



Amazon Customer Review Analytics

Clothing, Shoes & Jewelry

Group 1:

Christina Son, Hyunjin Yu, Kaushiki Tiwary,
Shiv Nag, Shubham Kumar

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01

Introduction & Motivation



Objectives

- **Project Objective:**

- Extract actionable insights from Amazon reviews (Clothing, Shoes & Jewelry category).
- Empower business executives to make data-driven decisions

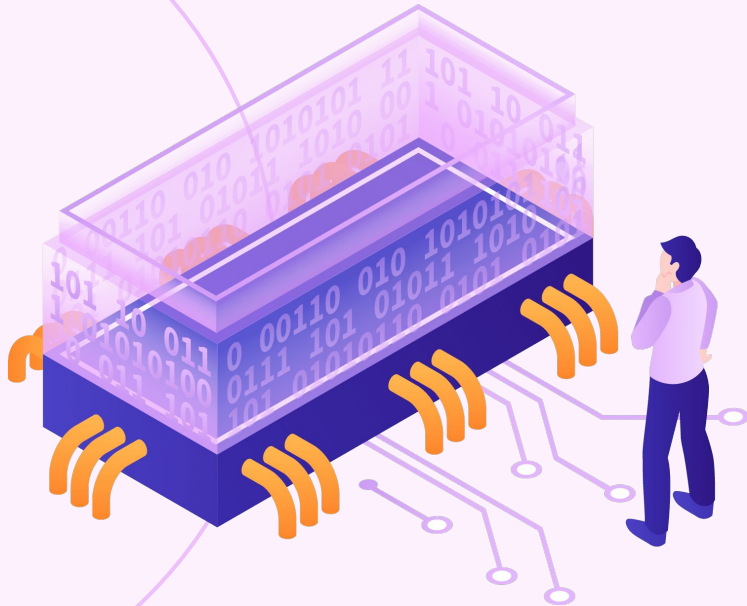
- **Focus Areas:**

- Improve customer satisfaction
- Optimize product offerings
- Enhance the overall shopping experience



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Dataset



Dataset

Amazon Reviews 2023 Dataset Overview (via HuggingFace):

- Over 571 million reviews spanning from 1998-2023, covering 33 product categories

Rich Data Features:

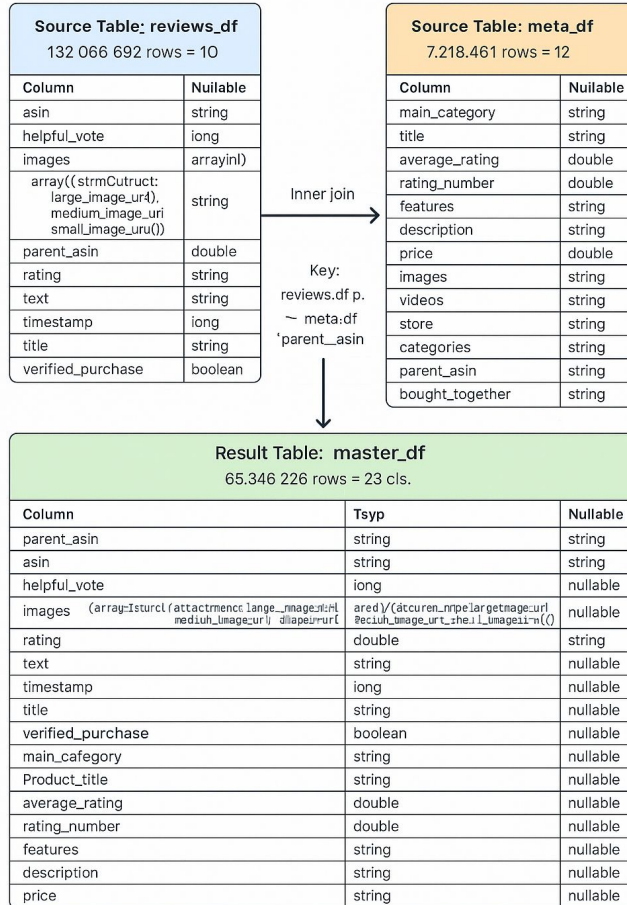
- User reviews with ratings, text, and helpfulness votes
- Detailed item metadata: descriptions, prices, and images

Enhanced Quality:

- Fine-grained timestamps at the second level
- Cleaner and more descriptive metadata
- Standardized data splits for benchmarking

Data Merging Pipeline

Period: July 1998–September 2023 (292 momonths)

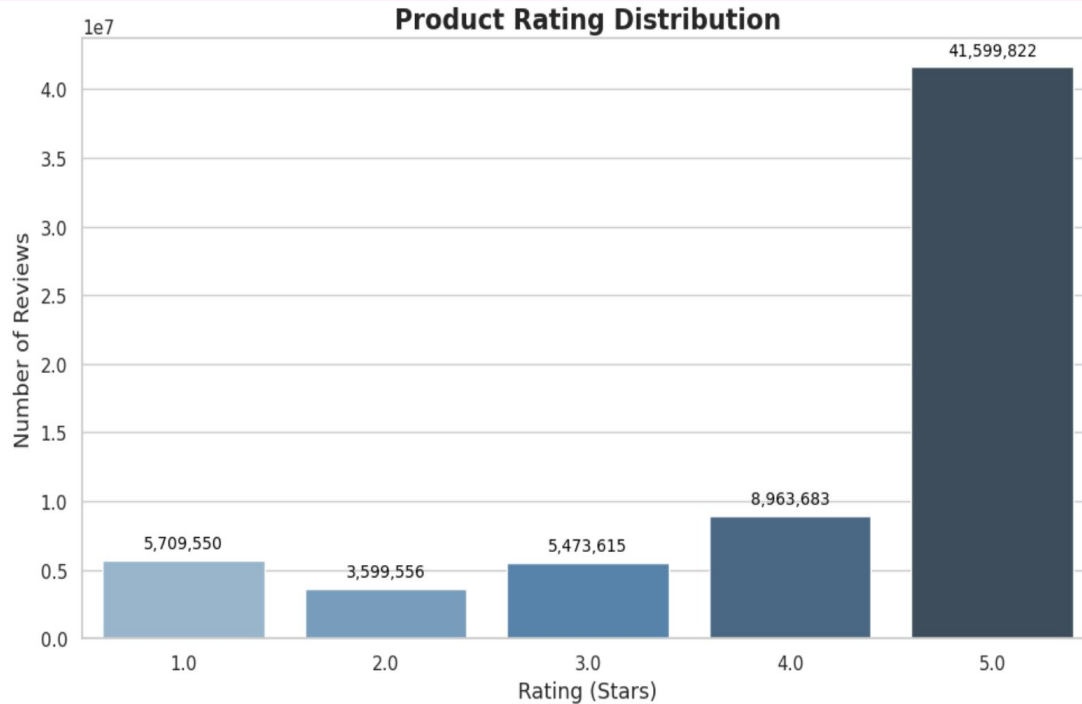


03

Data Overview

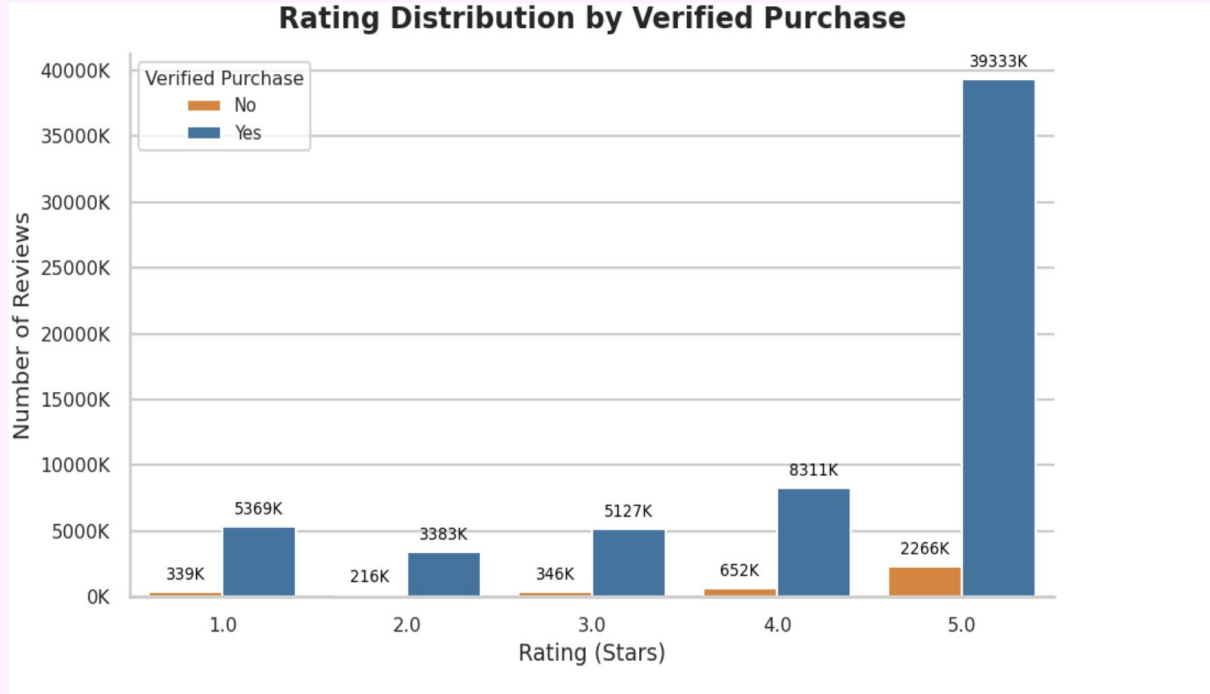


Data Overview



- 5-star reviews dominate, indicating overwhelmingly positive customer sentiment
- Very few 1- and 2-star reviews, suggesting a strong positivity bias in the feedback.
- Review counts increase progressively with rating levels.

Data Overview



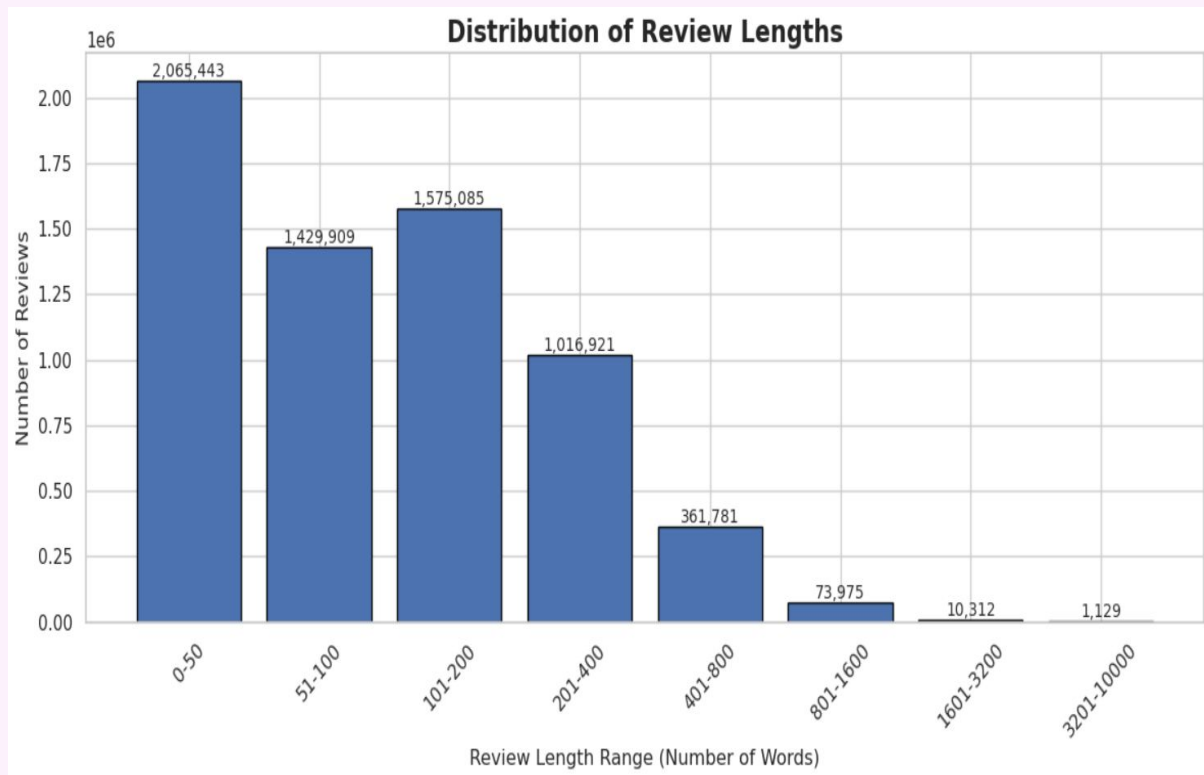
- Verified purchases account for the vast majority of reviews across all rating levels
- 5-star reviews from verified buyers dominate, with 39.33M reviews
- Unverified reviews are fewest for low ratings, and more frequent only at the 5-star level (2.27M)

Data Overview



- Sharp increase from 2011 to 2020, reflecting rising popularity and customer engagement.
- Peak reached in 2020 with 10.27 million reviews, marking the highest point of activity.
- Post-2020 decline in reviews, possibly due to market saturation, changing user behavior, or external factors

Data Overview



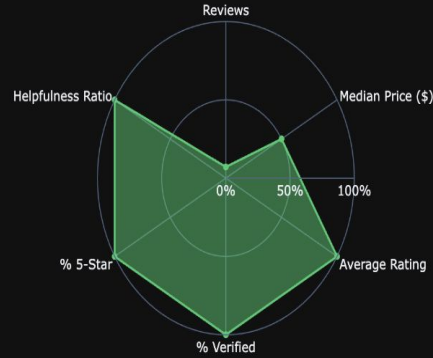
- Short reviews (0–50 words) dominate, with over 2 million entries, making them the most common.
- Review frequency steadily decreases as length increases, showing a preference for concise feedback.
- Very long reviews (800+ words) are extremely rare, making up only a tiny fraction of total reviews.

03

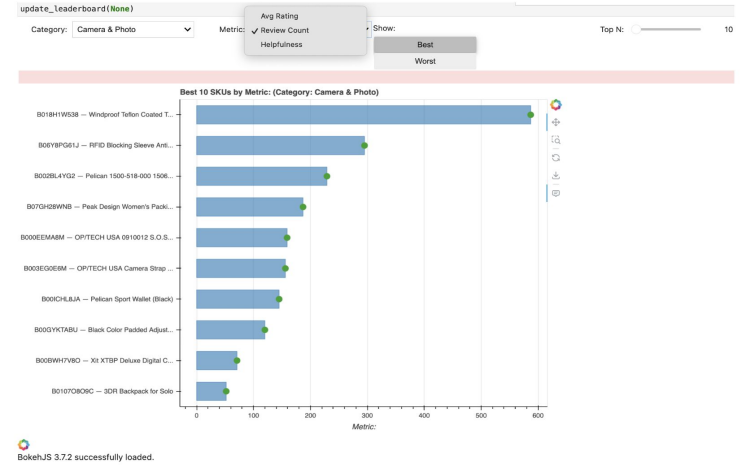
Dashboards



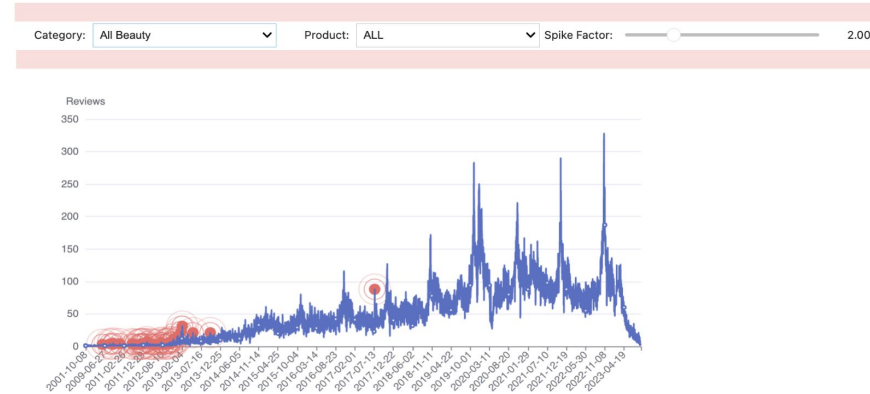
KPI Radar: Digital Music



Best/Worst SKU Dashboard

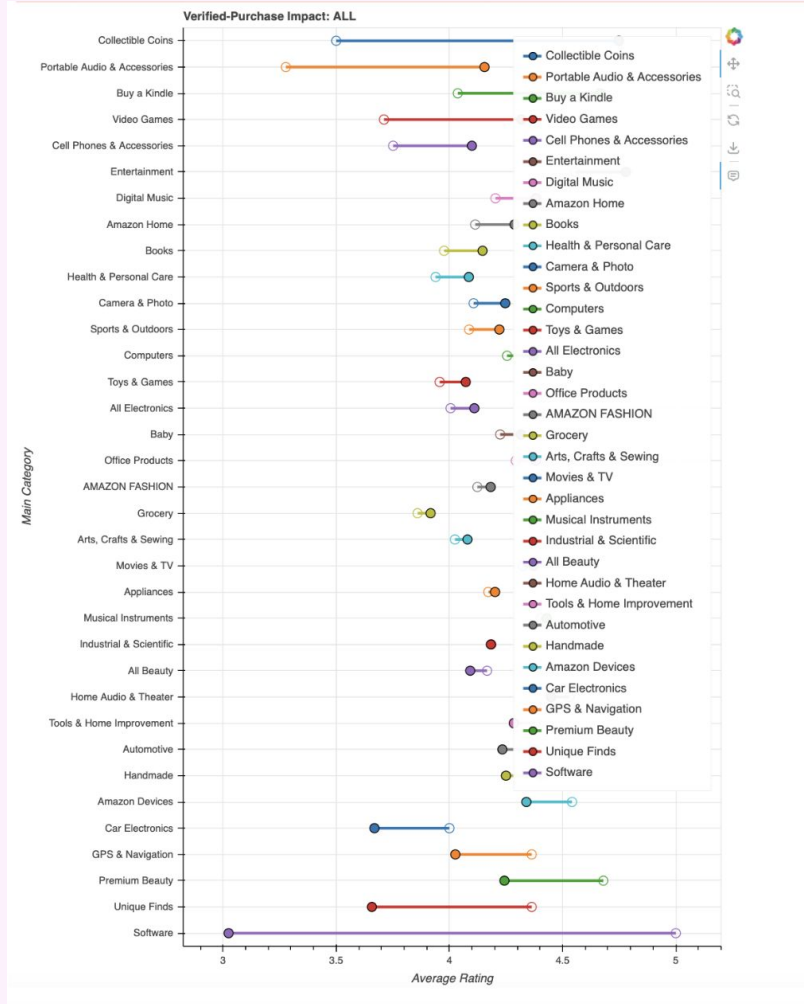


Review Velocity Spike Alert Dashboard



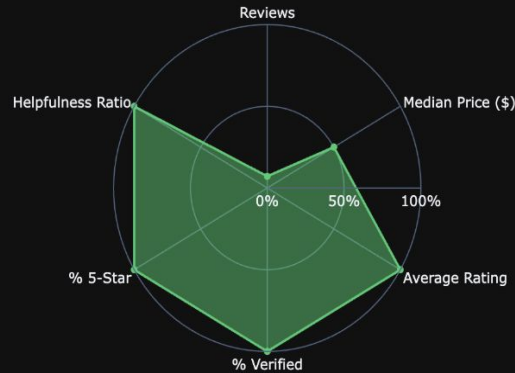
Dashboard – Verified Purchase Impact

- Unverified reviews often inflate ratings—most categories show higher overall scores than verified ones.
- Software shows the largest gap (~2★ difference), while categories like Unique Finds and Amazon Devices show 0.5–0.8★ gaps, signaling potential review bias. In contrast, segments like Video Games and Cell Phones show strong rating alignment, indicating trustworthiness. This gap between perception and verified experience may lead to increased returns or support issues.



Dashboard – KPI

KPI Radar: Digital Music

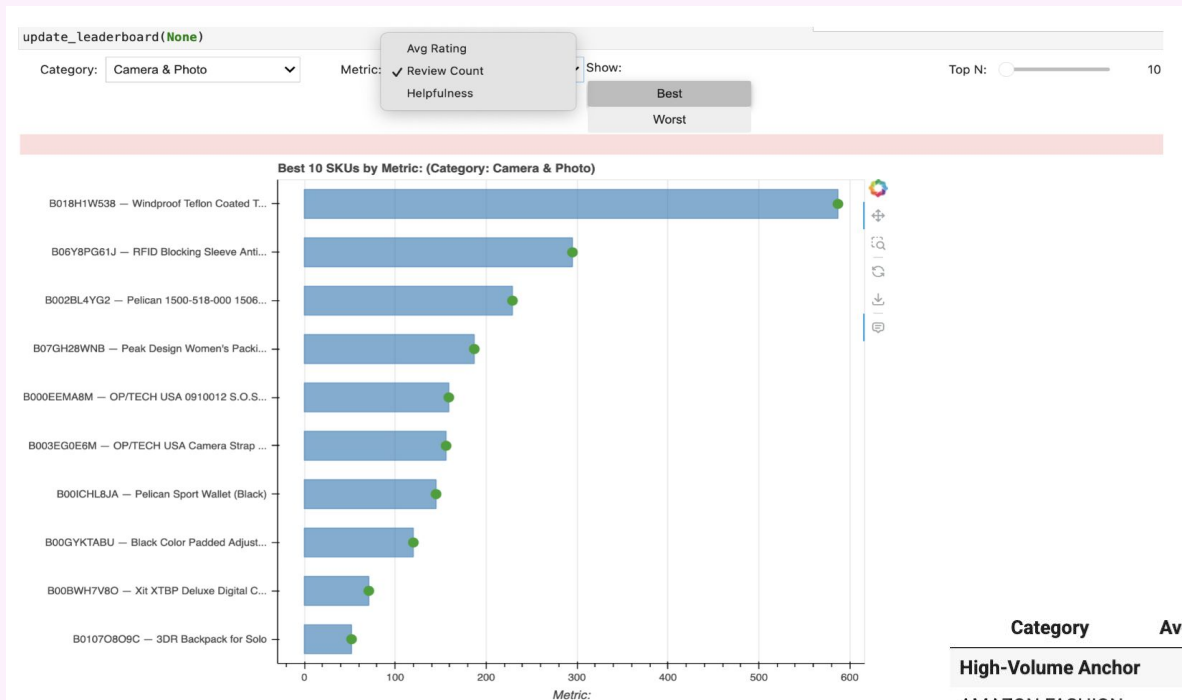


Category:	Digital Music
Average Ra...	4.2
Reviews	10000
% 5-Star	50
Median Pri...	45
Helpfulnes...	0.2
% Verified	80

Category	Avg. Rating	# Reviews	% 5★	Median Price	Helpfulness Ratio	% Verified
Computers	4.36	40,471	70.2	\$34.95	87.3%	94.4%
All Electronics	4.10	22,625	61.9	\$16.98	90.0%	91.8%
Overall (ALL)	4.18	2,740,763	64.4	\$27.99	86.2%	92.9%
Grocery	3.91	4,887	59.9	\$8.07	79.9%	94.9%
Books	4.14	84,352	60.4	\$14.97	62.7%	95.0%

- Computers top the chart with the highest rating (4.36) and 5★ share (70.2%), backed by strong engagement (87.3%) and solid pricing (\$34.95).
- All Electronics shows exceptional review helpfulness (90%), indicating a vocal, engaged audience—ideal for bundling or upsell opportunities.

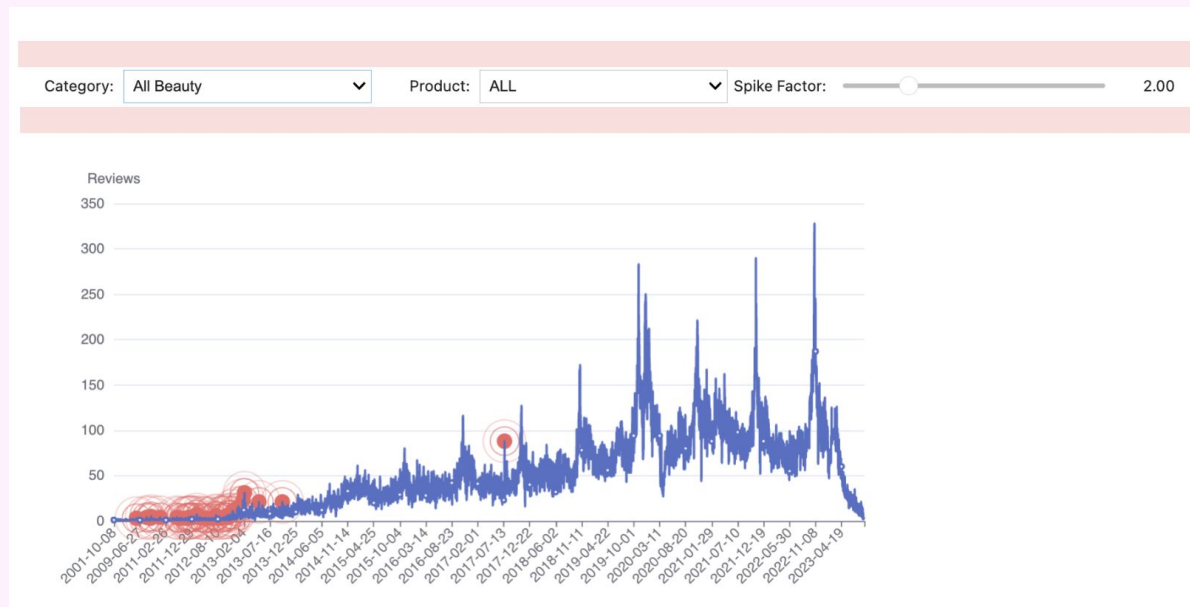
Dashboard – Best/Worse SKU



- Traffic Drivers:** Amazon Fashion, Sports & Outdoors, and All Beauty generate high traffic with **moderate satisfaction** (mid-60% 5★, 75–90% helpfulness).
- Niche Categories:** Small-volume hits like Gifts or Magazines reach **5.0★** but lack scale—**statistical outliers**, not strategic anchors.
- Under-Performers:** Software, Car Electronics, and Grocery show **low ratings (<4.0)** and **5★ share <60%**—ideal for **quality audits** and **supplier reviews**.

Category	Avg Rating	Reviews	% 5★	Median Price	Helpfulness Ratio
High-Volume Anchor					
AMAZON FASHION	4.18	59 476 862	63.5%	\$24.99	75.2%
Sports & Outdoors	4.21	751 958	65.3%	\$24.99	81.6%
All Beauty	4.10	232 320	61.0%	\$14.99	87.2%
Office Products	4.38	168 115	71.8%	\$10.99	49.4%
Books	4.14	84 352	60.4%	\$14.97	62.7%

Dashboard – Review Velocity Spike

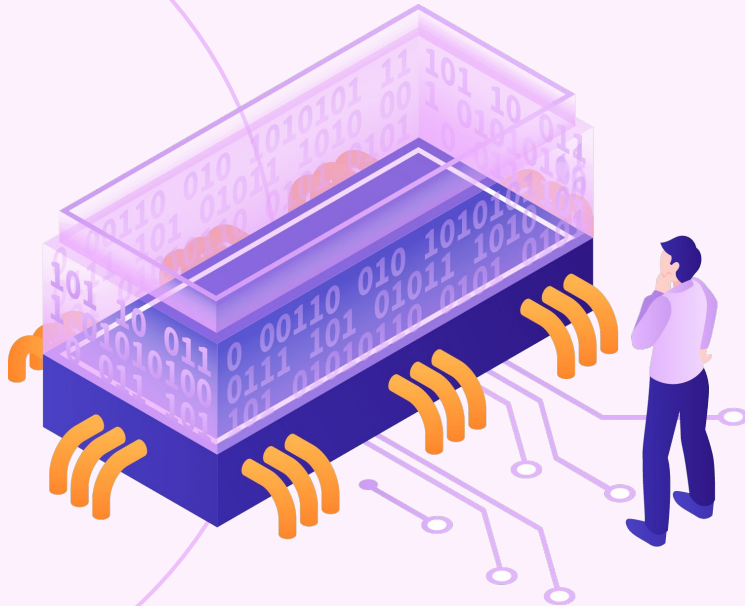


- Consistent rise in reviews from 2011 to 2022, with **moderate daily spikes (250–350 reviews)** tied to **mid-year and holiday seasons**—signaling sustained interest and maturing category presence.
- Review surges are **tightly clustered around summer and Q4**, aligning with **influencer campaigns** and **seasonal promotions** like Prime Day and holiday sales.
- **Platform-wide events (e.g., Prime Day, Black Friday)** drive the largest spikes, while **category-specific pushes (e.g., Beauty Week)** create smaller, controlled uplifts.

We applied a $\geq 2\times$ spike factor to daily review data across key categories to detect unusual surges, revealing patterns tied to promotions, launches, seasonality, or service issues.

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Key Insights & Business Implications



Association Rule – Key Insights

Top 10 Products by Review Volume

1. **Funny Civil Engineers TShirt** – “I’m A Crazy Civil Engineering T-Shirt”
2. **Hail Satan Unicorn Cat Rainbow Pullover Hoodie**
3. **Crocs Unisex-Adult Classic Clog**
4. **Andy Griffith Show “Floyd’s Barber Shop” Premium T-Shirt**
5. **SATINA High-Waisted Capri & Full-Length Women’s Leggings**

Most Frequently Purchased Individual Items

Item	Purchases
Amazon Essentials Women’s Classic-Fit Polar Fleece Jacket (Plus Sizes)	3,992
Bali Women’s One Smooth-U Underwire T-Shirt Bra (Convertible Straps)	2,915
Carhartt Men’s Loose-Fit Heavyweight Short-Sleeve Pocket Henley T-Shirt	2,420
Clarks Women’s Suede Knitted-Collar Clog Slippers (Faux-Fur Lining)	1,286
BOBS from Skechers Women’s Highlights Flexpadrille Wedge	893

Key Cross-Sell Opportunities

Antecedent	Consequent
Kanu Surf Men’s Barracuda Swim Trunks	CB Rashguard UPF 50+ Swim Shirt
Grumpy Old Man “Killing It” Sweatshirt	Hail Satan Unicorn Cat Rainbow Hoodie
Grumpy Old Man “Killing It” Sweatshirt	Funny Civil Engineers TShirt

Association Rule– Business Implication

Strategic Recommendations

1. Bundle & Promote

- Launch *Swim Essentials* sets (trunks + rashguard)
- Offer graphic-apparel combos (sweatshirt + hoodie or tee)

2. Inventory & Merchandising

- Prioritize top 5 high-support items (e.g., bras, clogs)
- Feature in homepage carousels and email newsletters

3. Personalized Cross-Sell

- Dynamically recommend complements on product pages
- Use lift-based ranking (e.g., rashguard ranks highest with swim trunks)

4. Marketing & Promotions

- Campaigns like *Graphic Apparel Week* and *Active-Wear Essentials*
- Highlight user-generated review images for social proof

Text Analysis – Key Insights

1. Volume & Sentiment

- Top Categories: Apparel, Electronics, Home & Kitchen, and Health & Beauty account for 70–80% of total reviews.
- Sentiment Breakdown:
 - Positive (4–5): ~60% – praise for comfort, reliability, and design
 - Neutral (3): ~15–25% – minor usability feedback
 - Negative (1–2): ~20–25% – common issues include fit problems, durability concerns, and shipping delays

2. Dominant Themes (LDA Topics)

Category	Top Topics
Apparel	Fit & sizing, fabric quality, color accuracy
Electronics	Battery life, ease of setup, audio/performance issues
Home & Kitchen	Assembly instructions, material durability, finish
Health & Beauty	Texture consistency, ingredient transparency, packaging

3. Review Summary Example (BART)

“Customers love the softness and stretch of these leggings, though many recommend sizing up for the perfect fit.”

Text Analysis – Business Implication

1. Marketing & Merchandising

- Use strong customer quotes (e.g. “I love the comfort and stretch!”) in product listings.
- Bundle frequently paired items from reviews (e.g. leggings + sports bra).
- Run targeted email campaigns by review topic (e.g. “Fit Issues” → “Extended Size Preview”).

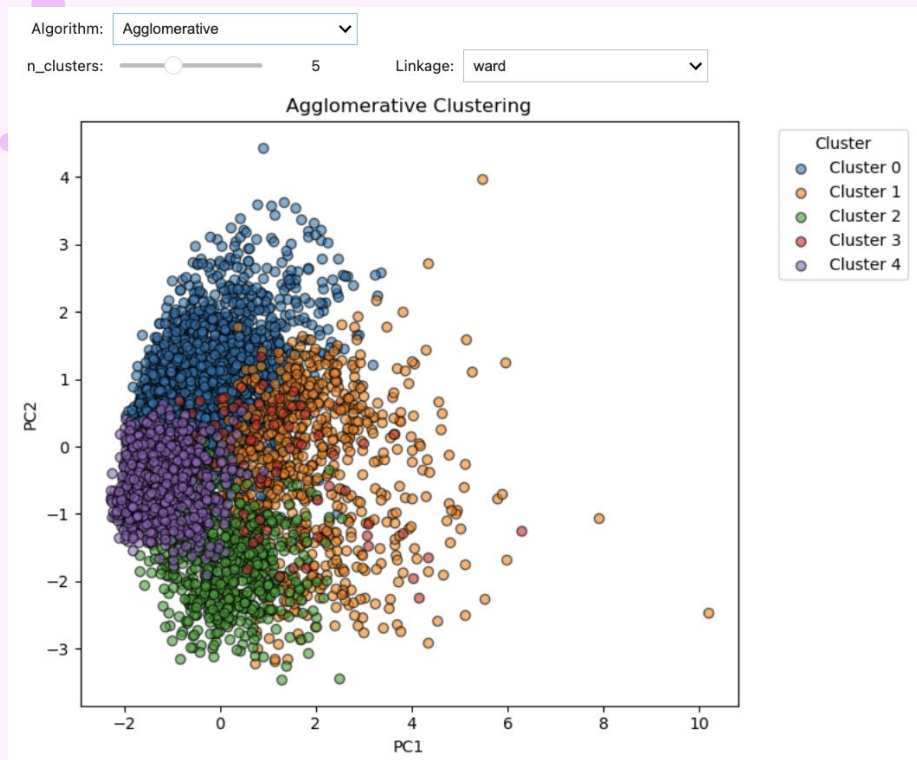
2. Customer Experience

- Deploy an FAQ chatbot trained on review content.
- Prioritize service for high-risk complaints (e.g. “battery won’t hold,” “arrived damaged”).

3. Product & Design

- Add “Runs Small / True to Size” badges and update size charts using real user data.
- Upgrade fabrics to reduce pilling/stretching issues.
- Improve home product manuals with clear diagrams and videos.

Customer Clustering – Key Insights



Cluster Categories

- Video First Low Helpfulness
- Balanced Video & Text
- High Help Multimedia Champions
- Image-First Enthusiasts
- Mixed-Content Contributors
- Ultra-Rare Micro-Reviewers
- Text-Focused Occasional Video
- Pure Text Reviewers

Customer Clustering – Business Implications

1 Tailor Engagement

- Spotlight media content (Cluster 2 & 3)
- Embed context adding prompts (Cluster 0 & 7)

3 Product & UX Improvement

- Fix issues using Cluster 6 & 7 feedback
- Surface negative one-liners (Cluster 7)

2 Optimize Review Quality

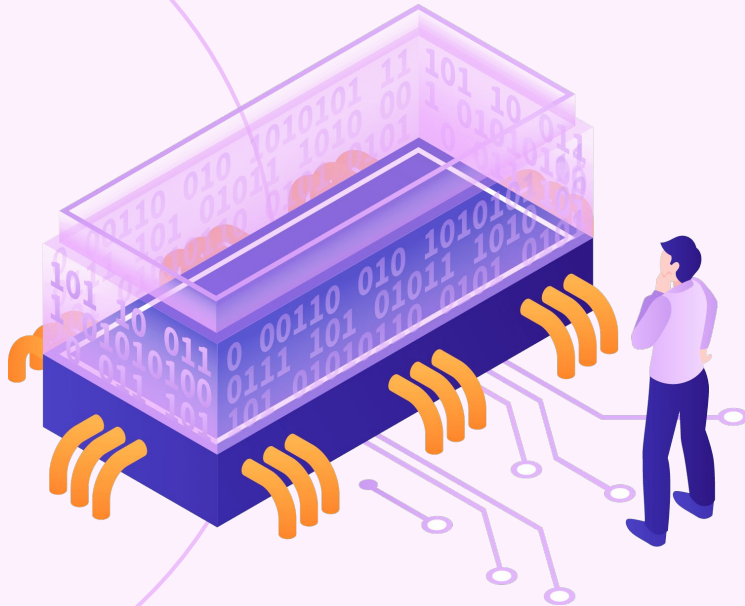
- Step-by-step guided questions (Cluster 0)
- Photo upload Call to Actions (Cluster 1 & 6)

4 Personalized Communications

- Email Campaigns (Utilize Cluster 2 & 3)
- On-Site Microcopy: Tailor prompts by segment

05

Challenges



Challenges

Dataset volume – 132 M rows × 23 columns overwhelmed a single-node cluster; we down-sampled for EDA and upgraded to a multi-node Dataproc cluster.

- **Kernel and YARN failures** – large joins and ML pipelines exhausted memory, triggering YARN container kills; increasing executor memory and enabling dynamic allocation stabilised jobs
- **Gateway outage** – Jupyter returned *HTTP 500 java.io.IOException*. We deleted the faulty cluster and recreated a clean one
- **Egress blockage** – the new cluster could not fetch Python packages; attaching the subnet to a Cloud NAT and allowing HTTPS egress resolved the issue
- **Notebook bloat** – a monolithic notebook consumed excessive RAM, so we split the workflow into four smaller notebooks, reducing load times and memory footprint

06

Conclusion & Next Steps





Turning Amazon Reviews into Actionable Strategies for Product, Marketing, and Engagement

- We uncovered hidden product affinities and bundling opportunities that inform dynamic merchandising.
 - We captured authentic customer voices to guide content, design decisions, and sentiment-aware communication.
 - And we segmented reviewers into meaningful personas—empowering teams to tailor experiences, campaigns, and support based on real behavioral patterns.
-

Next Steps

- **Predict Review Helpfulness**



- Build a supervised machine learning model to estimate how helpful a review is.
- Use features like sentiment, review length, and reviewer behavior.

- **Apply Fine-Tuned Language Models**

- Use advanced NLP models (e.g., BERT) fine-tuned on e-commerce reviews.
- Improve sentiment analysis and topic extraction for deeper insights.

- **Conduct Time-Series Sentiment Analysis**

- Track changes in customer sentiment over time.
- Identify seasonal trends, product lifecycle issues, and shifting customer needs.



Thank you
Q & A

