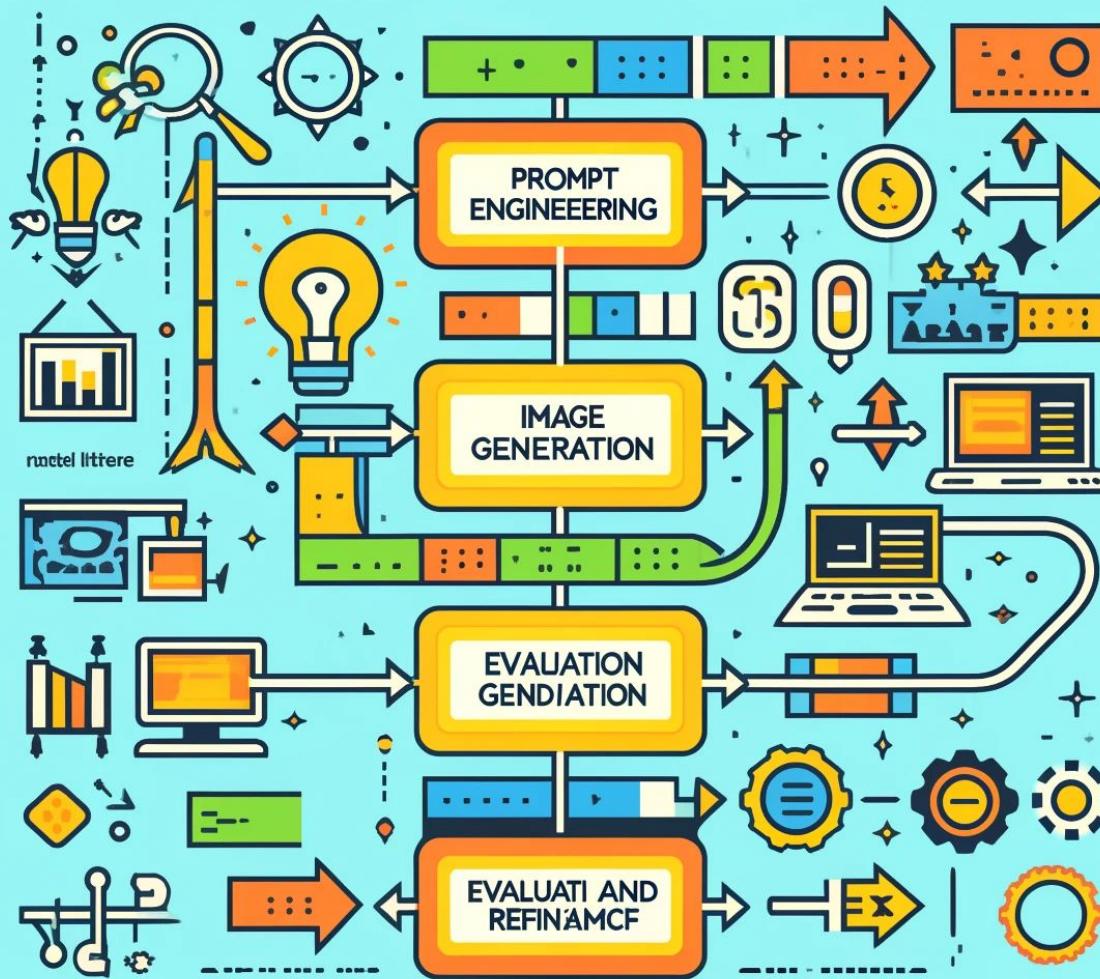
A word cloud centered around the words "fit", "affordable", "good", "stylish", and "comfortable". The words are in various sizes and colors (purple, blue, green, yellow, orange). Associated adjectives include "value", "comfortable", "design", "accurate", "lightweight", "great", "quality", "soft", "durable", "fit", "comfortable", "service", "excellent", "accurate", "value", "good", "value", "service", "design", "soft", "lightweight", "stylish", "good", "excellent", "comfortable", "lightweight", "stylish", "good", "excellent", "comfortable", "lightweight", "good", "value", "service", "design", "soft", "lightweight".

Negative Responses

A word cloud centered around the words "size", "fake", and "comfort". The words are in various sizes and colors (purple, green, blue, yellow). Associated adjectives include "design", "narrow", "service", "packaging", "size", "narrow", "comfort", "quality".

# Nintendo Switch - OLED Model: Mario Red Edition





# Architecture

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