RESULTS

Model Evaluation Results

To assess the performance of the predictive models used in the Cognitive Customer Insights system, a range of evaluation metrics were applied, including accuracy, precision, recall, and F1-score. These metrics provide a comprehensive understanding of how well each model classifies customer sentiment based on textual reviews.

The models evaluated include:

- Logistic Regression
- Decision Tree
- Random Forest
- Deep Learning

Each model was trained using the cleaned and pre-processed Amazon Reviews dataset. The dataset was split into training and test sets using an 80:20 ratio to ensure unbiased evaluation.

Code Link:

https://colab.research.google.com/github/ZenVInnovations/1.-cognitive-customer-insights-with-watson-ai---7c9a3c8d/blob/Manasa/Cognitive_Customer_Insights_Final.ipynb

Table 1 presents a comparative analysis of the performance metrics (accuracy, precision, recall, and F1-score) for each machine learning and deep learning model used in the project.

Table 1: Evaluation Metrics

Model	Accuracy	Precision	Recall	F1 Score
Logistic Regression	0.81	0.84	0.69	0.76
Decision Tree	0.68	0.62	0.61	0.62
Random Forest	0.81	0.82	0.71	0.76
Deep Learning	0.79	0.76	0.73	0.74

Streamlit Dashboard

Figure 1 shows the Streamlit dashboard with model performance metrics on the left and a text box for entering product reviews. Users can input reviews and analyze sentiment in real time using the available models.

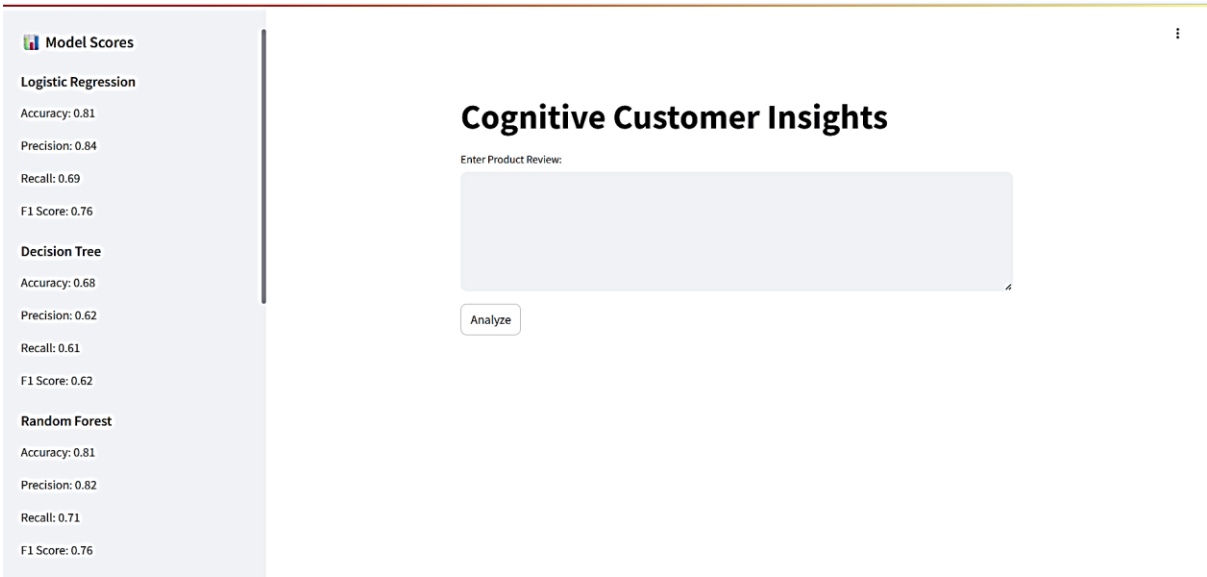

Figure 1: Streamlit Dashboard Showing Model Metrics and Review Input

Analysis Results

Case 1: Positive Feedback

Product Review Input: "The product quality is excellent and exceeded my expectations!"

Sentiment Analysis:

Figure 2 illustrates the analysis of a positive customer feedback instance. The review text provided indicates a highly favorable opinion about the product or service. This sentiment is validated by the sentiment pie chart, which reflects a 100% positive classification, confirming the model's ability to accurately detect affirmative sentiment.

Keywords Extraction:

Figure 3 displays the keyword cloud generated from the same feedback, showcasing the most prominent and positively connoted terms extracted using natural language processing techniques. These keywords help highlight aspects that were particularly appreciated by the customer. Complementing this, Figure 4 presents the keyword frequency count, offering a quantitative view of term occurrences to better understand the focus areas of customer satisfaction.

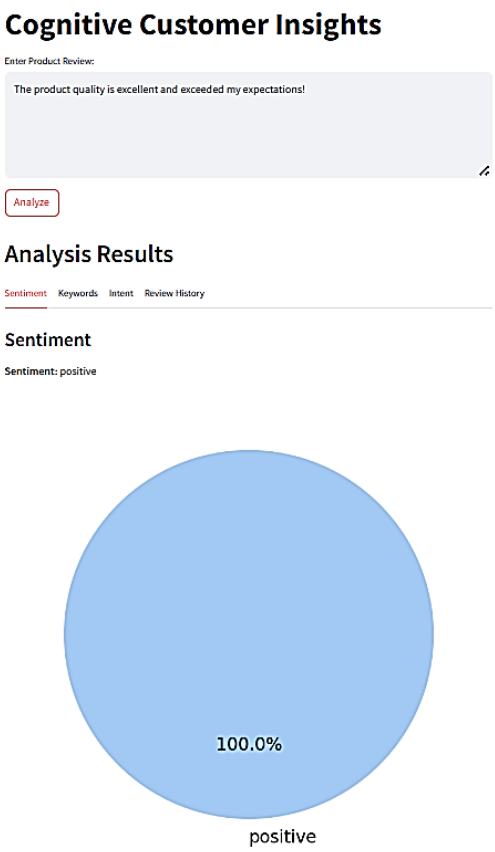

Figure 2: Sentiment Analysis Result for Case 1

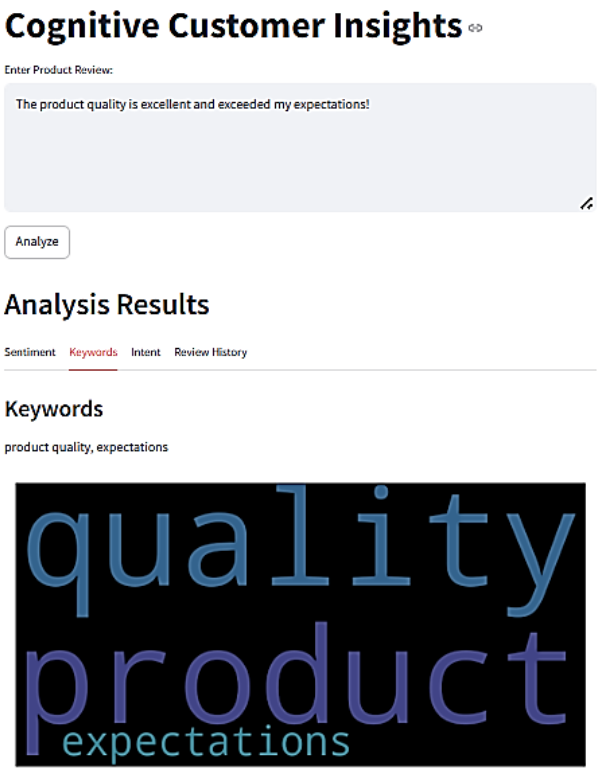

Figure 3: Keyword Extraction for Case 1

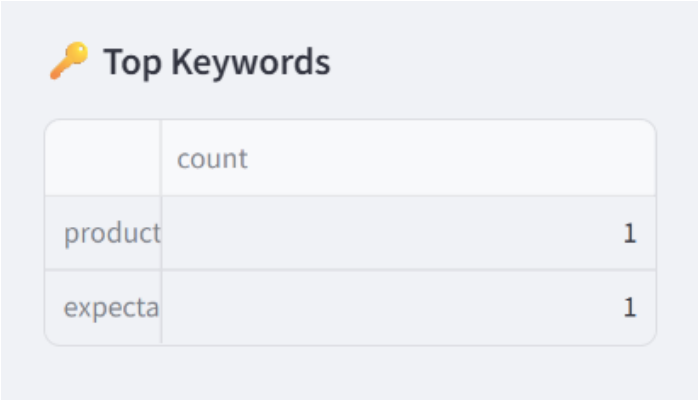

Figure 4 Keywords Count After Executing Case 1

Case 2: Negative Feedback

Product Review Input: "The item arrived damaged and was not as described."

Sentiment Analysis:

Figure 5 presents the sentiment analysis of a negative customer feedback instance. The input review expresses dissatisfaction or criticism, which is clearly captured by the sentiment model. The accompanying pie chart illustrates a balanced sentiment distribution with 50% positive and 50% negative, as it reflects cumulative input where the first review was positive and the second was negative. This balance demonstrates the system's ability to distinguish between contrasting sentiments across different reviews.

Keywords Extraction:

Figure 6 illustrates the keyword cloud, where frequently mentioned words from all feedback entries—positive and negative—are visualized. Negative terms become more prominent with the addition of the latest critical feedback. Figure 7, the keyword frequency chart, quantifies these terms cumulatively, offering a broader view of the most discussed topics. This helps identify recurring customer concerns or sentiments that may need attention or further exploration.

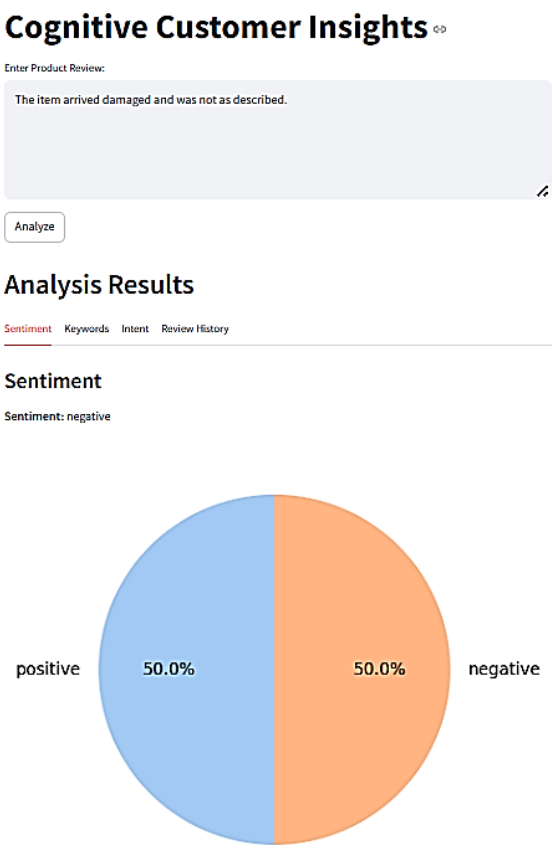

Figure 5: Aggregated Sentiment Distribution Pie Chart for Case 1 and Case 2

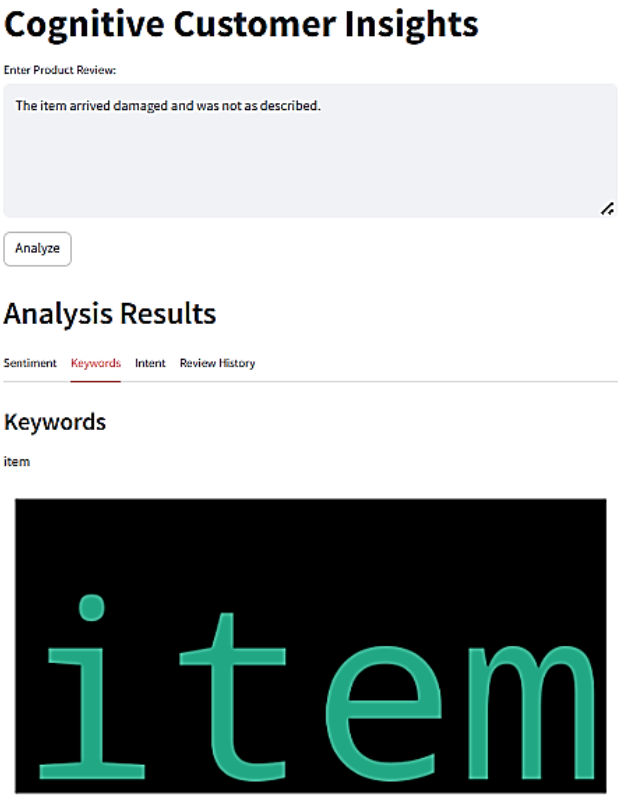

Figure 6: Keyword Extraction for Case 2

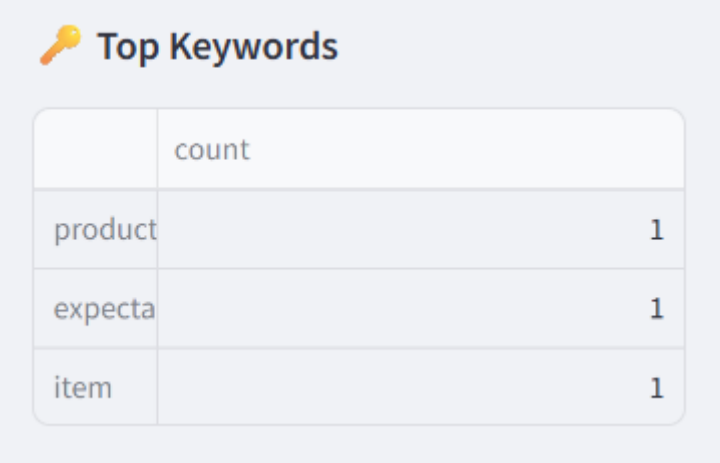

Figure 7 Aggregate Keywords Count After Executing Case 2

Case 3: Neutral Feedback

Product Review Input: "The item arrived damaged and was not as described."

Sentiment Analysis:

Figure 8 presents the sentiment analysis of a neutral customer feedback instance. The accompanying pie chart displays an even distribution of 33.3% across positive, negative, and neutral sentiments, representing the cumulative sentiment outcome after three sequential reviews: one positive, one negative, and one neutral. This proportional representation demonstrates the model's capability to integrate and reflect sentiment trends over time, highlighting its responsiveness to varied emotional tones in ongoing customer feedback.

Keywords Extraction:

Figure 9 displays the keyword cloud generated specifically from the most recent (neutral) review. The cloud highlights the key terms used in that feedback, such as "improvements," which suggest a moderately favorable experience with suggestions for enhancement. These terms provide valuable insight into the specific areas customers believe could be refined. Figure 10 shows the cumulative keyword frequency chart, where the system quantifies recurring keywords across all three inputs. The visualization helps in identifying not only the emotional polarity of words but also recurring themes that can provide actionable insights into customer expectations, concerns, and satisfaction levels.

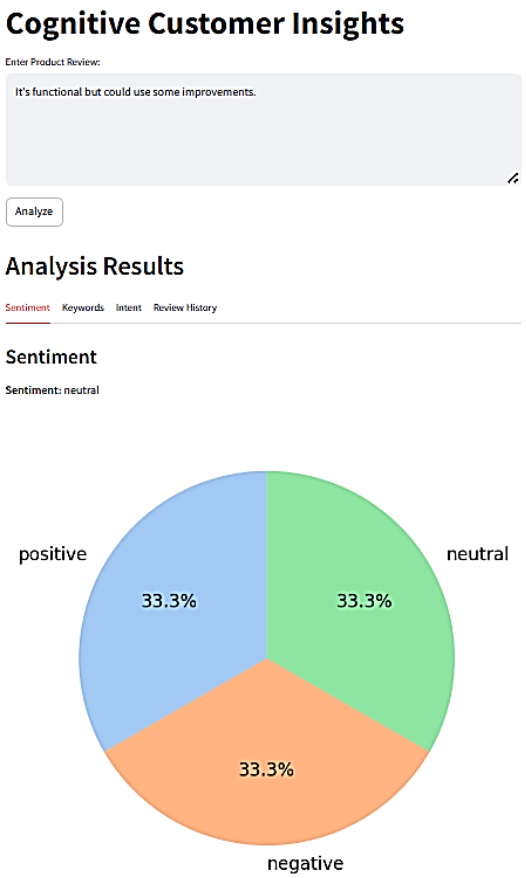

Figure 8: Aggregated Sentiment Distribution Pie Chart for Case 1, Case 2, and Case 3

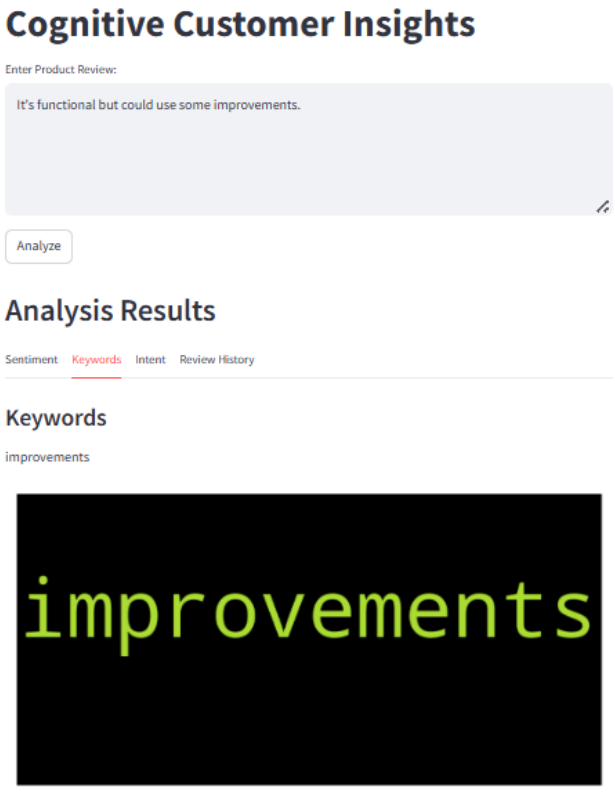

Figure 9: Keyword Extraction for Case 3

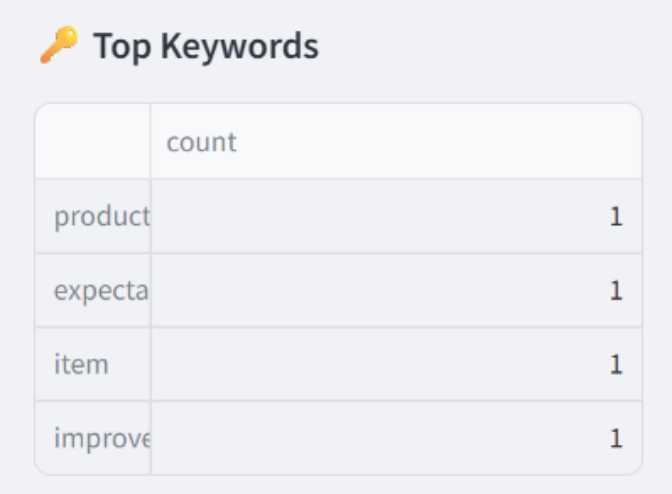

Figure 10 Aggregate Keywords Count After Executing Case 3

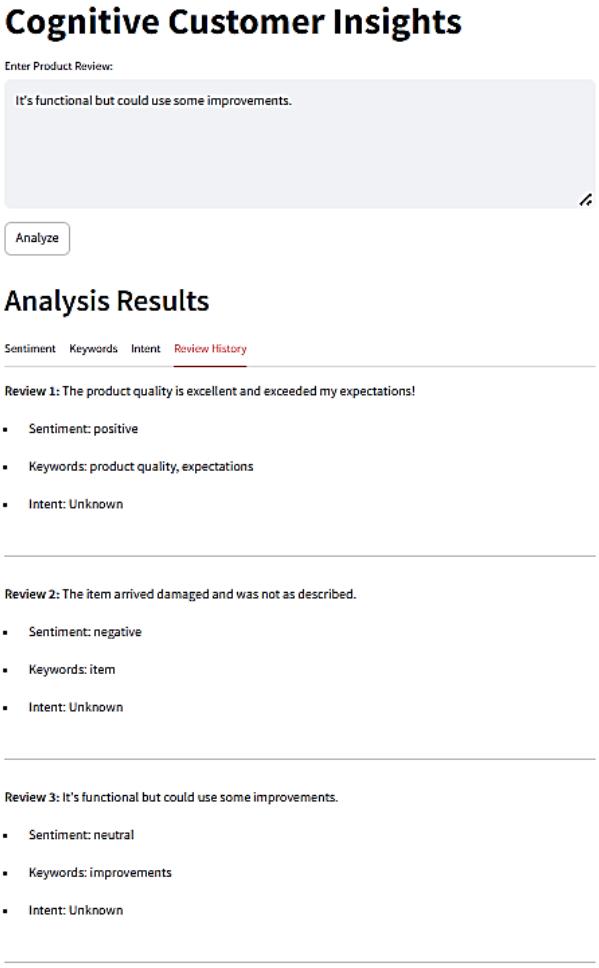

Figure 11 Review History

Figure 11 shows the Review History tab of the Cognitive Customer Insights dashboard displays a chronological summary of previously analyzed product reviews. Each review entry includes extracted sentiment, keywords, and intent derived using natural language processing.