Analyzing Consumer Sentiment and Trends in Amazon Reviews

Presented by:

Becca, Jyun-Ru, Neha, Nruthya, Praveen, Shamkhal

Objective: Analyze 2023 Amazon reviews to uncover consumer sentiment, emerging trends, and key factors influencing ratings in clothing, shoes, and jewelry

Value: Provide actionable insights to enhance business strategies and align with evolving consumer preferences

QSTIS843

Data Dictionary

Review Dataset: Useful for understanding customer preferences, evaluating product quality, and identifying areas for improvement based on ratings and reviews

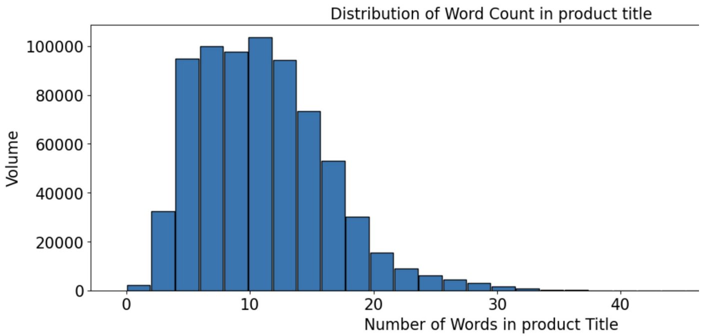
- **rating**: Product rating (10–50)
- **title**: Title of the user review
- **text**: Text body of the user review
- **images**: URLs of user-posted images (small, medium, large)
- **asin**: Product ID
- **parent_asin**: Parent product ID (shared for variants)
- **user_id**: Reviewer ID
- **timestamp**: Review time (Unix time)
- **verified_purchase**: Indicates verified purchases
- **helpful_vote**: Number of helpful votes

Items Dataset: Supports cross-referencing with review data to identify correlations between product attributes and customer sentiment or behavior

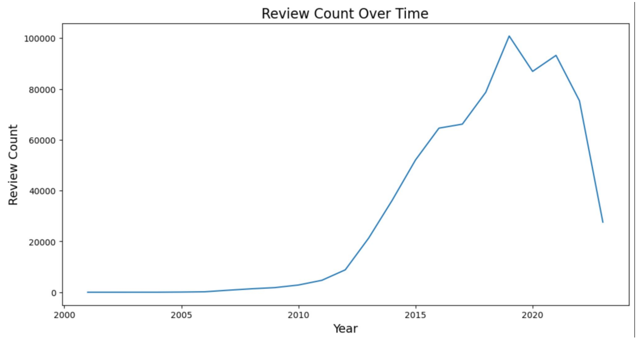
- **main_category:** Main category of the product
- **title:** Product name
- **average_rating:** Average product rating
- **rating_number:** Number of ratings received
- **features:** Key product features (bullet points)
- **description:** Product description
- **price:** Product price
- **images:** URLs of product images videos
- **store:** Store name selling the product
- **categories:** Categories of the product
- **details:** Product details
- **parent_asin:** Parent product ID
- **bought_together:** Recommended product bundles

Exploratory Data Analysis

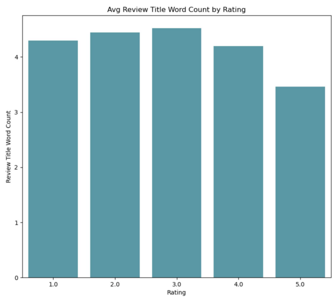
Word Lengths in Reviews: Reviews are short, not exceeding 20 words in the text and 3 words in the title.

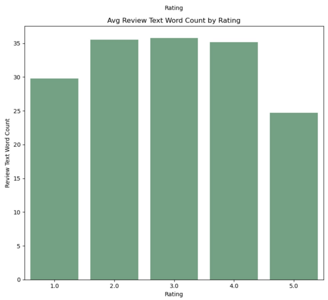


Time vs Avg Rating: Post-2020, a decline hints at shifting consumer behavior or stricter platform policies.

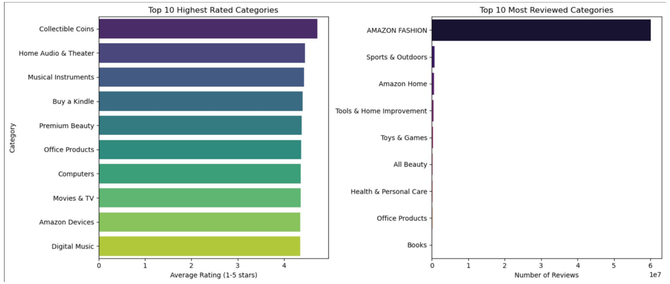


Avg title word count must be 3-4 words.





Highest Rated and most Reviewed categories



Association Rules

High Rating : Review Length

detail_category	count
Short Review	35295621
Detailed Review	4449174

Low Rating : Review Length

detail_category	count
Short Review	4846717
Detailed Review	931564

No Correlation in both the cases

Review Length : Helpful Votes

detail_category	average_helpful_votes	review_count
Short Review	0.5795859600294806	60172548
Detailed Review	6.079925899228142	2003218

Encouraging users to leave detailed reviews can boost helpfulness scores for future customers.

Higher Price Range: Review Length

price_range	detail_category	review_count
High Price	Detailed Review	1072490
High Price	Short Review	21346134
Low Price	Short Review	37035647
Low Price	Detailed Review	1185999
Medium Price	Short Review	5095527
Medium Price	Detailed Review	297549

High priced and low priced categories often prompt more detailed reviews.

Holiday Season : Positive Sentiment

review_month	avg_rating	review_count
1	4.241786038292041	7030286
2	4.188395973547184	5501418
3	4.179510253646257	5756245
4	4.156393949968309	4914685
5	4.150282382407559	4957993
6	4.162754782451423	5130946
7	4.175054672445455	5717231
8	4.171501289788217	5401662
9	4.161365008178564	4569262
10	4.151560566231378	5224578
11	4.176698423351596	5042088
12	4.209897904095977	6786952

Ratings driven by holiday discounts, offering great value and encouraging more positive reviews.

Sentiment Analysis & Topic Modeling

- **Topic modeling** reveals that **fit and comfort** dominate customer reviews, emphasizing the need for better size guidance and personalized recommendations to boost satisfaction and reduce returns.

- Smaller topics highlight **appearance and quality** in watches, jewelry, and accessories, underscoring the need for high-quality visuals and descriptions. **Size complaints and unmet expectations** point to opportunities for improved product guidance and quality.

- **Sentiment Analysis** - built a pipeline with tokenization, TF-IDF feature extraction, and Logistic Regression to classify Amazon reviews as positive or negative. Achieved a ROC-AUC score of **79%.**

topicLabel	count
Fit & Comfort	28081
General Positivity	19499
Watches / Appearance	6257
Aesthetics & Quality	2130
Small-size Experi...	1867

reviewText	label	prediction	probability
	1	1.0	[0.23098101049825018,0.7690189895017499]
"It's awesome!", that's what the boy for whom this costume was a gift said when he saw it. He lo...	1	1.0	[4.3311591109038574E-14,0.9999999999999567]
"The Eyes" t-shirt is a beauty! I love the vibrant purple color and I get lots of compliments on...	1	1.0	[7.276680184954224E-14,0.9999999999999273]
"ex" has been looking for and needing new bra's for some time. had bali before and really liked ...	1	1.0	[3.560696096634904E-10,0.9999999996439304]
Красивые и элег&#10...	1	1.0	[1.666698377967735E-37,1.0]
👍👍👍	1	0.0	[0.9994395486293094,5.60451370690606 7E-4]
" Black and Sliver , Mens Shirt Fractal Design Cufflinks , Cuff-links for Wedding "Gorgeo...	1	0.0	[0.999999247198794,7.52801206038711 3E-7]
"I like them because they're just cool." - 5 year old son.I like them because he can put...	1	1.0	[5.830821219424863E-6,0.9999941691787806]
'Great Shirt' has beautiful butterfly design on front & back. A-line cut with long sides, comes ...	1	1.0	[0.02100160062314256 8,0.9789983993768574]
'I like that they are very long and cover my entire leg(s). I am pretty tall too...over 5'8"....	1	1.0	[0.47985567617180236,0.5201443238281976]

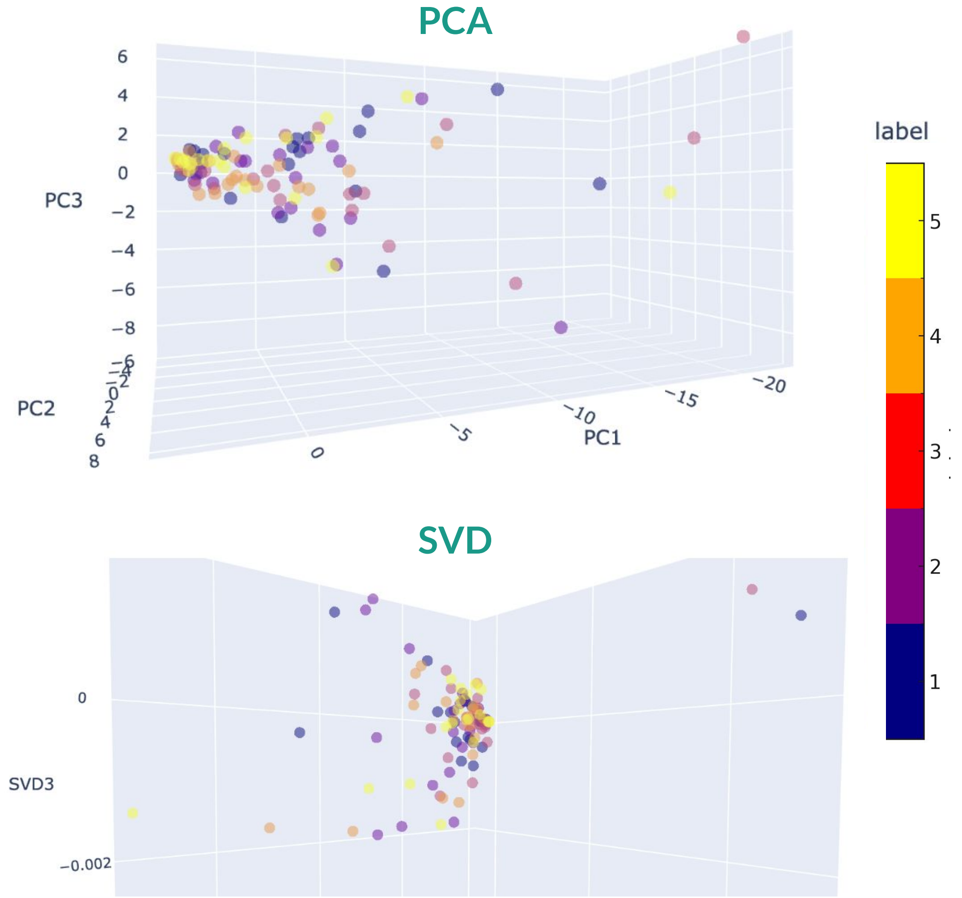
only showing top 10 rows

Different Ratings vs Context comparison

- **Goal:**
  We wanted to explore whether reviews with different ratings would naturally cluster together in feature space.

- **Method:**
  We converted review texts into TF-IDF vectors, applied dimensionality reduction (PySpark natively supports PCA and SVD), and visualized the results in 3D plots with different colors for different ratings.

- **Finding:**
  The 3D plots showed that reviews with different ratings were mixed together, meaning the data did not cluster by rating as we originally expected.



Rating Prediction

Prediction of review ratings based on the text vector.

Review text ⇒ TF-IDF ⇒ Input word vector into Logistic Regression model to predict review rating

Overall Accuracy: 0.69, seemed acceptable

Review Rating	Ratio	Precision	Recall	F1 Score
1	8.51%	0.51	0.52	0.51
2	5.64%	0.28	0.06	0.09
3	8.35%	0.33	0.17	0.22
4	13.67%	0.42	0.14	0.21
5	63.62%	0.75	0.95	0.84

⇨ imbalanced Dataset issue

⇩

This imbalance caused the model to focus on capturing features of the 5-star samples during training.

Recommendations

- **Enhance Quality Control:** Electronics and clothing show quality-related complaints. Institute tighter supplier audits and inspect incoming inventory to reduce defect rates.

- **Optimize Fulfillment & Packaging:** Shipping-related topics (late delivery, damaged packaging) were among the top association-rule patterns. Improve carrier SLA monitoring and strengthen packaging materials.

- **Incentivize Verified Reviews:** Verified-purchase reviews are both more positive and more reliable. Encourage purchasers via post-delivery email prompts or small discounts to leave feedback.

- **Leverage Power Reviewers:** Identify "prolific" reviewers (those whose detailed feedback co-occurs across categories). Engage them in early-access programs or beta-testing new products to generate richer, trusted content.

Future Steps

- **Aspect-Based Sentiment Analysis:** Drill into specific attributes (e.g. “battery life,” “fit,” “sound quality”) to pinpoint feature-level pain points.
- **Real-Time Review Monitoring:** Deploy the text classifier in a streaming pipeline to flag negative reviews immediately, triggering proactive customer service outreach.
- **Multimodal Feedback Integration:** Analyze user-uploaded images/videos (via computer vision) to augment text insights, especially for product damage or wear patterns.
- **A/B Test Interventions:** Roll out targeted improvements (e.g. improved packaging, QC changes, review incentives) in controlled experiments to measure their effect on ratings and sales.

THANK YOU!