

E-Commerce Sentiment Analysis Report

Samsung Galaxy S24 & iPhone 15 (Flipkart Reviews)

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1 Project Overview

This project performs an end-to-end sentiment analysis on Flipkart customer reviews for Samsung Galaxy S24 and iPhone 15.

The pipeline includes data loading, preprocessing, EDA, sentiment labelling, dataset balancing, model training, FastAPI deployment, and insight reporting.

2 Dataset Summary

Raw reviews were manually collected due to scraping restrictions. Both positive and negative reviews were included, and additional negative reviews were manually added.

Sentiment labelling rules:

- Rating $\geq 4 \rightarrow$ Positive
- Rating $\leq 2 \rightarrow$ Negative
- Rating = 3 \rightarrow Neutral (used only in EDA)

3 Major Issues Faced & Resolutions

Issue 1: Flipkart Scraping Blocked

Flipkart blocks automated extraction.

Resolution: Manual CSV extraction.

Issue 2: Strong Sentiment Imbalance

Dataset had far more positive reviews.

Resolution: Added negative reviews manually and used SMOTE + undersampling.

Issue 3: Inconsistent Date Formats

Many dates were invalid or unparseable.

Resolution: Regex cleaning and standardization.

Issue 4: Model Predicting Only Positive

Due to imbalance.

Resolution: Retrained on balanced dataset.

Issue 5: Docker Not Supported on HP ProBook 4530s

Older hardware lacks virtualization support.

Resolution: API run locally using FastAPI.

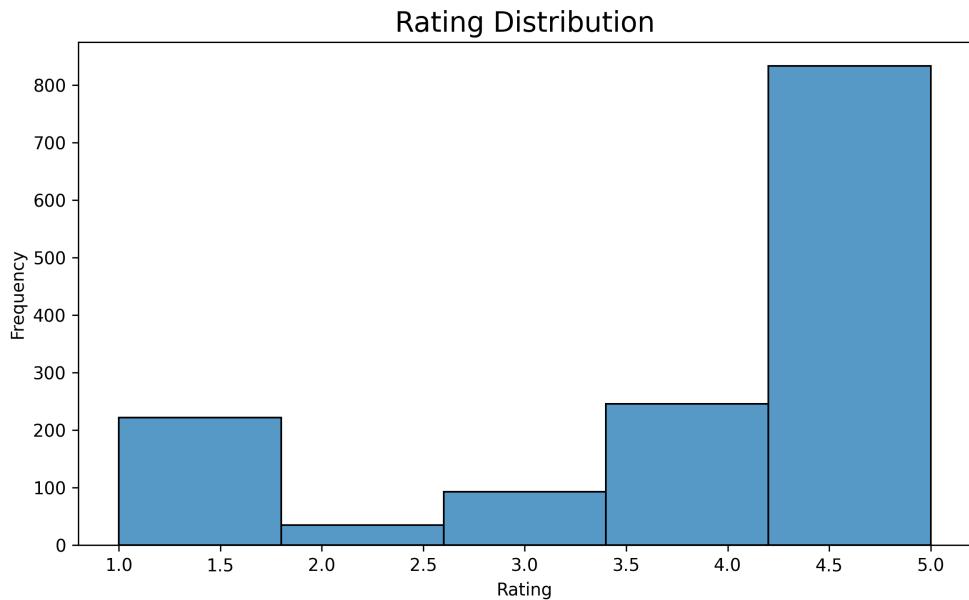
Issue 6: FastAPI Served Old Model

Old model.pkl was loaded.

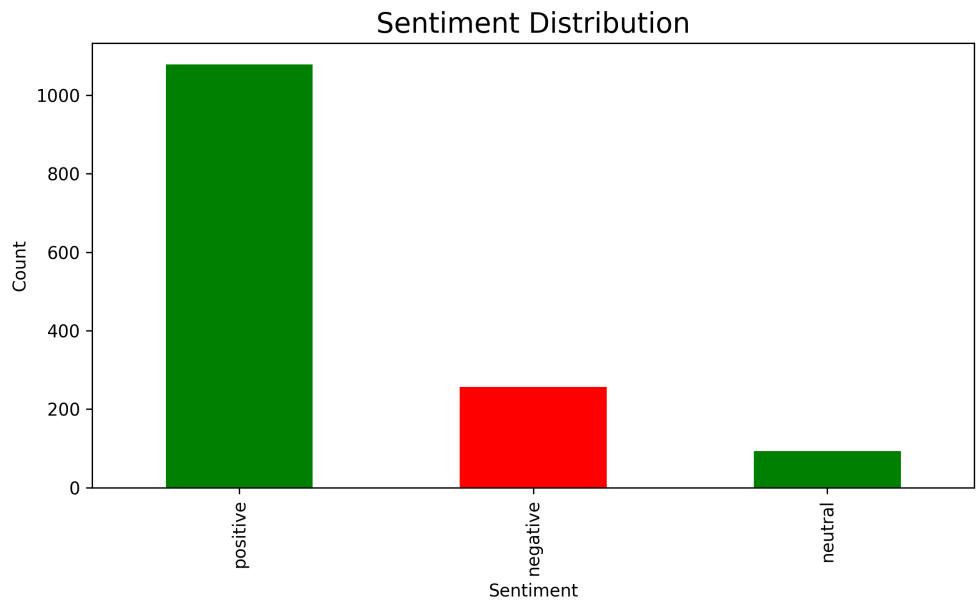
Resolution: Replaced with new balanced model.

4 Key Visual Insights

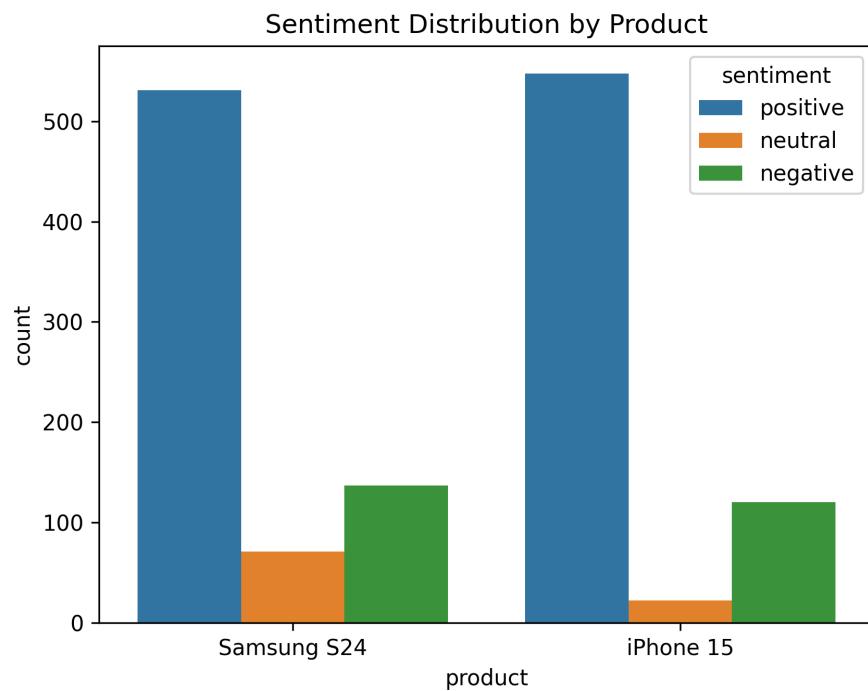
4.1 Rating Distribution



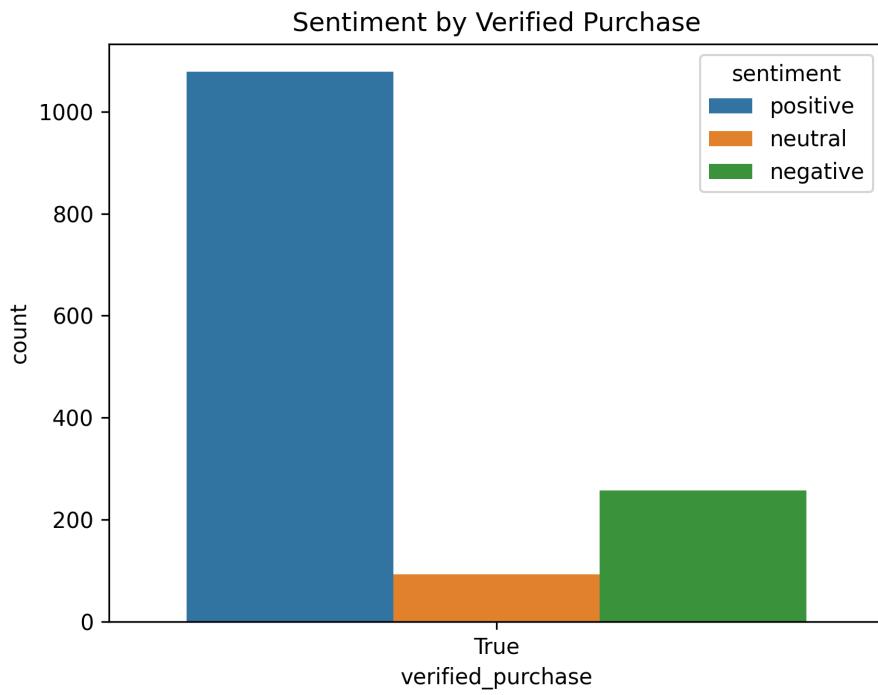
4.2 Sentiment Distribution



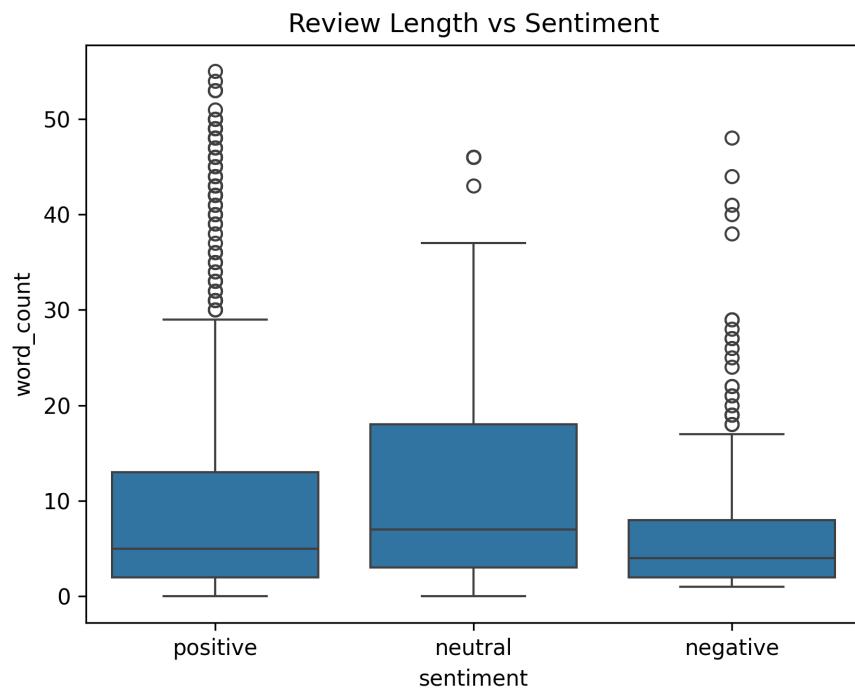
4.3 Sentiment by Product



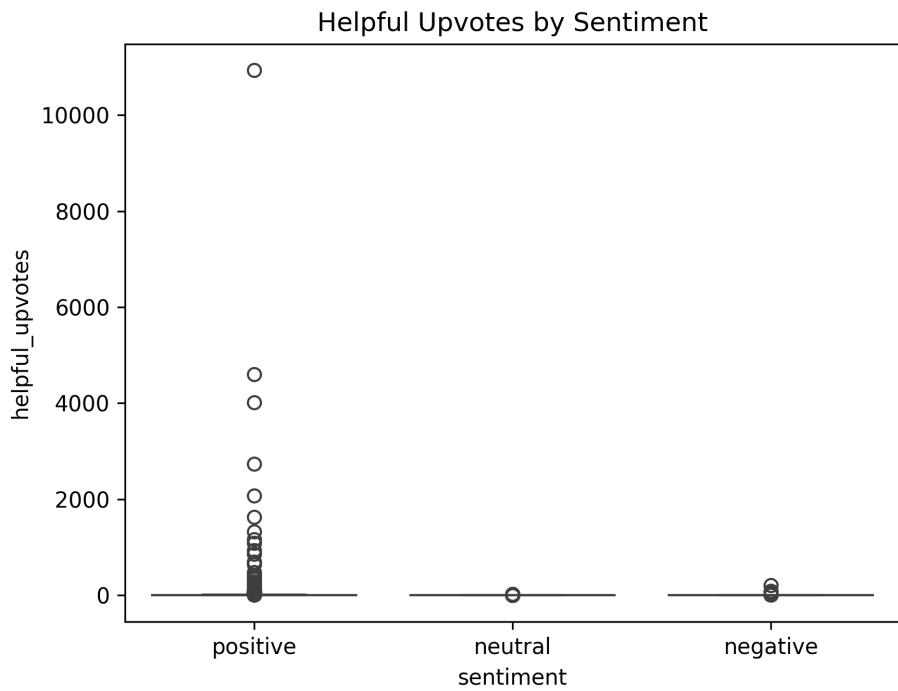
4.4 Sentiment by Verified Purchase



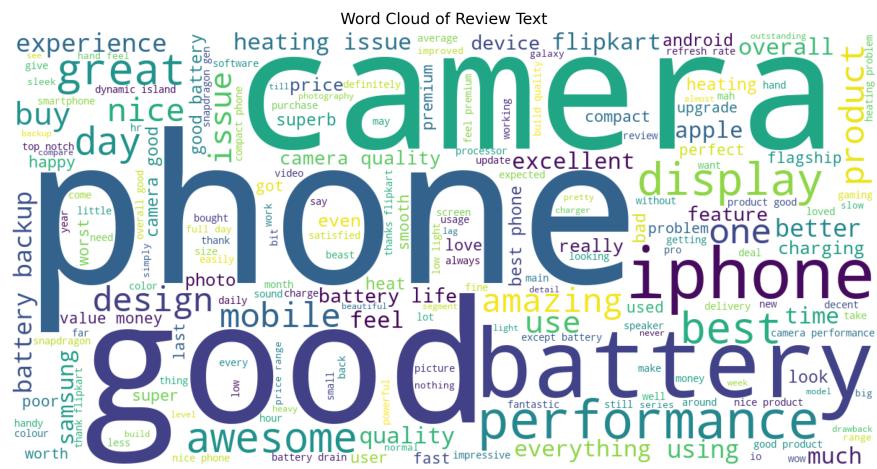
4.5 Review Length vs Sentiment



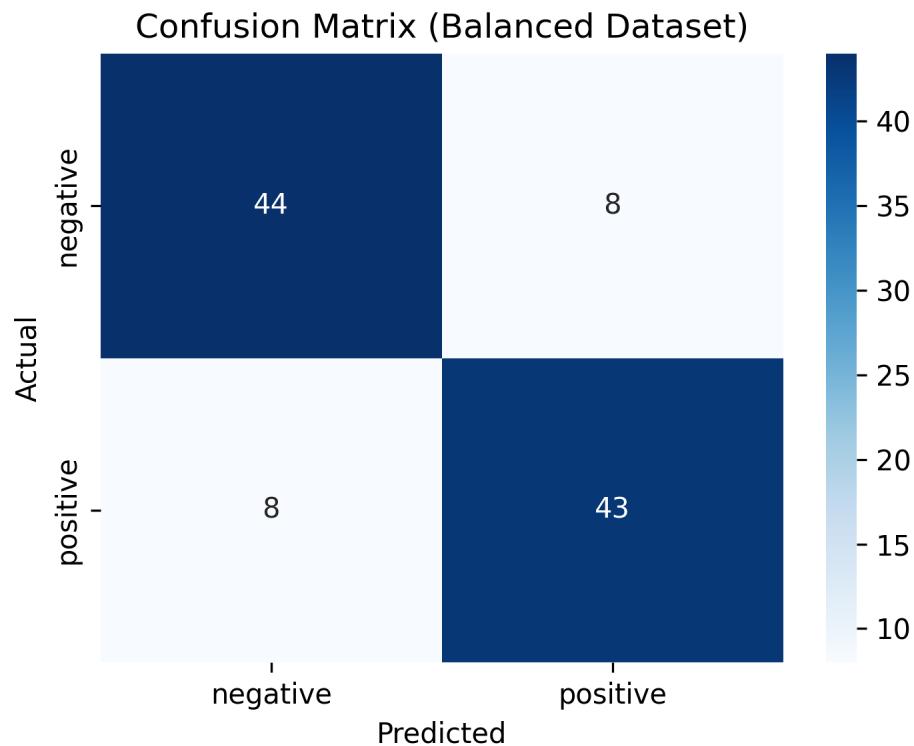
4.6 Helpful Upvotes vs Sentiment



4.7 Word Cloud



4.8 Confusion Matrix (Balanced Dataset)



5 Model Summary

The model used:

- TF-IDF Vectorizer
- Logistic Regression Classifier

Performance:

- Accuracy: 84%
- Balanced precision and recall
- F1-score: 84%

6 Business Insights

- Heating and battery issues are the most common complaints.

- iPhone reviews frequently praise camera quality.
- Verified buyers write more reliable and detailed reviews.
- Dataset shows a heavy positive bias.
- Balanced training improves detection of negative feedback.

7 Model Testing on FastAPI Server

The deployed FastAPI model was tested using Swagger UI. Below are the actual request–response screenshots from the live API hosted locally.

Test Case 1: Strongly Positive Review

```

curl -X POST \
  http://127.0.0.1:8000/predict \
  -H "Content-Type: application/json" \
  -H "User-Agent: curl/7.64.0" \
  -d "{'review_text': 'Loved the performance! Smooth display, great sound and excellent build quality. Highly recommended.'}"
  
```

Request URL: <http://127.0.0.1:8000/predict>

Server response:

Code	Details
200	Response body
<pre>"review_text": "Loved the performance! Smooth display, great sound and excellent build quality. Highly recommended.",\n"predicted_sentiment": "positive"</pre>	
Response headers	
<pre>content-length: 203\ncontent-type: application/json\nDate: Mon, 25 Nov 2023 10:34:46 GMT\nserver: uvicorn</pre>	

Test Case 2: Positive Experience Review

```

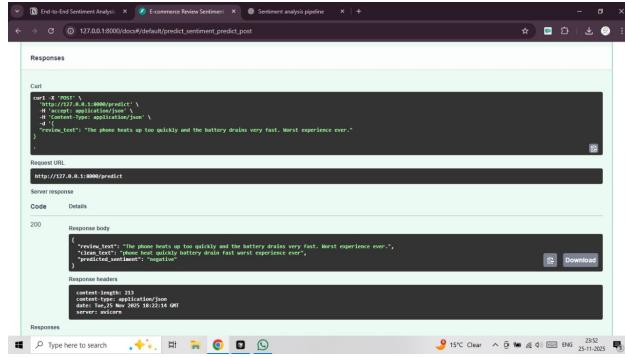
curl -X POST \
  http://127.0.0.1:8000/predict \
  -H "Content-Type: application/json" \
  -H "User-Agent: curl/7.64.0" \
  -d "{'review_text': 'The phone is super fast, the camera quality is amazing and the battery lasts all day. Totally worth the money!'}"
  
```

Request URL: <http://127.0.0.1:8000/predict>

Server response:

Code	Details
200	Response body
<pre>"review_text": "The phone is super fast, the camera quality is amazing and the battery lasts all day. Totally worth the money!",\n"predicted_sentiment": "positive"</pre>	
Response headers	
<pre>content-length: 203\ncontent-type: application/json\nDate: Mon, 25 Nov 2023 10:34:46 GMT\nserver: uvicorn</pre>	

Test Case 3: Strongly Negative Review



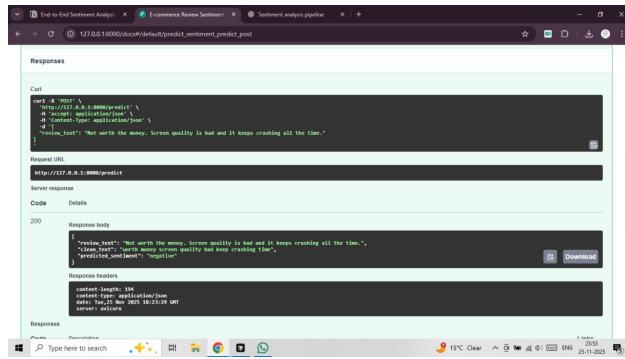
A screenshot of a browser window titled "End-to-End Sentiment Analysis" showing a "Sentiment analysis pipeline". The URL is "http://127.0.0.1:8000/predict/default/predict_sentiment_predict_post". The "Responses" tab is selected. The "Call" section shows a POST request to "http://127.0.0.1:8000/predict" with JSON input: {"review_text": "The phone heats up too quickly and the battery drains very fast. Worst experience ever."}. The "Server response" section shows a 200 OK response with the following JSON body:

```
{"review_text": "The phone heats up too quickly and the battery drains very fast. Worst experience ever.", "label": "negative", "predicted_sentiment": "negative"}
```

The "Response headers" section shows:

```
content-length: 111  
content-type: application/json  
date: Tue, 25 Nov 2025 18:23:19 GMT  
server: uvicorn
```

Test Case 4: Negative Experience Review



A screenshot of a browser window titled "End-to-End Sentiment Analysis" showing a "Sentiment analysis pipeline". The URL is "http://127.0.0.1:8000/predict/default/predict_sentiment_predict_post". The "Responses" tab is selected. The "Call" section shows a POST request to "http://127.0.0.1:8000/predict" with JSON input: {"review_text": "Not worth the money. Screen quality is bad and it keeps crashing all the time."}. The "Server response" section shows a 200 OK response with the following JSON body:

```
{"review_text": "Not worth the money. Screen quality is bad and it keeps crashing all the time.", "label": "negative", "predicted_sentiment": "negative"}
```

The "Response headers" section shows:

```
content-length: 104  
content-type: application/json  
date: Tue, 25 Nov 2025 18:23:19 GMT  
server: uvicorn
```

8 Limitations

- **Manual data extraction:** Limited by Flipkart's anti-scraping policies.
- **Small number of negative reviews:** Required oversampling rather than natural distribution.
- **Rating-based sentiment labelling:** Some users give high ratings but write negative comments.
- **Model trained only on text:** No metadata (likes, reviewer profile, purchase history) included.
- **FastAPI not containerized on this system:** Docker virtualization unsupported on laptop hardware.
- **No neural models used:** Logistic Regression works well but misses complex contextual meaning.

9 Future Work

- Expand dataset with more naturally occurring negative reviews.
- Deploy the API on cloud platforms like AWS, Railway, or Render.
- Use BERT or other transformer models for deeper text understanding.
- Build aspect-based sentiment (battery, camera, delivery, pricing).
- Integrate dashboard using Streamlit / PowerBI for real-time monitoring.
- Add multilingual sentiment support (Hindi, Hinglish).

10 Conclusion

This project successfully demonstrates an end-to-end sentiment analysis pipeline with actionable insights for e-commerce platforms. The balanced model performs well on unseen reviews and the FastAPI endpoint enables easy integration into real-world applications.