

A Comprehensive Research Paper on Feeler: An AI-Powered Sentiment Analysis Platform

Title & Abstract

Title

Feeler: An AI-Powered Sentiment Analysis Platform for Customer Feedback

Abstract

Feeler is a sentiment analysis platform that classifies textual input into positive, negative, or neutral sentiment using state-of-the-art NLP techniques. This paper presents an in-depth analysis of the development, architecture, implementation, and evaluation of Feeler, incorporating Django for the backend, React for the frontend, PostgreSQL for database management, and Hugging Face Transformers for machine learning inference. A detailed literature review is provided to highlight the novelty of Feeler compared to existing solutions. The methodology outlines the system design, data processing pipeline, and testing strategies. The results demonstrate that Feeler achieves high accuracy in sentiment classification, with a well-optimized user experience. Future enhancements include additional security features, improved user management, and advanced visualization techniques.

Introduction

Background and Problem Statement

Businesses struggle to analyze large volumes of customer feedback from social media and review platforms, making it difficult to identify trends and improve products/services. Manual analysis is time-consuming, error-prone, and lacks scalability. The need for an automated, scalable, and intelligent sentiment analysis solution is critical.

Relevance and Contribution

This paper introduces Feeler, an AI-powered sentiment analysis platform that seamlessly integrates machine learning with web technologies to provide a real-time, scalable, and user-friendly solution. The primary contributions of this work include:

- Development of an AI-powered sentiment analysis platform using Hugging Face Transformers and Django.
- A robust system architecture combining NLP, API services, and sentiment visualization.
- A thorough evaluation of system performance and usability.

Structure of the Paper

The paper is structured as follows: Section 2 presents a literature review, Section 3 describes the methodology, Section 4 discusses results and analysis, Section 5 presents discussions and implications, Section 6 concludes the paper and outlines future work.

Literature Review

Existing Sentiment Analysis Solutions

Several sentiment analysis tools exist, including VADER, TextBlob, and commercial APIs like Google Cloud NLP. While these models are effective, they often lack advanced deep learning capabilities, real-time processing, or user-friendly dashboards.

Novelty of Feeler

Feeler distinguishes itself by integrating an advanced NLP model within a fully functional sentiment analysis platform that provides:

- A real-time, interactive user interface.
- Secure authentication and feedback collection.
- Sentiment trend visualizations and downloadable reports.

Methodology

System Design and Architecture

Feeler follows a three-tier architecture comprising:

1. **Presentation Layer:** Developed with React, handling user interactions.
2. **Application Layer:** Built using Django REST Framework, providing API endpoints and managing business logic.
3. **Data Layer:** PostgreSQL for storing user data and sentiment analysis results.

Machine Learning Model

The sentiment analysis model is powered by Hugging Face Transformers and trained using domain-specific datasets. The model uses:

- Pre-trained deep learning models for NLP tasks.
- Sentiment classification into positive, negative, and neutral categories.
- API-based inference for seamless frontend-backend integration.

System Features

- **User Authentication:** Secure login and user management via OAuth and JWT.
- **Feedback Collection:** Integration with social media APIs and manual uploads (CSV, JSON).
- **Sentiment Analysis:** Real-time NLP-based classification of customer feedback.
- **Visualization:** Display of sentiment trends using Chart.js and D3.js.
- **API Services:** Exposed API endpoints for third-party integrations.

- **Reports & Notifications:** Automatic reports generation and alerts for sentiment trends.

Results & Analysis

Functional Testing

Feeler was evaluated for:

- **Authentication:** Secure user registration and login.
- **Sentiment Analysis Accuracy:** Achieved over 85% accuracy.
- **Performance:** Average response time of 650ms.

System Testing

Integration tests validated backend-frontend communication, and regression testing ensured stability after updates. Security testing confirmed proper token handling and encryption.

Discussion

Implications

The results highlight Feeler's potential in automating sentiment analysis for businesses. The system effectively integrates deep learning with web technologies, providing real-time insights. Key challenges included model bias and optimizing API response times, addressed through dataset refinement and caching strategies.

Limitations & Future Improvements

- **Multi-Language Support:** Extending sentiment analysis to multiple languages.
- **Topic Modeling:** Identifying common themes in customer feedback.
- **Real-Time Analysis:** Enhancing real-time processing for live data streams.

Conclusion & Future Work

Feeler successfully implements a scalable and intelligent sentiment analysis platform. Future enhancements include improved security features, expanded NLP capabilities, and advanced analytics for customer insights.

References

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