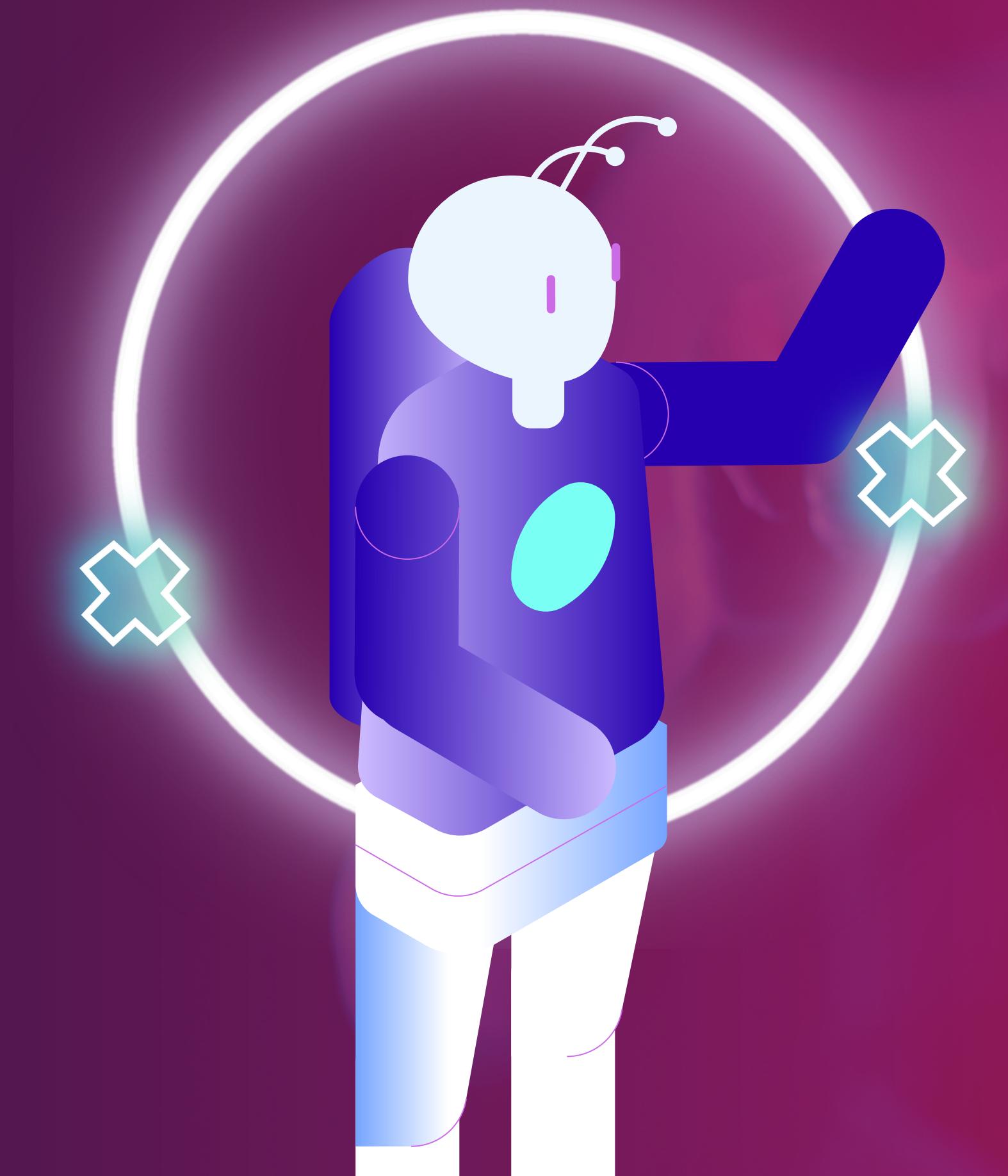


Ranwah
Sadik

AUTOMATED CUSTOMER REVIEWS USING NLP

Review Classification | Category Clustering |
Review Summarization





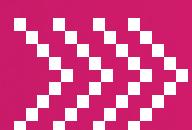
PROJECT OVERVIEW

Goal:

To develop an NLP-powered system
that automates the analysis of
Amazon product reviews.

Key Tasks:

1. Sentiment classification
2. Product category clustering
3. Generative review summarization



DATASET OVERVIEW



Amazon Consumer Reviews of_Amazon Products

- 28,000+ reviews (Feb–Apr 2019)
- Products: Tablet, Batteries, Accessories, etc.
- Key columns used: reviews.text, reviews.rating, primaryCategories, name, categories.



REVIEW CLASSIFICATION



CLASSIFY REVIEWS INTO POSITIVE, NEUTRAL, OR NEGATIVE CATEGORIES USING NLP

01

Data Preprocessing

- selected columns:
reviews.text, reviews.rating
- Balanced classes via
upsampling
- Mapped star ratings:
1-2 ★ → Negative (0)
3 ★ → Neutral (1)
4-5 ★ → Positive (2)

02

Model & Training

- Model: Roberta, DistilBERT
(pretrained transformer)
- Tokenized text with
TokenizerFast
- Split into 80/20 train/test
- Trained for 3 epochs

03

Evaluation Metrics

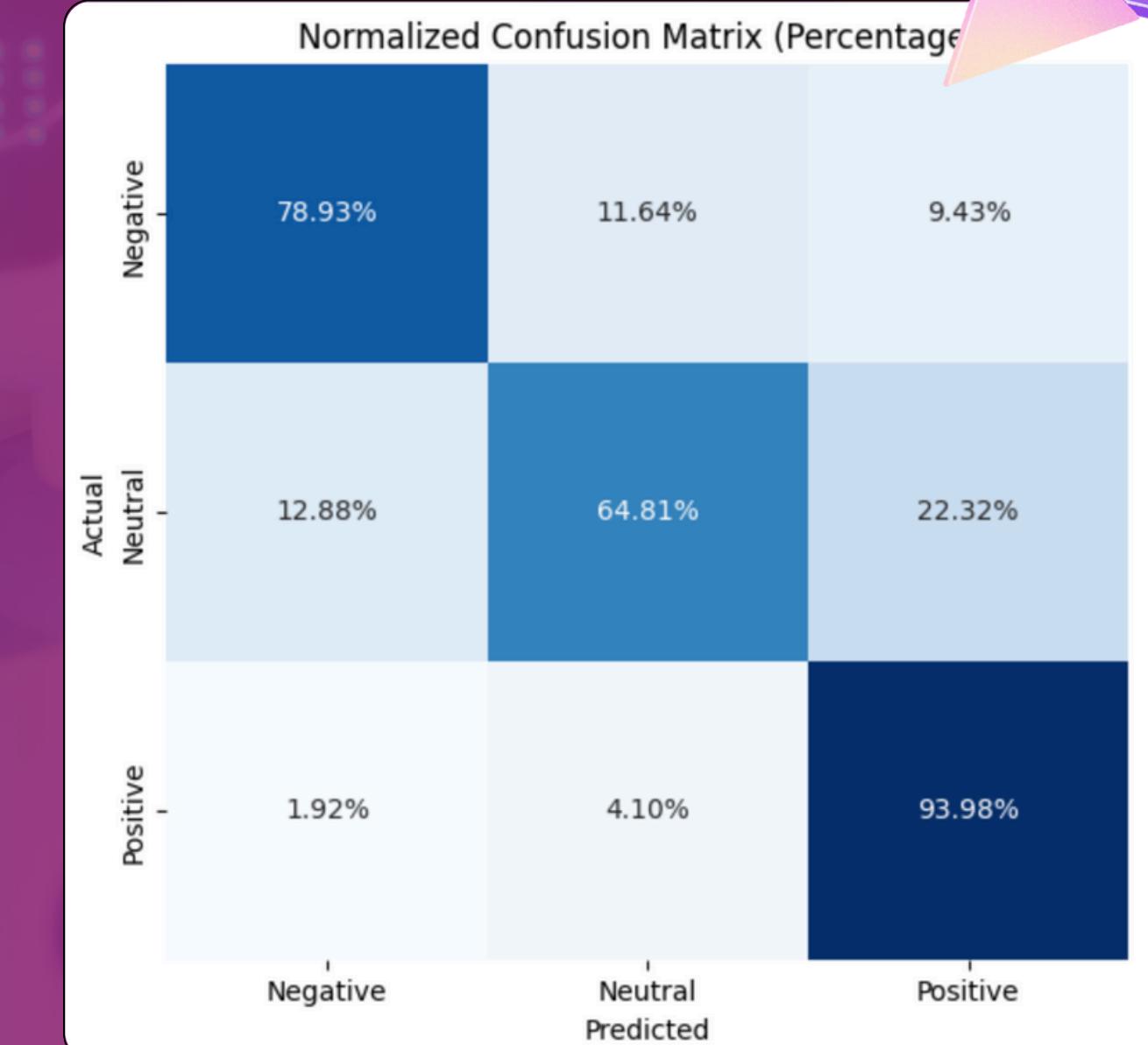
- Accuracy
- F1 Score
- precision/recall/F1
- Confusion Matrix



ROBERTA EVALUATION

	precision	recall	f1-score	support
Negative	0.66	0.79	0.72	318
Neutral	0.38	0.65	0.48	233
Positive	0.98	0.94	0.96	5116
accuracy			0.92	5667
macro avg	0.67	0.79	0.72	5667
weighted avg	0.94	0.92	0.93	5667

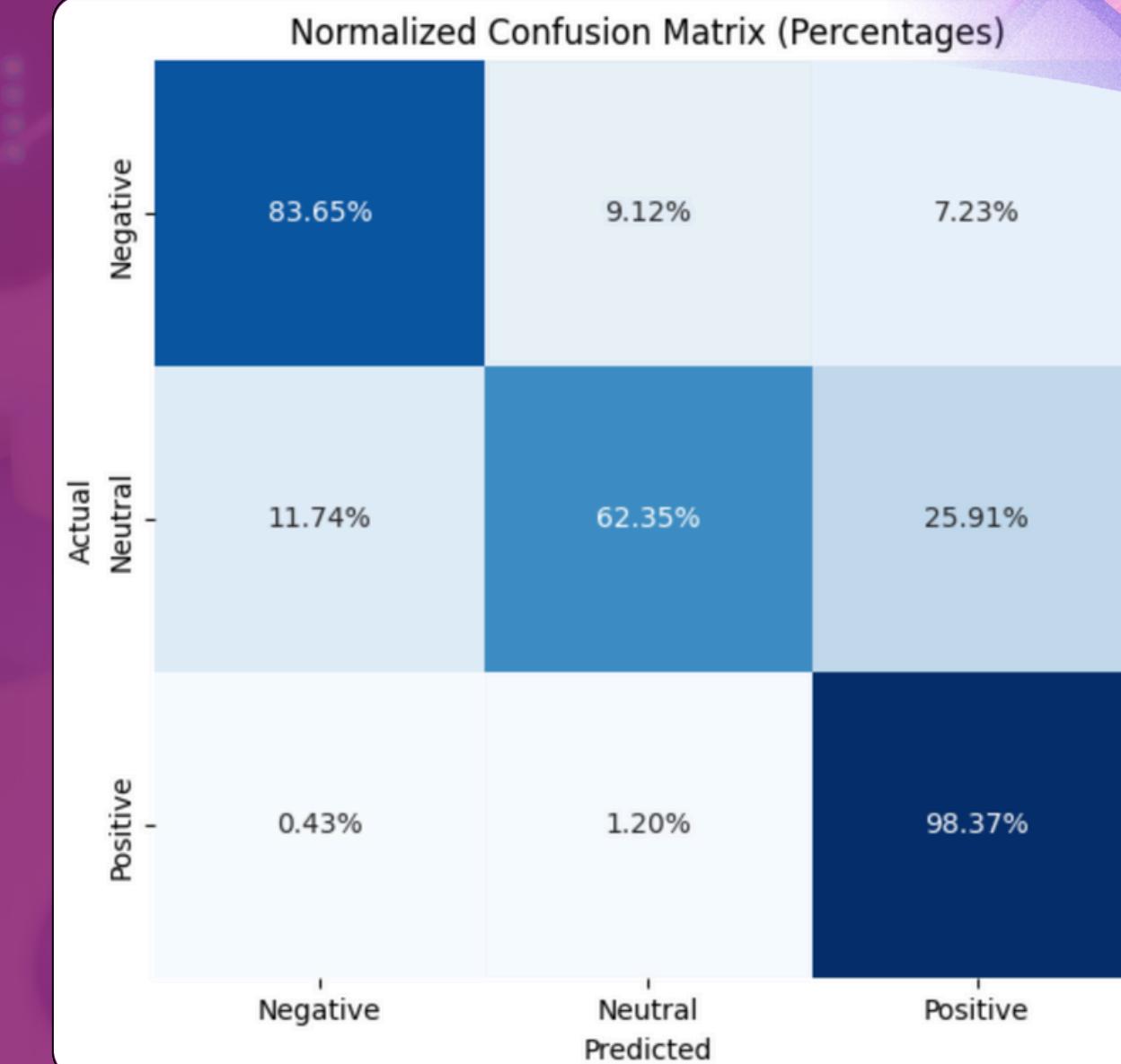
- Model is highly reliable for positive sentiment, useful in highlighting strong customer feedback.
- Can detect negative reviews effectively, making it valuable for identifying dissatisfaction.
- Neutral class could be improved further.



DISTILBERT EVALUATION

	precision	recall	f1-score	support
Negative	0.85	0.88	0.87	318
Neutral	0.64	0.64	0.64	233
Positive	0.99	0.98	0.98	5116
accuracy			0.96	5667
macro avg	0.82	0.83	0.83	5667
weighted avg	0.96	0.96	0.96	5667

- The model is highly reliable for classifying positive and negative sentiments.
- Neutral sentiment detection has improved compared to earlier results, but the performance still lags behind due to limited examples and less distinctive language cues.



PRODUCT CATEGORY CLUSTERING



GROUP THOUSANDS OF PRODUCTS INTO A FEW MEANINGFUL META-CATEGORIES TO
SIMPLIFY DOWNSTREAM ANALYSIS AND RECOMMENDATIONS

Data Preprocessing

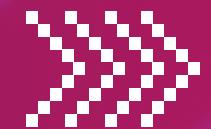
- Combined categories + primaryCategories into a unified text field.
- Cleaned and normalized text (removed special characters, lowercased)

Text Embedding

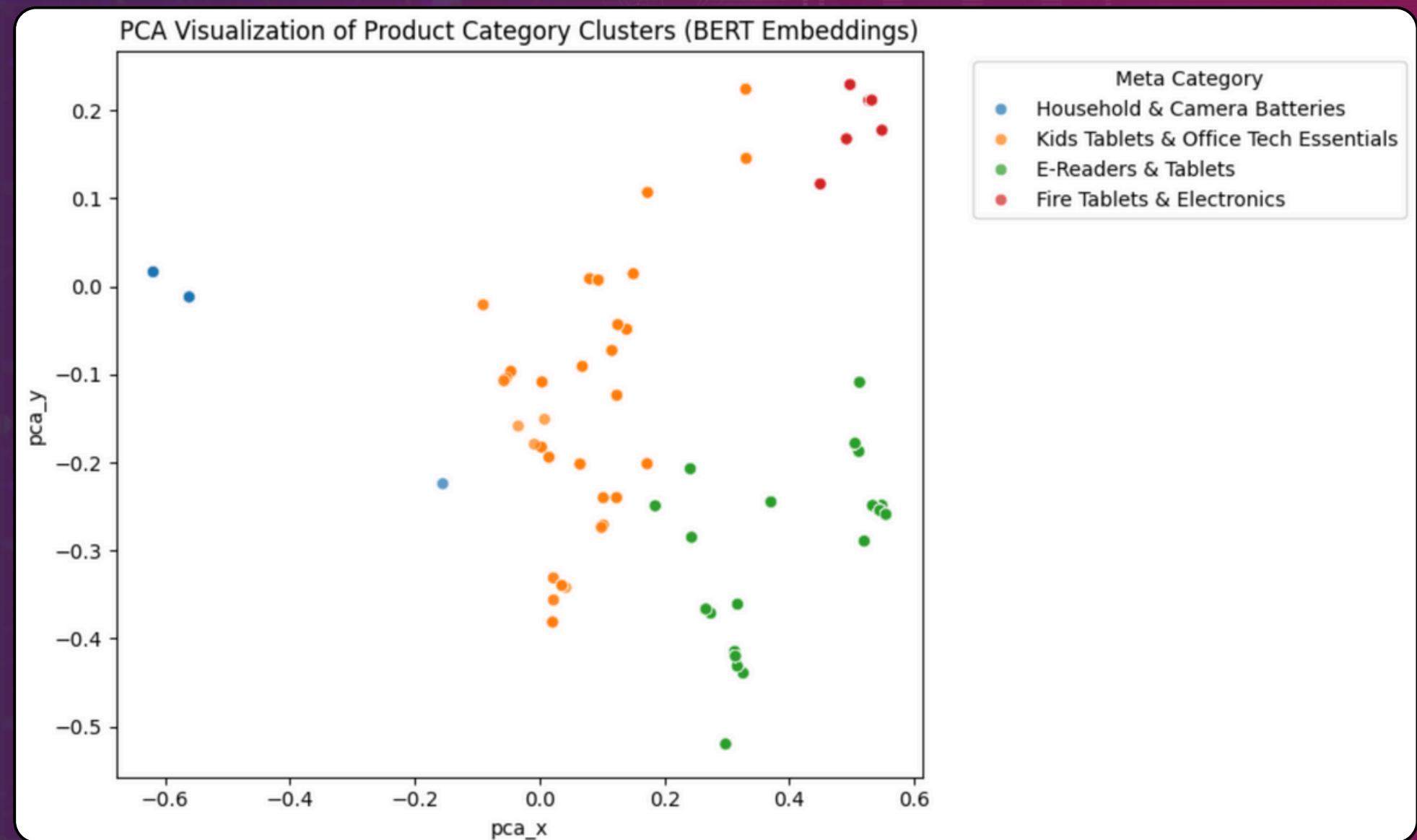
Used Sentence-BERT (all-MiniLM-L6-v2) to convert category text into vector representations.

Clustering

- Applied K-Means clustering on embeddings ($n_{clusters} = 5$).
- Mapped clusters to interpretable meta-categories .



VISUALIZATION



REVIEW SUMMARIZATION WITH GENERATIVE AI



GENERATE INSIGHTFUL SUMMARIES OF CUSTOMER REVIEWS FOR TOP-PERFORMING AND POOR-PERFORMING PRODUCTS IN EACH META-CATEGORY.

01

Data Preparation

- Used product name, category, review text, and rating.
- Filtered out missing values and cleaned review text.

02

Model

- Applied facebook/bart-large-cnn summarization model via HuggingFace pipeline.

03

Product Selection & Summarization

- Identified Top 3 and worst Products based on average rating and number of reviews
- Generated summarized highlights using a pre-trained generative model
- Extracted and summarized frequent complaints from low-rated reviews for better clarity



SAMPLE OUTPUT: HOUSEHOLD & CAMERA BATTERIES

🔍 TOP PRODUCT RECOMMENDATIONS: HOUSEHOLD & CAMERA BATTERIES

HERE ARE THE TOP-RATED PRODUCTS IN THIS CATEGORY, THEIR HIGHLIGHTS, AND WHAT TO AVOID.

⭐ TOP PRODUCTS:

► **AMAZONBASICS NESPRESSO POD STORAGE DRAWER - 50 CAPSULE CAPACITY**
NESPRESSO'S CAPSULE DRAWERS ARE SO MUCH NEATER THAN HAVING THE SLEEVES PILED ON TOP OF EACH OTHER. I WORK FOR NESPRESSO SO I HAVE A LOT OF CAPSULES.

► **AMAZONBASICS AA PERFORMANCE ALKALINE BATTERIES (48 COUNT) - PACKAGING MAY VARY**
BATTERIES FAIL IN A SHORT TIME ON ITEMS LIKE WIRELESS THERMOMETERS AND WALL CLOCKS. ON AN AVERAGE CHANGING IS REQUIRED WITHIN A MONTH. BULK IS ALWAYS THE LESS EXPENSIVE WAY TO GO FOR PRODUCTS LIKE THESE.

► **AMAZONBASICS AAA PERFORMANCE ALKALINE BATTERIES (36 COUNT)**
AMAZONBASICS AA AAA BATTERIES HAVE DONE WELL BY ME APPEAR TO HAVE A GOOD SHELF LIFE. I FIND AMAZON BASICS BATTERIES TO BE EQUAL IF NOT SUPERIOR TO NAME BRAND ONES. HOWEVER, THE PRICE IS HARD TO BEAT.

⚠ TOP COMPLAINTS:

- **AMAZONBASICS NESPRESSO POD STORAGE DRAWER - 50 CAPSULE CAPACITY**: NO MAJOR COMPLAINTS.

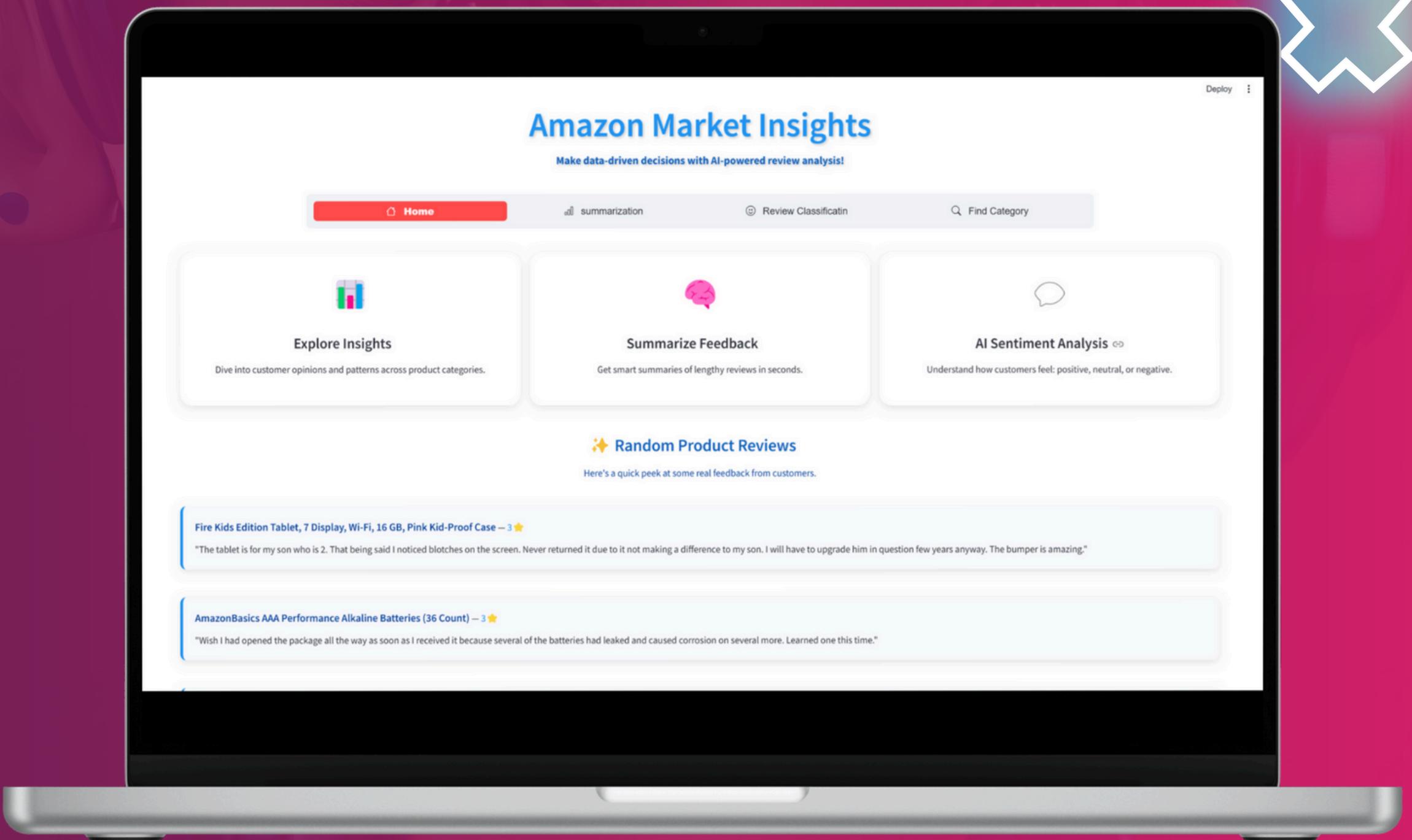
- **AMAZONBASICS AA PERFORMANCE ALKALINE BATTERIES (48 COUNT) - PACKAGING MAY VARY**:
THE BATTERY LIFE IS MUCH POORER COMPARED TO NAME BRANDS LIKE ENERGIZER AND DURACELL.; THESE DON'T LAST AS LONG AS NAME BRAND OF BATTERIES LIKE DURACELL OR ENERGIZER. THEY ARE CHEAPER BUT I'D RATHER PAY A LITTLE BIT MORE AND HAVE THEM LAST A LOT LONGER.

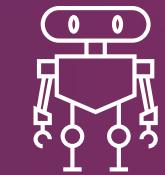
- **AMAZONBASICS AAA PERFORMANCE ALKALINE BATTERIES (36 COUNT)**: I DON'T KNOW IF I WOULD BUY THIS BRAND AGAIN SEEMS LIKE THEY DON'T LAST AS LONG AS DURACELL; IN MY OPINION THESE DID NOT LAST ANYWHERE NEAR AS LONG AS DURACEL IN THINGS LIKE LED CANDLES (WHICH IS CRAZY) AND TRAIL CAMERAS. CAMERAS WERE NOT EXPOSED TO COLD TEMPS MORE OR LESS THAN OTHER BATTERIES. WE BUY IN BULK FOR THE NORTH HOUSE. AMAZON BASICS IS GREAT FOR THINGS LIKE SHEETS AND BEDDING AND TOWELS. IN MY OPINION THE BATTERY LIFE, IN THE LARGE PACKAGE OF AAA AND AA SIZE WE PURCHASED WERE LACKING.

THERE IS NO WORSE PRODUCT.



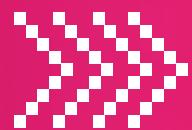
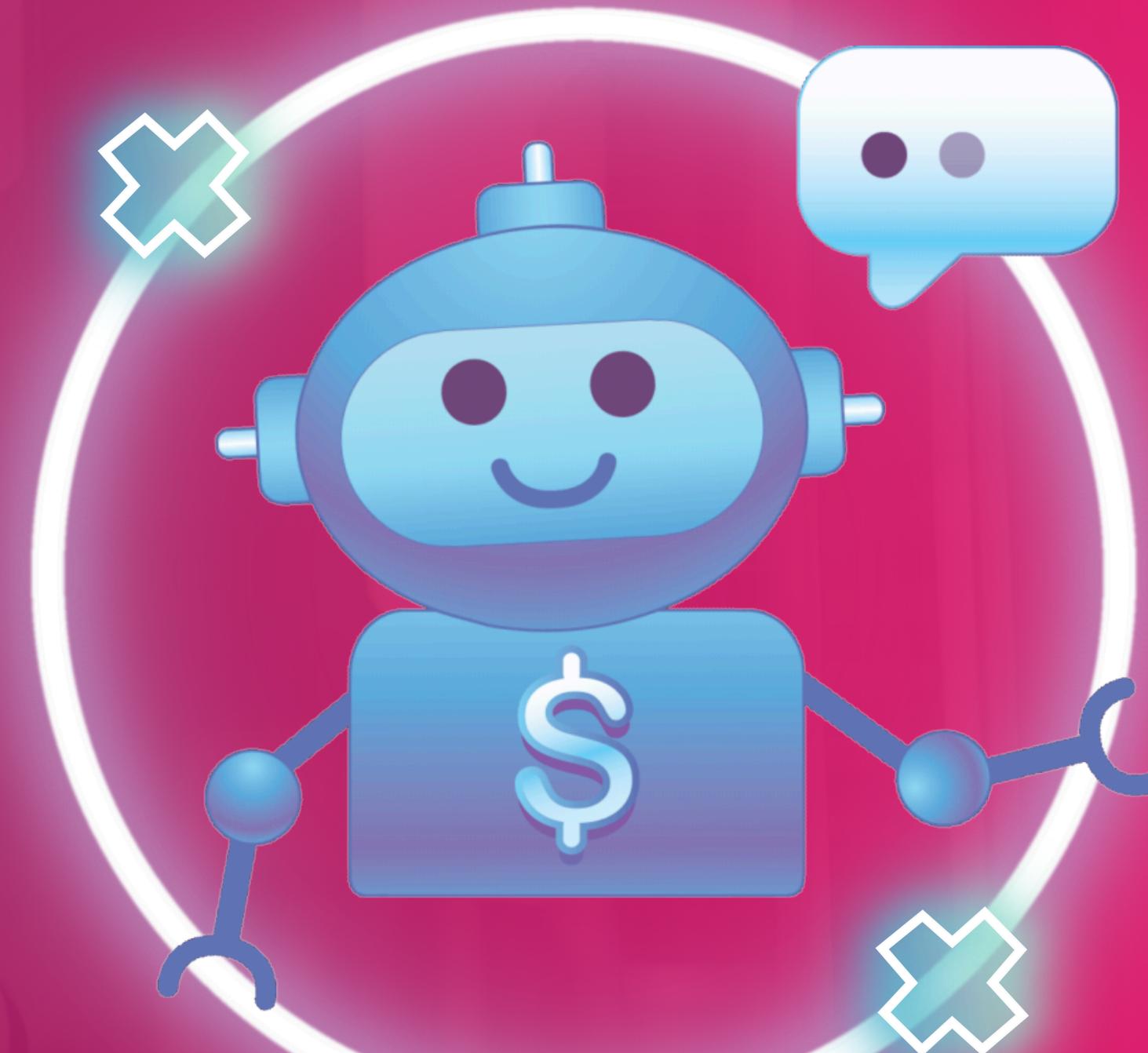
DEPLOYMENT USING STREAMLIT

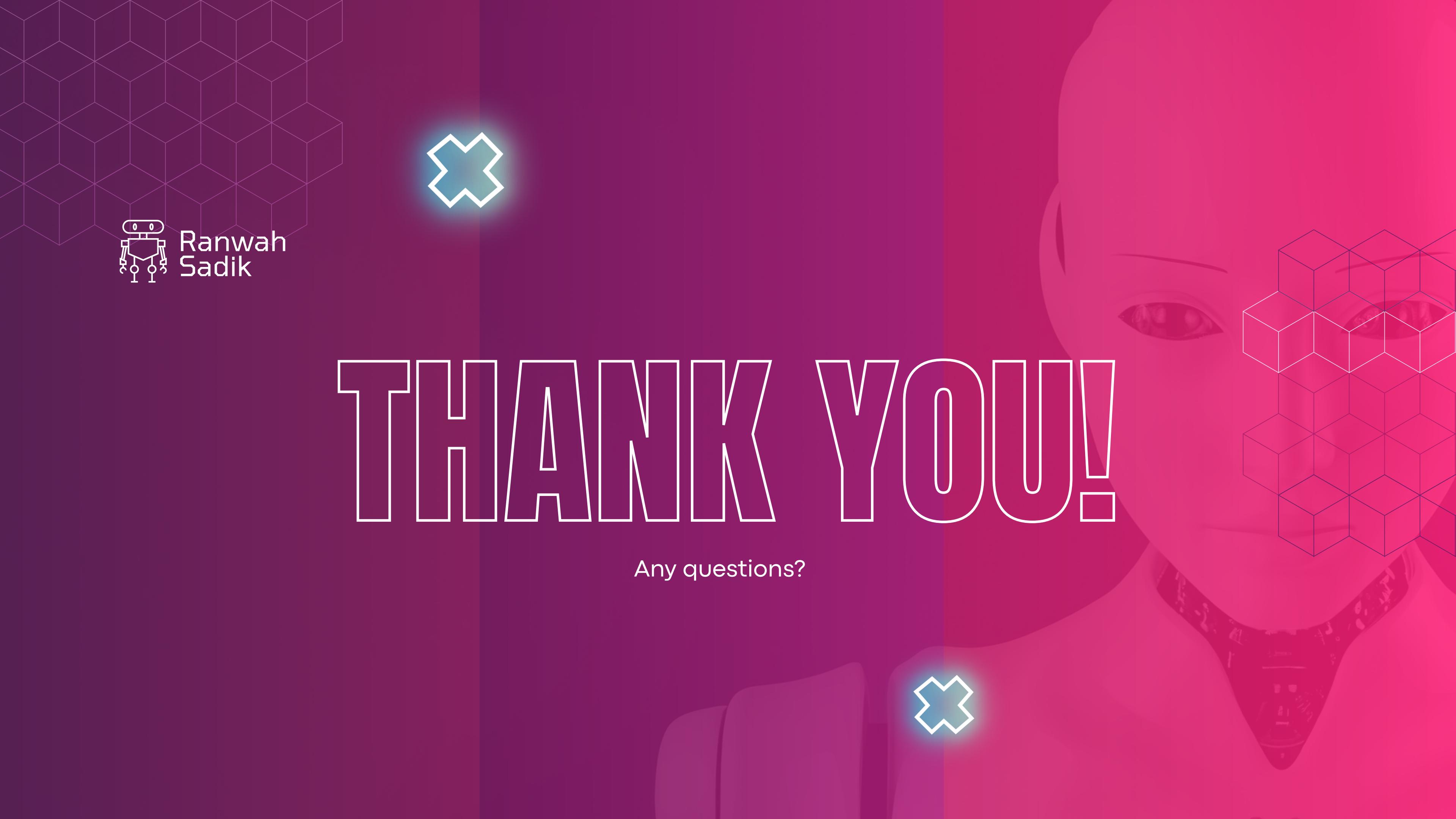




CONCLUSION

This project shows how NLP can transform raw review data into actionable business insights from classification to summarization. It provides companies with a scalable way to understand customer needs and market products more effectively.





THANK YOU!

Any questions?

