Group one: NLP Task

Non-Technical Report

Introduction

This is a sentiment analysis project designed to automatically understand and categorize customer sentiment from written feedback into Positive, Negative, No Emotion, or Unclear categories.

Objectives

Measure public opinion of its products or services.

Identify negative feedback early to improve on customer experience.

Support `marketing and product strategy decisions` based on data-driven insights.

Method Summary

Several machine learning models were trained on thousands of labeled text samples using different balancing and feature extraction methods.

Key Steps:

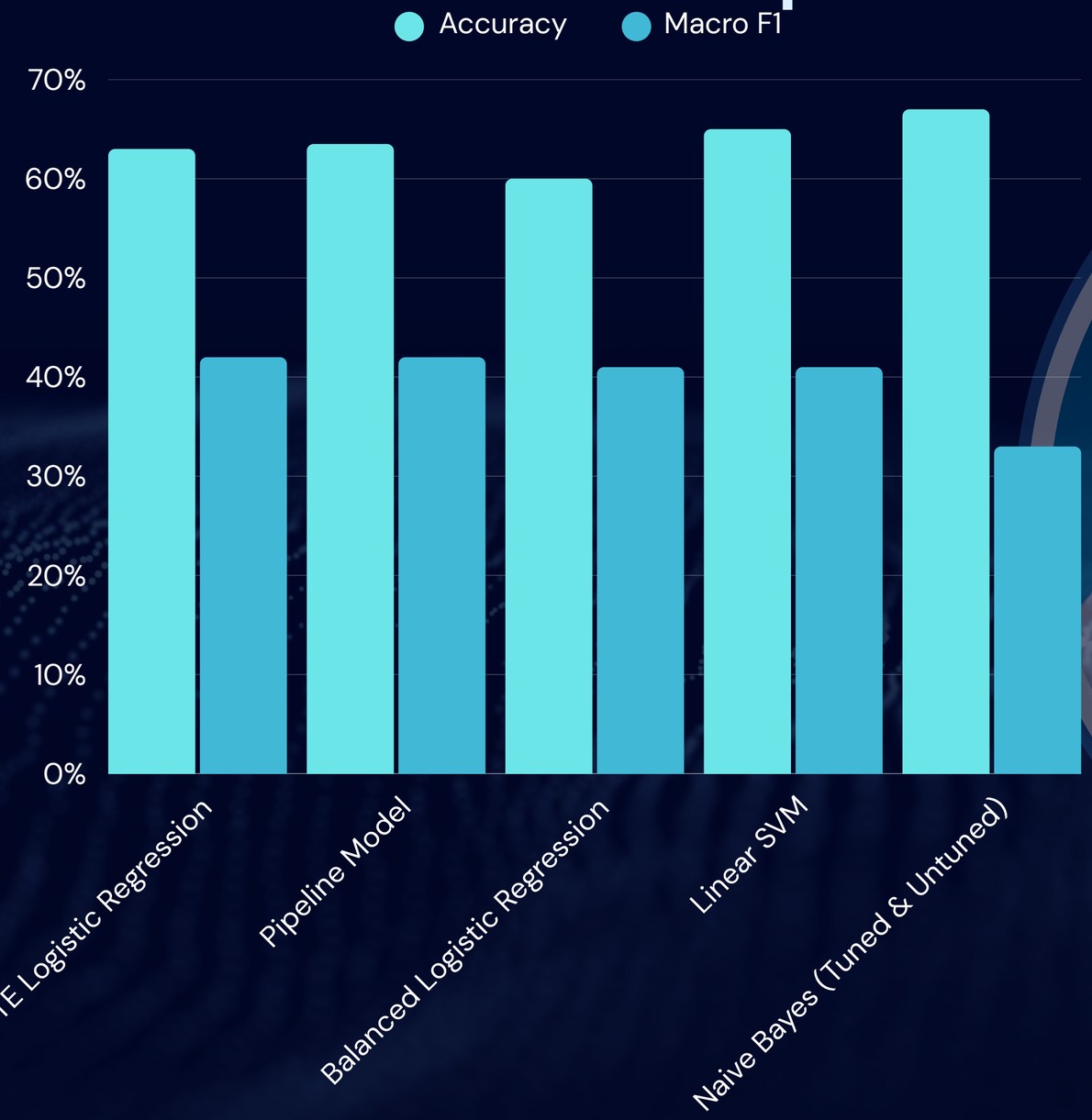
Data Preprocessing: cleaning and converting text into numeric form using TF-IDF.

Model Training : testing multiple algorithms including Logistic Regression, Naive Bayes, and Support Vector Machines.

Optimization: applied data balancing (SMOTE) and pipeline automation for consistency and reproducibility.

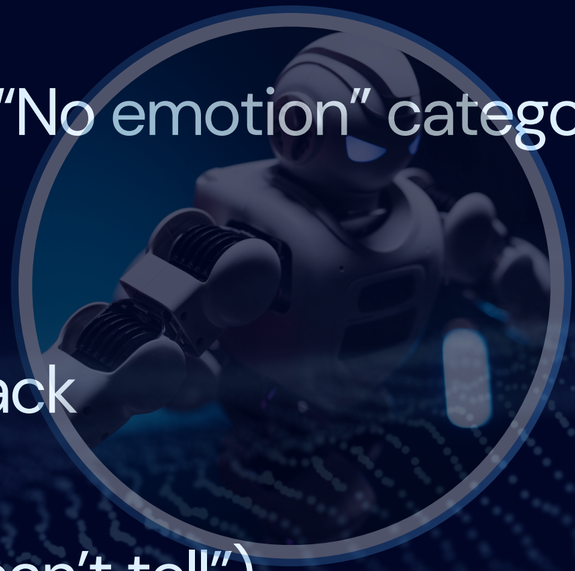
Performance Evaluation: measuring Accuracy and Macro F1-score to assess overall and balanced performance.

Model perfomances



Key Findings and Insights:

- Model Balance: SMOTE and Logistic Regression improved fairness by helping the model learn from rare emotions.
- Dominant Class Bias: Models tended to favor the “No emotion” category, indicating dataset imbalance.
- Emotion Detection Strength:
  - High accuracy for Neutral and Positive feedback
  - Moderate success with Negative feedback
  - Weak recognition of Uncertain responses (“I can’t tell”)
- Pipeline Efficiency: Simplified end-to-end process, ensuring consistent preprocessing and easier deployment.



The Final Recommendation

After careful analysis, we recommend deploying the Pipeline Model.

This is the right choice for our business because:

1. It Builds Trust: Its "Negative" alerts are more reliable. When we task our team to follow up on a complaint, they can be more confident it's a real issue, not a false alarm. This improves efficiency.
2. It's the Most Correct Overall: It has the highest overall accuracy, meaning we can trust its judgments across all sentiment types more than any other model.
3. It Strikes the Perfect Balance: It maintains an excellent balance between finding important feedback (recall) and being accurate about it (precision).