DATA MINING
DSAI 4102

SUCCESS PREDICTION AND RECOMMENDATION SYSTEMS FOR GOOGLE APPS BASED ON RATING AND SENTIMENT DISCREPANCIES

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OUTLINE

1. Introduction
2. Dataset and Preprocessing
3. Exploratory Data Analysis (EDA)
4. Methodology
5. Results, Business Implications and Next Step
6. Conclusion

INTRODUCTION

THE PROBLEM

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Star ratings often don’t match the sentiment in reviews and is is inconsistent with the opinion expressed in the review.

THE REASON

1. Users may give a star rating based on their emotional state
2. Reviews often focus on specific app features while star ratings are meant to represent an overall impression, leading to mismatches.
3. Users may misinterpret the star rating scale, assigning a score that doesn't align with their written opinion

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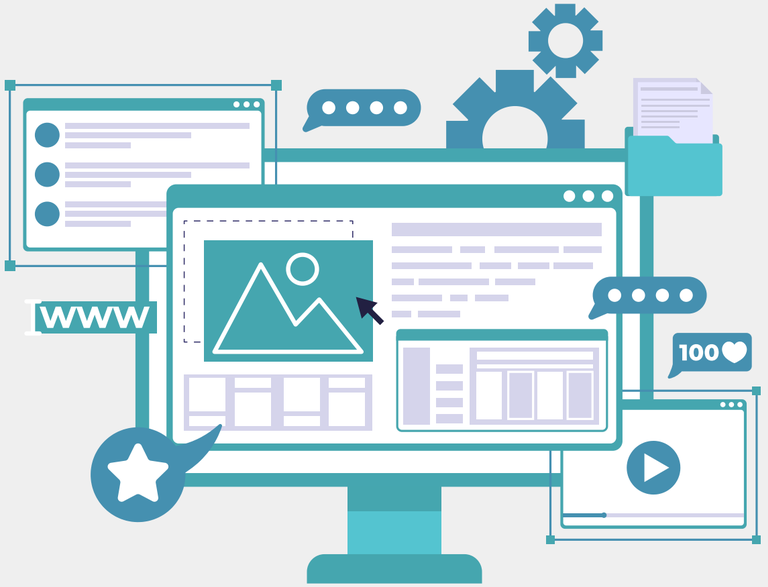
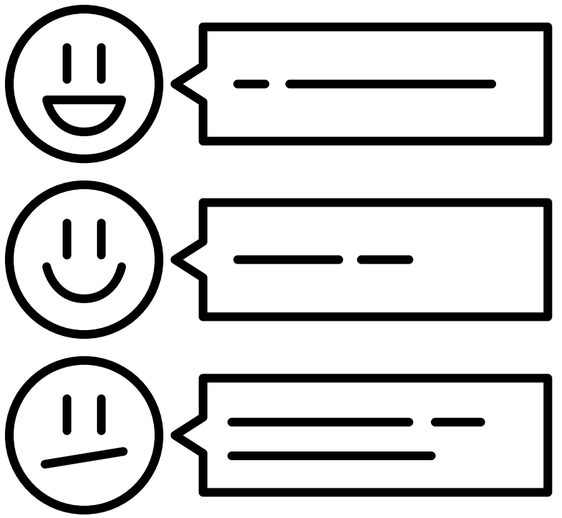


WHY IS THE PROBLEM CRUCIAL?

- Misleading Ratings
- Trust Issues
- Fewer Downloads
- Competition Problems

Additionally, even a few misaligned reviews can significantly lower the average rating, which is especially important for little apps with a few thousand downloads.



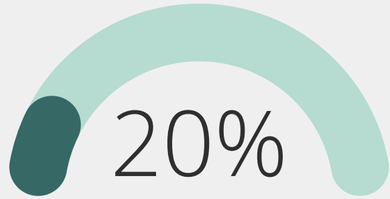
STUDY EXAMPLE

Review	App	Actual Rating	Predicted Rating
I love it. I am addicted to it.	Subway Surfers	1	5
App keeps crashing, reinstalled same thing happens FIX IT ASAP	Facebook	5	1
Love it! New favourite social network!	GooglePlus	1	5
I'm 74 and enjoy it. I can't get friends anymore. Good game	AngryBirds	1	4

Table 10: Sample of mismatched reviews across apps (Automatically identified by the DCNN model)

Aralika□E, R., IBM Research, Sridhara, G., IBM Research, Gantayat, N., IBM Research, Mani, S., & IBM Research. (2018). Fault in your stars: An Analysis of Android App Reviews [Journal-article].

"Fault in Your Stars: An Analysis of Android App Reviews" by IBM Research

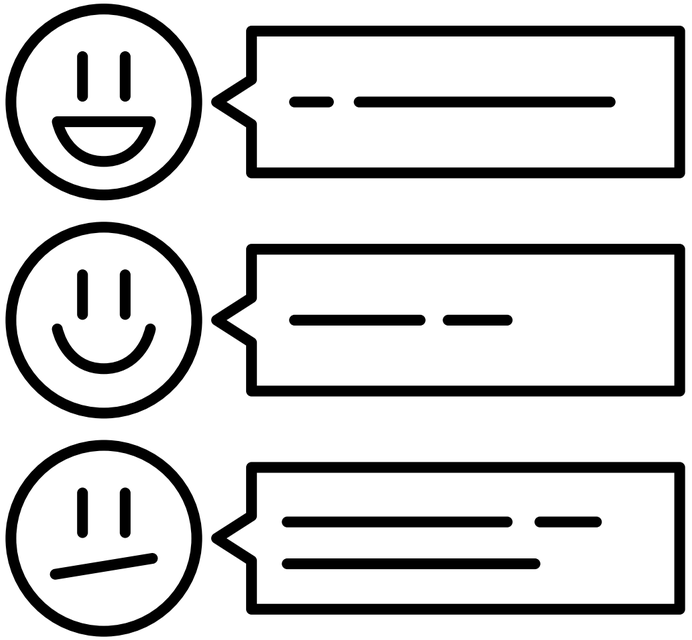


Reviews show discrepancies between ratings and sentiments.

PROJECT OBJECTIVE

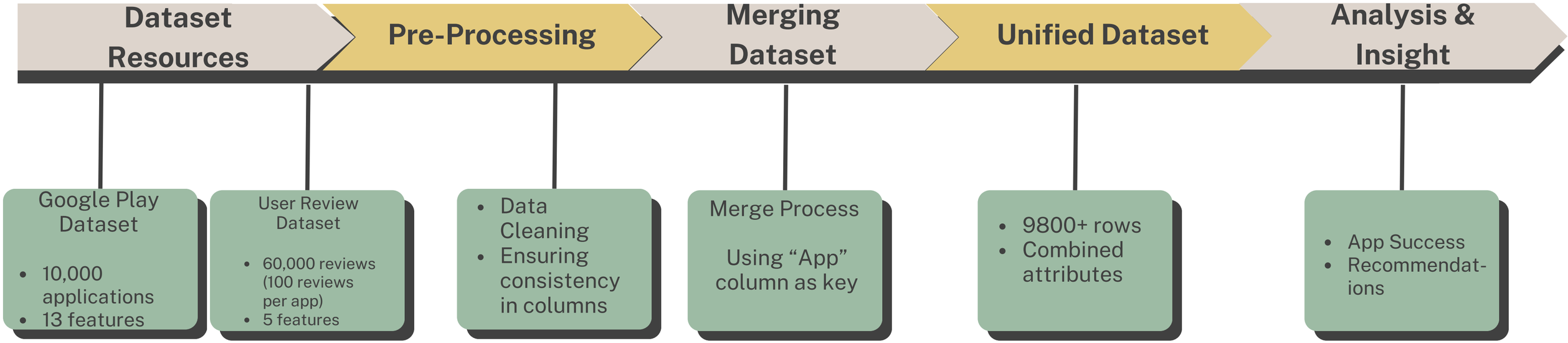
Objectives:

1. Identify successful apps by Investigating rating-sentiment discrepancies.
2. Two Discrepancy-driven strategies:
    - **App Success classification system**
    - **App Recommendation System**



DATASET AND PREPROCESSING

DATASET


Dataset Resources
Pre-Processing
Merging Dataset
Unified Dataset
Analysis & Insight
Google Play Dataset
10,000 applications
13 features
User Review Dataset
60,000 reviews (100 reviews per app)
5 features
Data Cleaning
Ensuring consistency in columns
Merge Process
Using “App” column as key
9800+ rows
Combined attributes
App Success
Recommendat-ions

DATA PREPROCESSSING

- Missing values
- Redundancies, and irrelevant attributes
- Noise, such as special characters, was removed
- Imbalance was handled using SMOTEENN
- Numerical features like *Size* and *Price* were normalized

FEATURE ENGINEERING

SENTIMENT RATING

DISCREPANCY

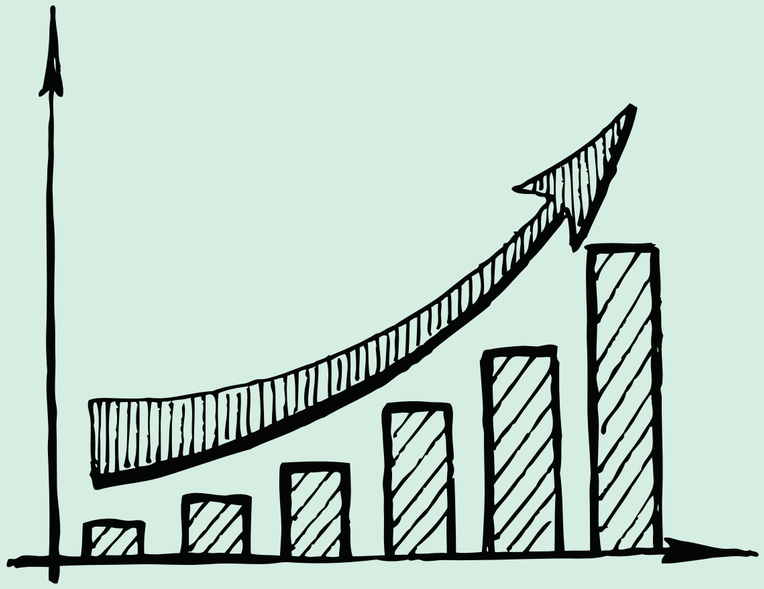
USER ENGAGEMENT

SUCCESS CATEGORY

FINAL DATASET

No.	Features	Description
1	App	Name of the application.
2	Category	The category the app belongs to (e.g., GAME, TOOLS).
3	Rating	Overall user rating of the app (1 to 5).
4	Reviews	Number of user reviews submitted for the app
5	Size	Size of the app in MB.
6	Installs	Number of users downloads or installs for the app
7	Type	Indicates whether the app is Paid or Free
8	Price	Cost of the app (in USD).
9	Content_Rating	Age group the app is targeted at (e.g., Everyone, Mature 21+, Adults)
10	Last_Updated	Date the app was last updated on the Play Store
11	Average_Sentiment_Rating	Average sentiment score for the app based on user reviews, rescaled to align with star ratings
12	Discrepancy	Difference between the star rating and sentiment rating, highlighting user feedback alignment.
13	User_Engagement	Measure of user activity based on reviews and installs interaction
14	Success Category	Categorization of app success as *Successful*, *Moderately Successful*, or *Unsuccessful*.

EXPLORATORY DATA ANALYSIS (EDA)



EXPLORATORY DATA ANALYSIS

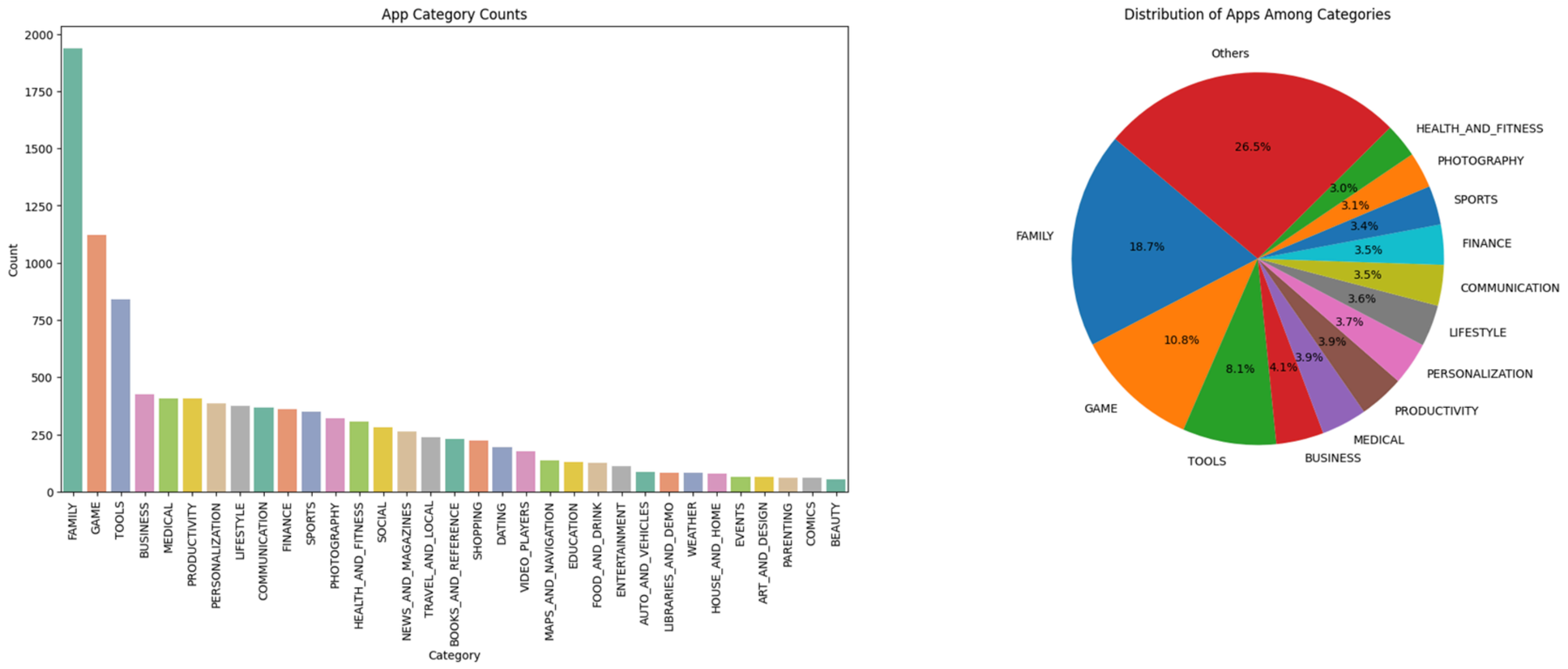


Figure 1 : Distribution of apps across different categories on the Google Play Store.

EXPLORATORY DATA ANALYSIS

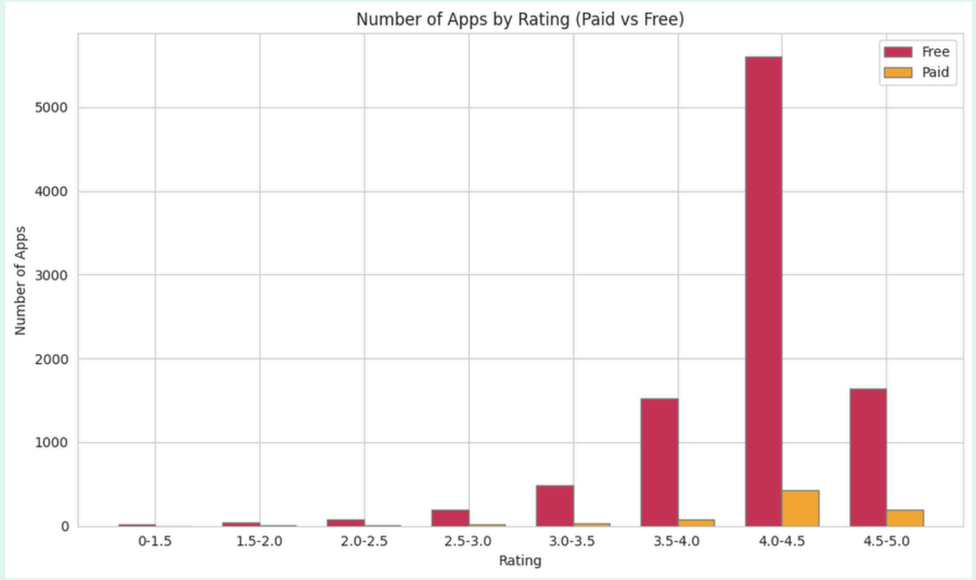


Figure 2 : Type Vs Rating

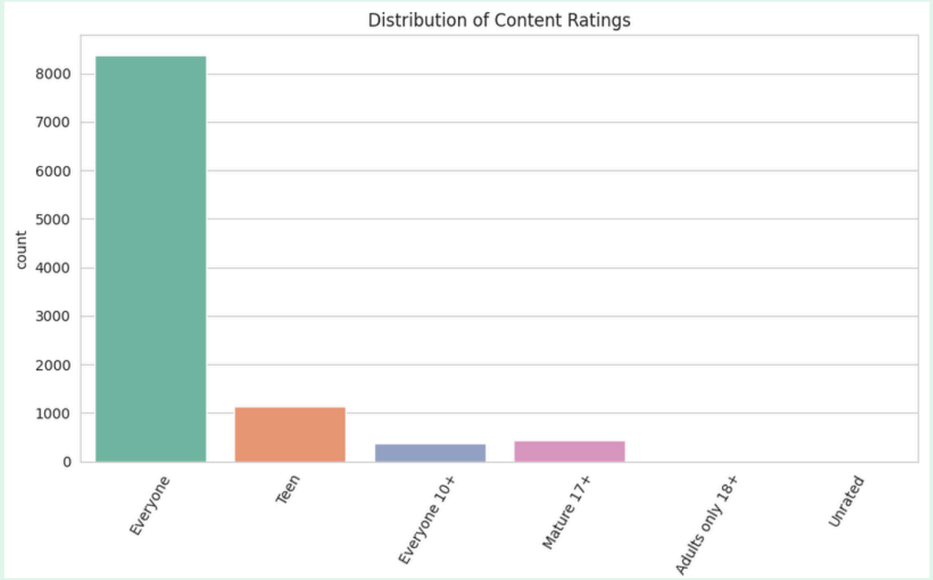


Figure 3 : Distribution of Content Rating

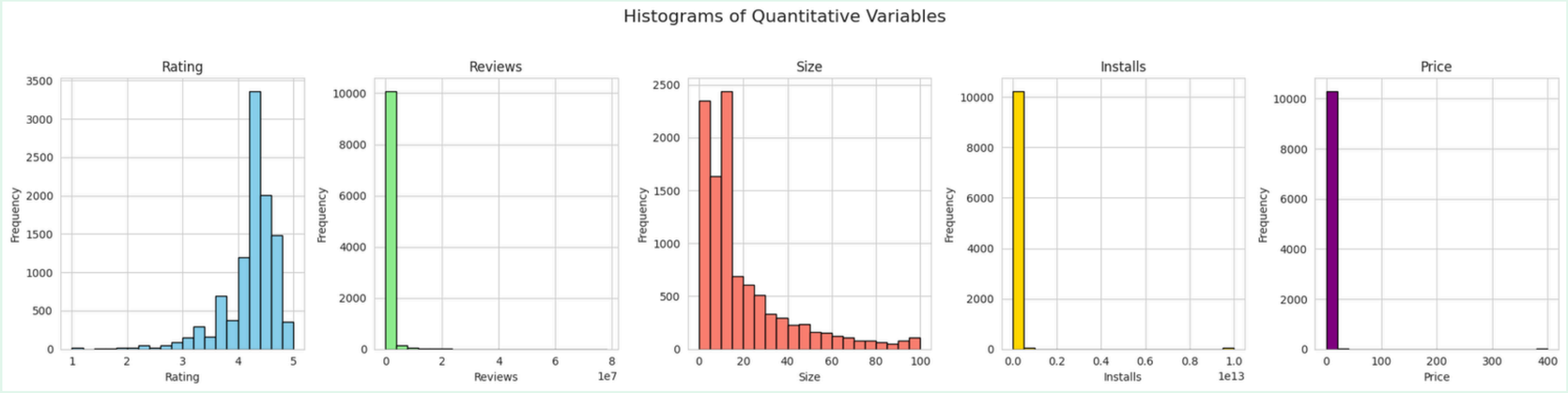


Figure 4 : Distribution of Quantitative Features

EXPLORATORY DATA ANALYSIS

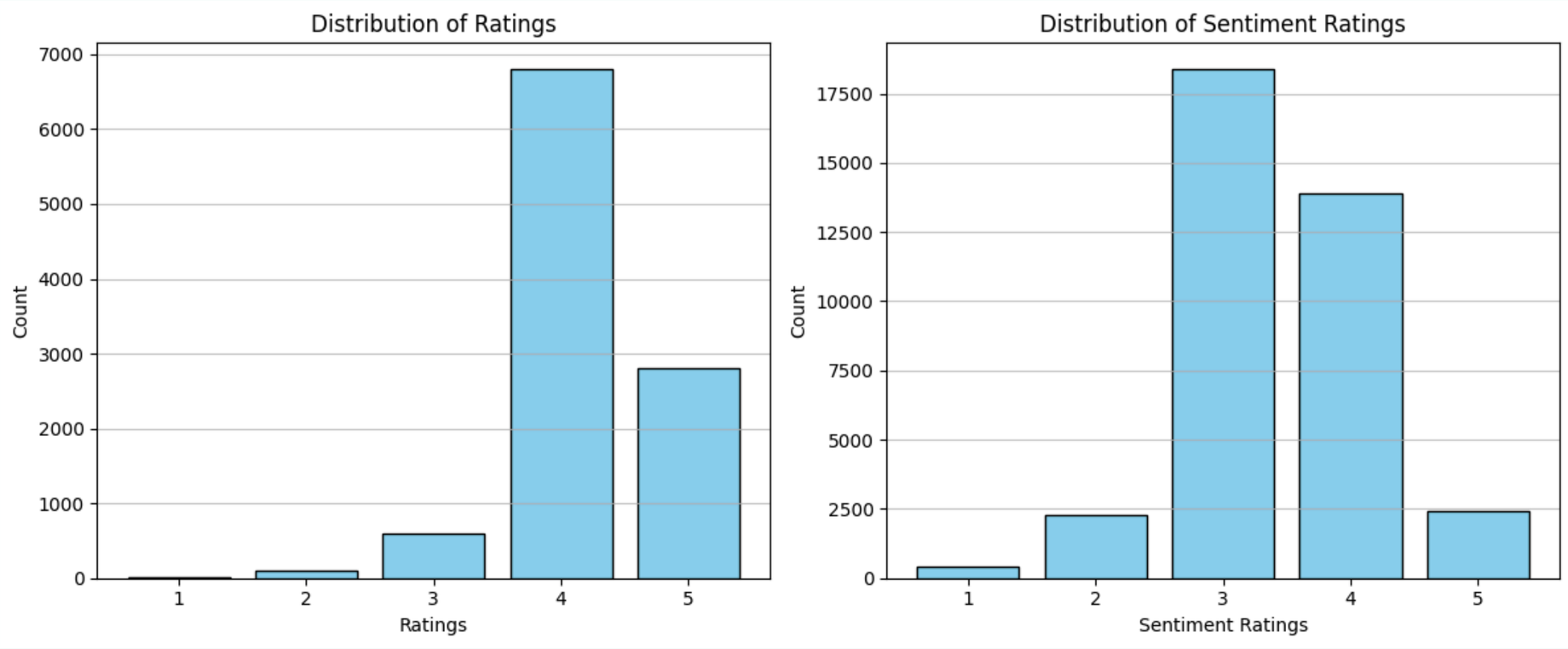


Figure 5: *Numeric Ratings and Sentiment Ratings* Discrepancy

EXPLORATORY DATA ANALYSIS

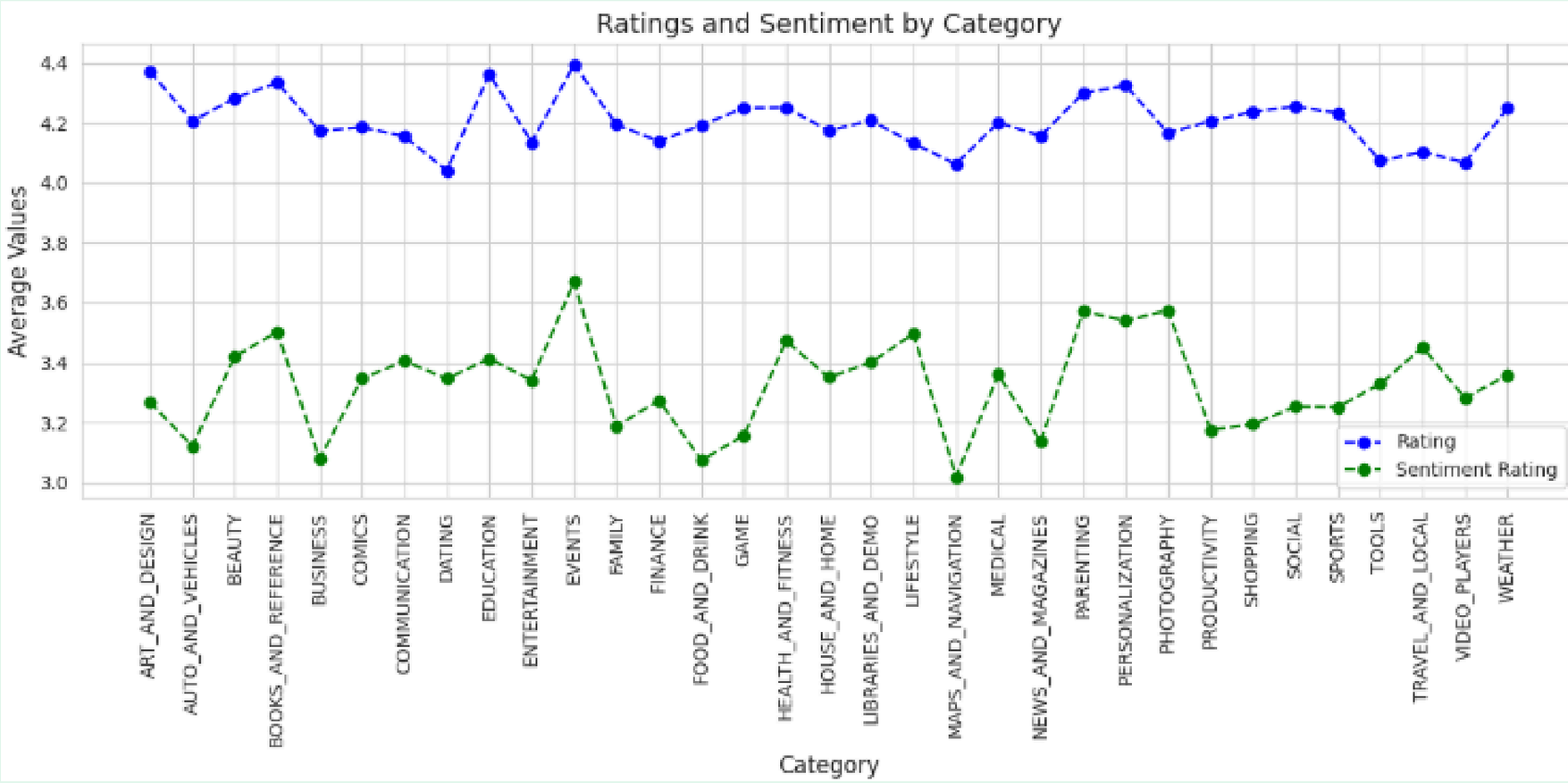
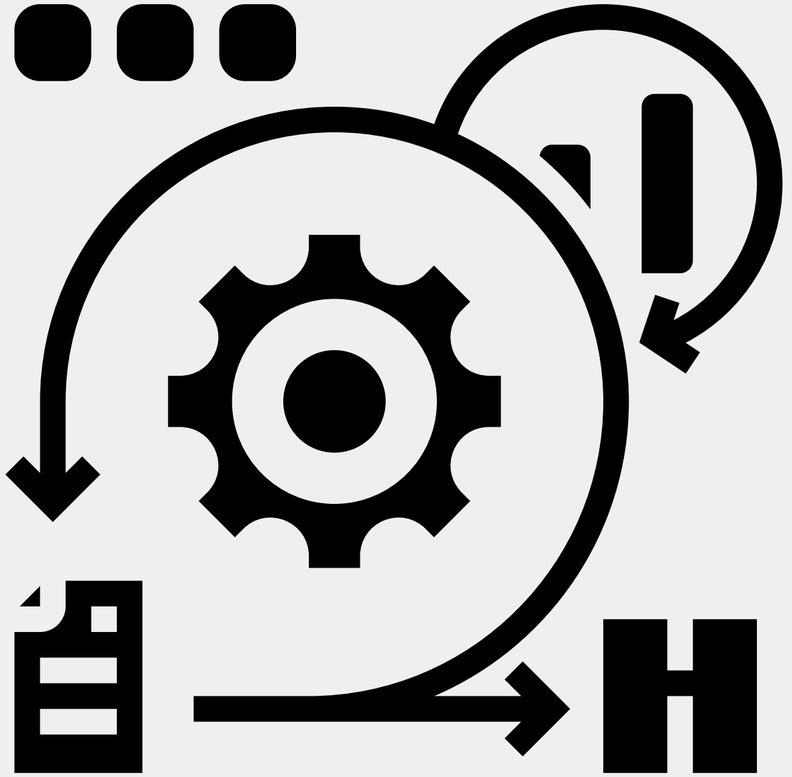


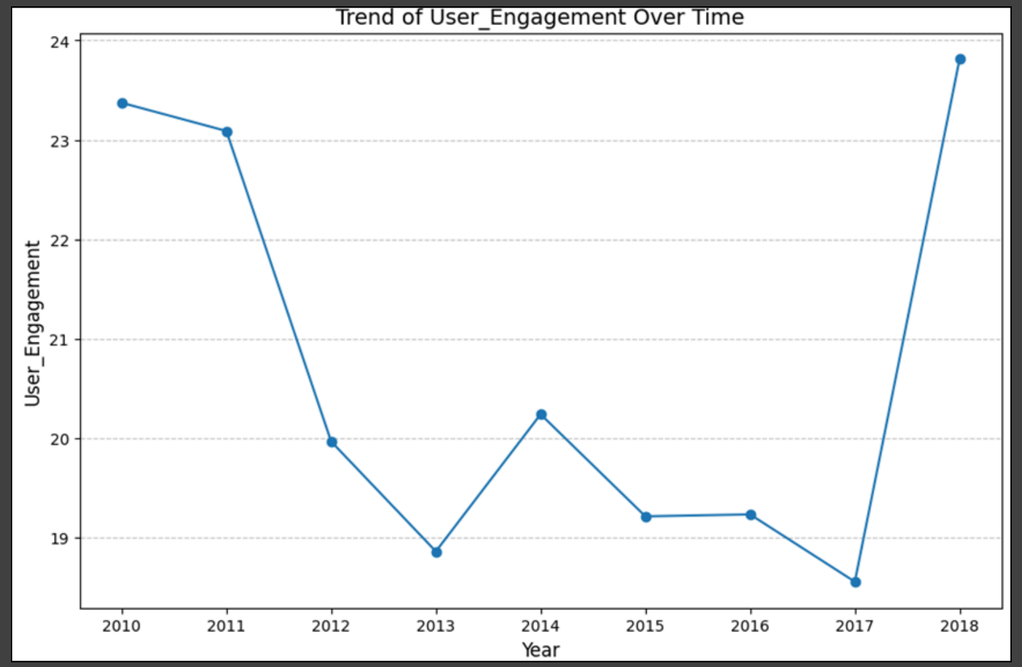
Figure 6 : Average Ratings and Sentiment by Category

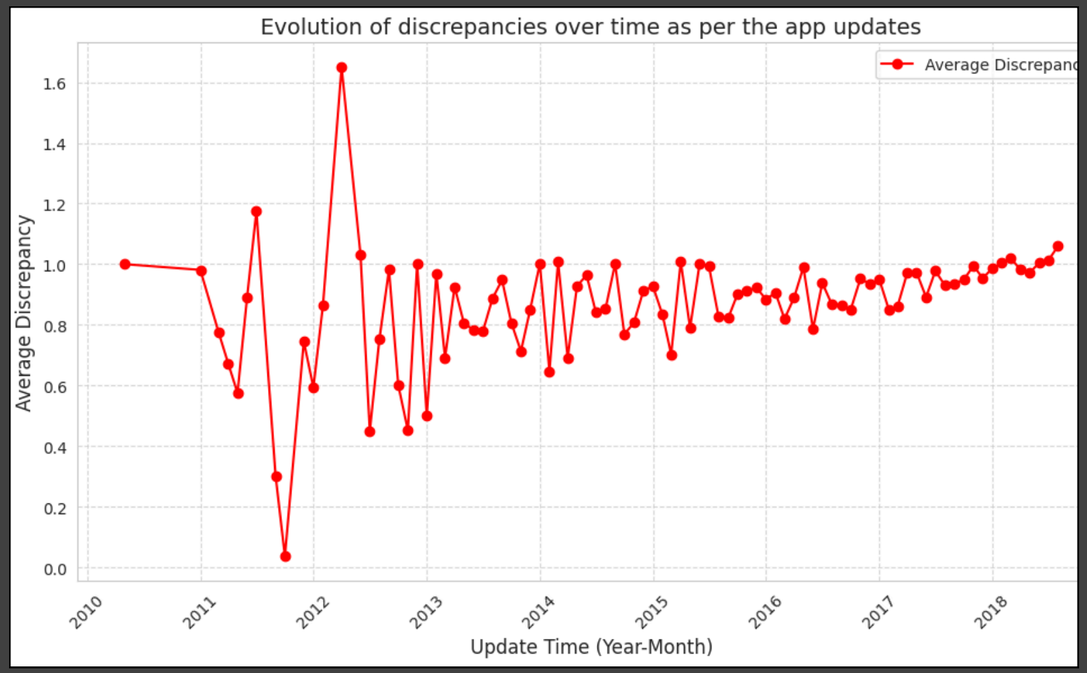
METHODOLOGY AND RESULTS



TARGET VARIABLE: SUCCESS CATEGORY

Key Features Utilized: User Engagement, Discrepancy, Last Updated





Key Insights:

- Higher user engagement leads to better ratings and app quality.
- Frequent updates reduce rating-sentiment gaps, improving app success.

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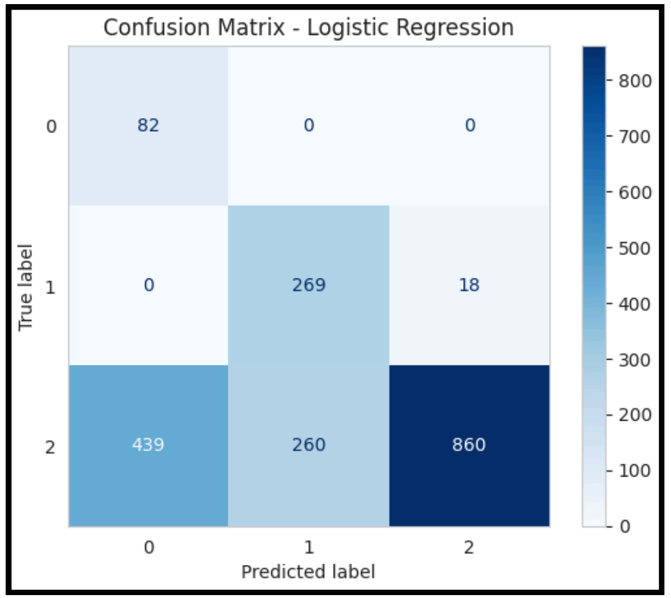
- [Vijayanarayanan A]. (2023). Google Play Store Reviews Prediction Using ML and NLP.

APP SUCCESS CLASSIFICATION

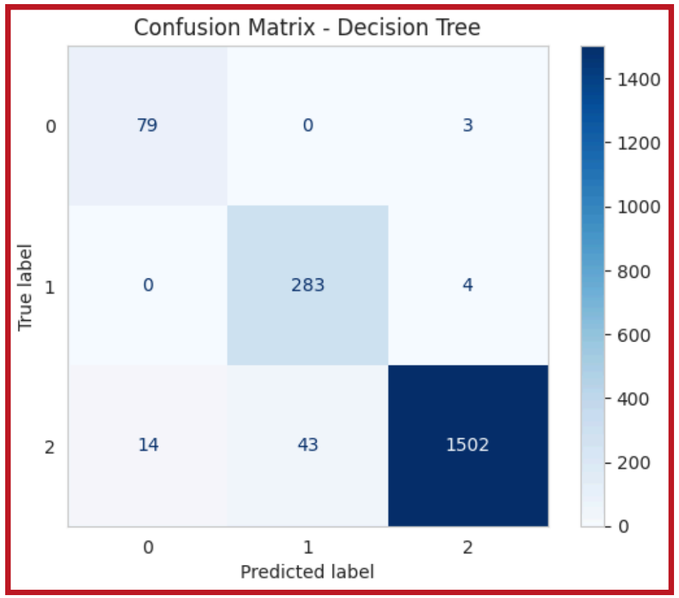
Baseline: Logistic Regression

Accuracy: 61.24
F1-Score: 66.95



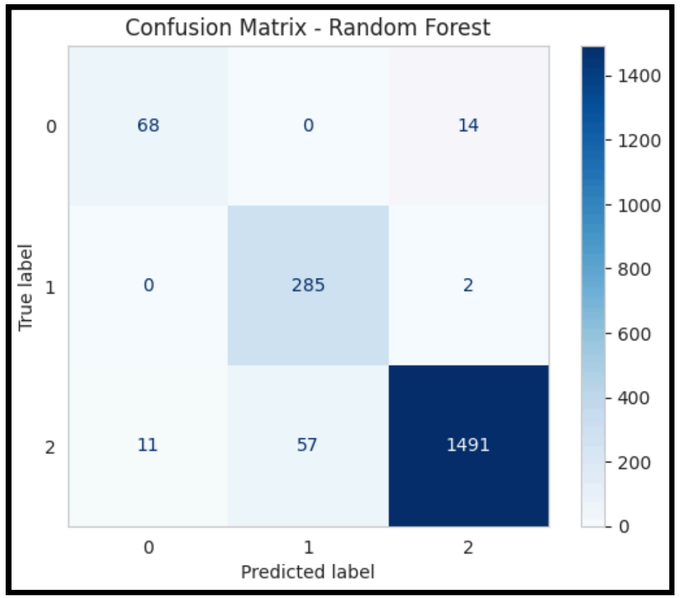
Medium-Complexity: Decision Tree

Accuracy: 96.68
F1-Score: 96.76



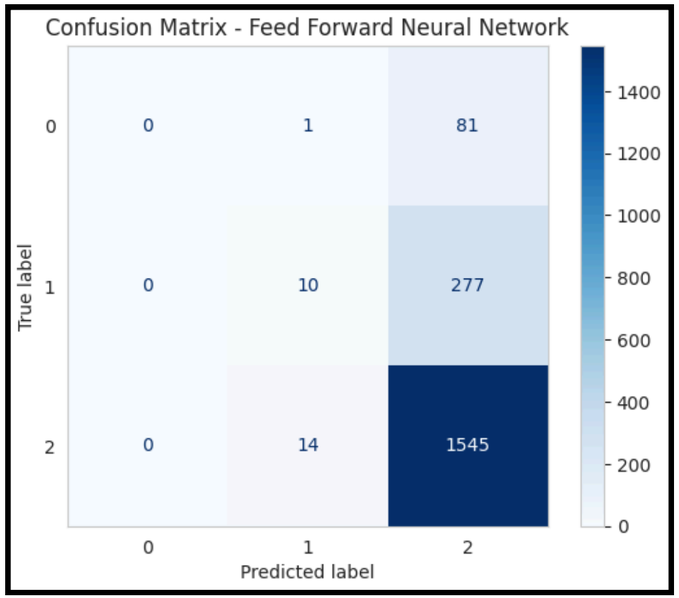
Medium-Complexity: Random Forest

Accuracy: 95.64
F1-Score: 95.73



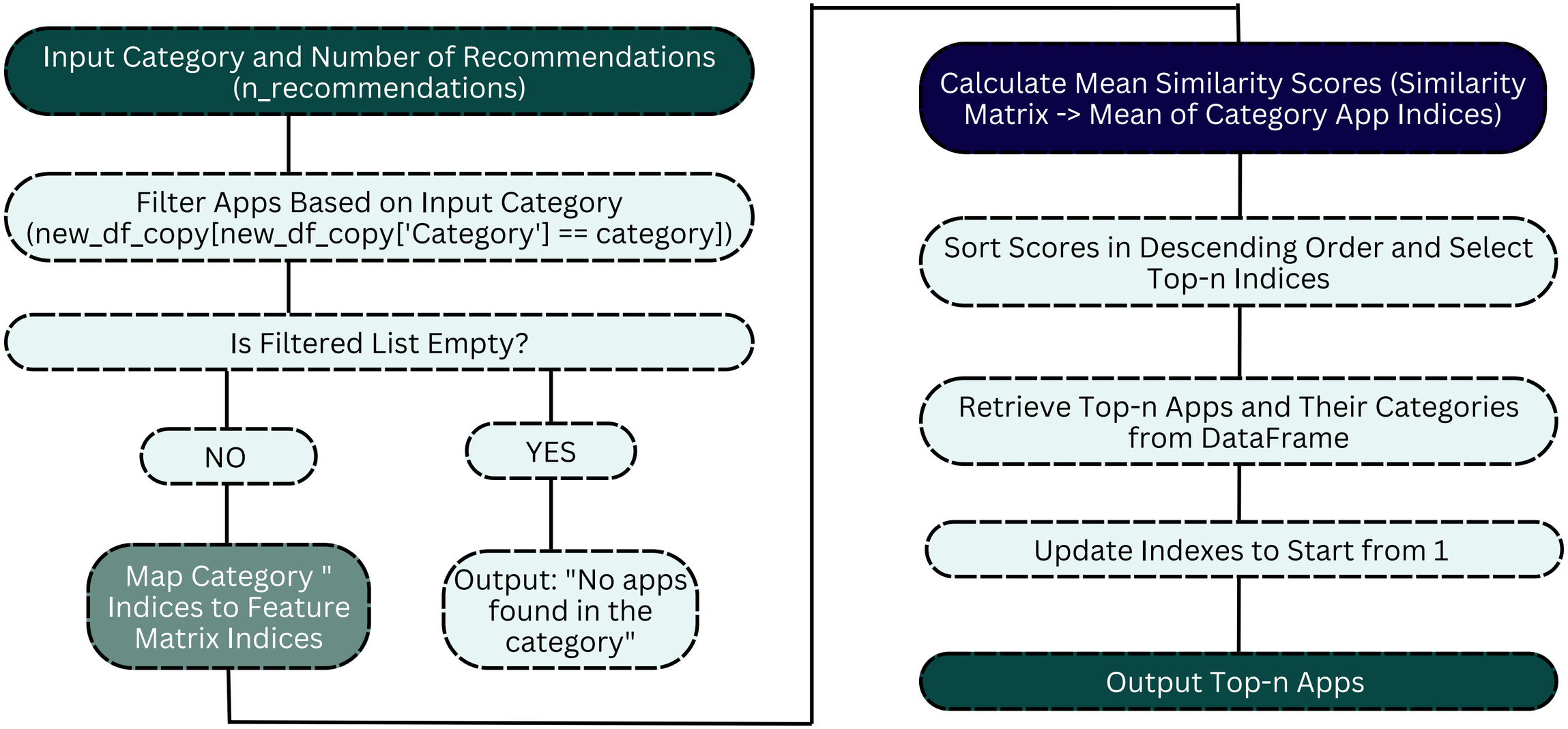
Highly Complex: FNN with hyper-parameters tuning

Accuracy: 80.6
F1-Score: 73.1



RECOMMENDATION SYSTEM - CONTENT BASED

Recommending top apps based on app category and discrepancy threshold



WEB INTERFACE FOR APP

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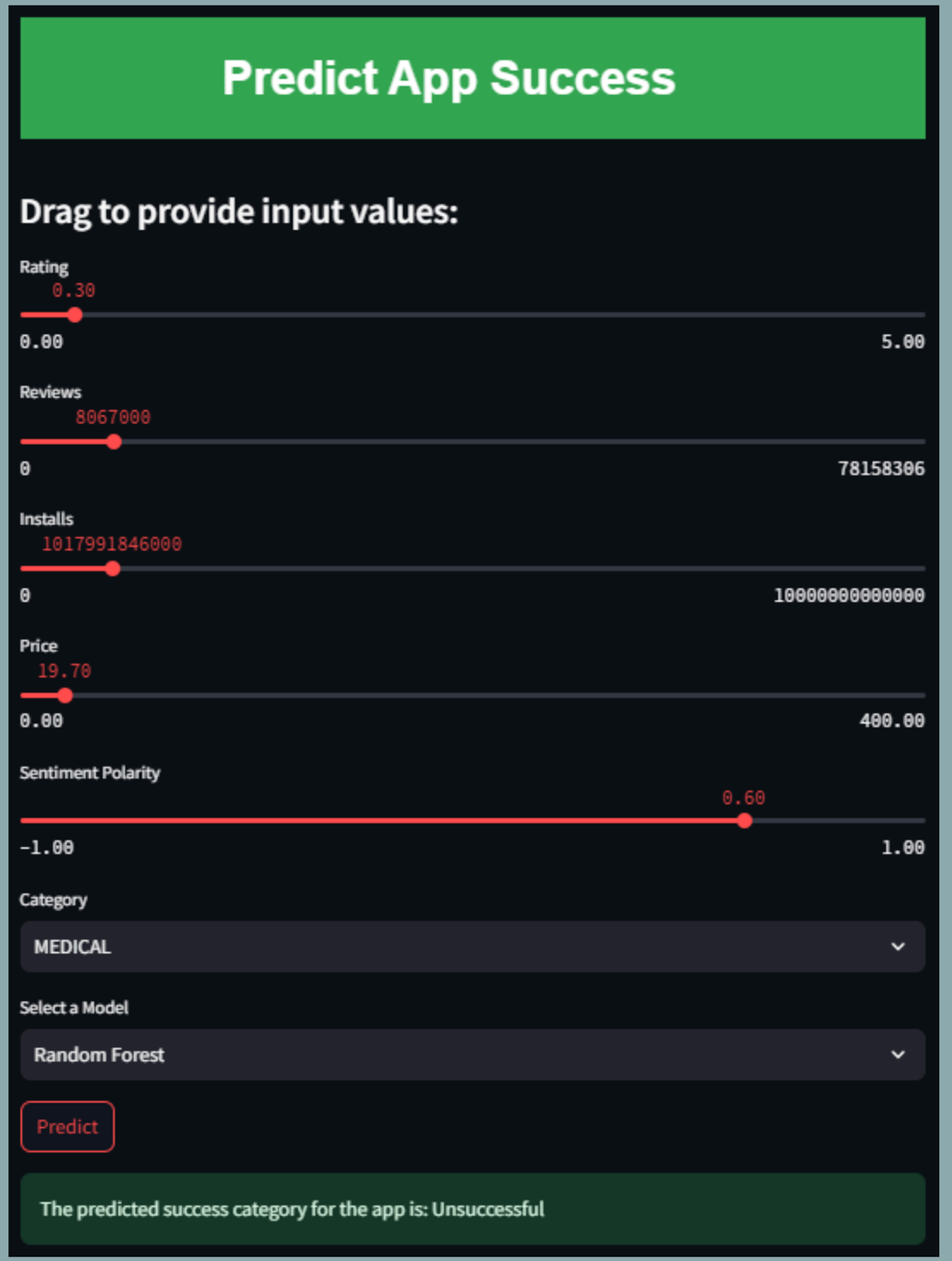

WEB INTERFACE FOR APP

App Recommendation

Get recommendations for Successful apps:

Select a Category

TRAVEL_AND_LOCAL

Number of Recommendations

4

Set Maximum Discrepancy Threshold

0.15

0.00 1.00

Get Recommendations

Here are your recommended apps:

	App	Category	Discrepancy
1	Foursquare Swarm: Check In	TRAVEL_AND_LOCAL	0.1029
2	Find Dining Restaurant Finder	TRAVEL_AND_LOCAL	0.1348
3	Google Trips - Travel Planner	TRAVEL_AND_LOCAL	0.1471
4	Fly Delta	TRAVEL_AND_LOCAL	0.1103

KEY FINDINGS, BUSINESS IMPLICATIONS AND NEXT STEP

FINDINGS

Model Performance

Best Success Prediction Model

- Random Forest - accuracy (95.64%) and F1 score (95.73%)
- Decision Tree - accuracy (96.68%)

The "Success Category" framework aligns user engagement with sentiment feedback for structured app evaluation.

Recommendation System

- Sentiment-driven content-based filtering
- Weighted features like Ratings, Sentiment Polarity, Discrepancy, and User Engagement
- Better discovery of high-performing apps within user-defined categories

BUSINESS IMPLICATIONS & NEXT STEPS

Business Implications:

- Enhancing User Satisfaction
- Strategic Decision-Making
- Revenue Growth
- Market Competitiveness

Next Steps:

- Enhancing Research Opportunities
- Industry Application
- Developer Tools and Innovations

CONCLUSION

Problem:

- Challenges mobile app marketplace faces.
- Misalignment in app recommendations reduces user satisfaction.

Solution:

- Sentiment-driven machine learning models
- Success Category framework for improved recommendation

Highlights:

- Discrepancies: Identified how misalignment affects application success
- Model Performance: Random Forest and Decision Tree outperformed others
- Key Features: Recent updates strongly correlates to discrepancy, impacting app success
- App success categorization: Successful, Moderately successful and Unsuccessful

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THANK YOU