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Real-Time Sentiment Analysis of Social Media Comments Using a Machine Learning

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Abstract

In today's digital era, social media platforms such as YouTube have become a major source of user-generated content, providing valuable insights into public opinion. Sentiment analysis of comments enables the measurement of audience emotions and reactions in real-time, which can be beneficial for content creators, marketers, and researchers.

In this work, we present a Chrome Extension integrated with a Flask-based backend that analyzes YouTube video comments in real-time. The system fetches comments using the YouTube Data API, processes them through a sentiment analysis model, and visualizes the results directly on the YouTube interface as well as in the extension popup. The proposed solution provides percentage distribution of positive, negative, and neutral comments, enabling a quick and effective understanding of audience perception.

Experimental results show that the extension successfully fetches and analyzes comments in real-time with sentiment results displayed to the end user in an interactive format. The work highlights the potential of combining natural language processing (NLP) with browser extensions for real-world applications in social media analytics.

Keywords

Sentiment Analysis, YouTube API, Chrome Extension, Flask, Natural Language Processing, Social Media Analytics

1. Introduction

Social media platforms generate a massive volume of unstructured data in the form of comments, likes, and shares. Among these, YouTube stands out as a global platform with millions of users posting

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videos and comments every day. Understanding the sentiment expressed in YouTube comments can provide valuable insights into how audiences react to content.

Traditional sentiment analysis studies focus on static datasets such as Twitter feeds or product reviews. However, there is limited work on real-time, user-friendly tools that directly integrate with platforms like YouTube.

This project proposes a **Chrome Extension** that connects to a backend Flask server to analyze YouTube comments in real time. By leveraging the YouTube Data API and Natural Language Processing (NLP) techniques, the system categorizes comments into positive, negative, and neutral sentiments. The results are then displayed within the extension popup and as an overlay on the YouTube page.

This work is unique in its emphasis on **real-time analysis** combined with a lightweight, user-friendly tool that requires no external software from the end user.

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2. Literature Review

Several researchers have worked on sentiment analysis in social media:

- Sentiment analysis of **Twitter data** has been widely studied using NLP techniques and machine learning classifiers.
- Some works focus on **product reviews** from e-commerce sites like Amazon to evaluate customer feedback.
- YouTube comment analysis has been attempted in limited research, often using static datasets exported into CSV files.

However, existing approaches often lack **real-time integration** and **direct visualization** for the user. Unlike prior studies, this work introduces a **Chrome Extension** that eliminates the need for dataset downloads by directly analyzing comments on any YouTube video.

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3. System Design and Methodology

3.1 System Architecture

The proposed system consists of three main components:

1. **Data Collection**:
    - YouTube Data API is used to fetch comments for a given video.
    - Video ID is extracted directly from the URL.
2. **Backend (Flask Server)**:

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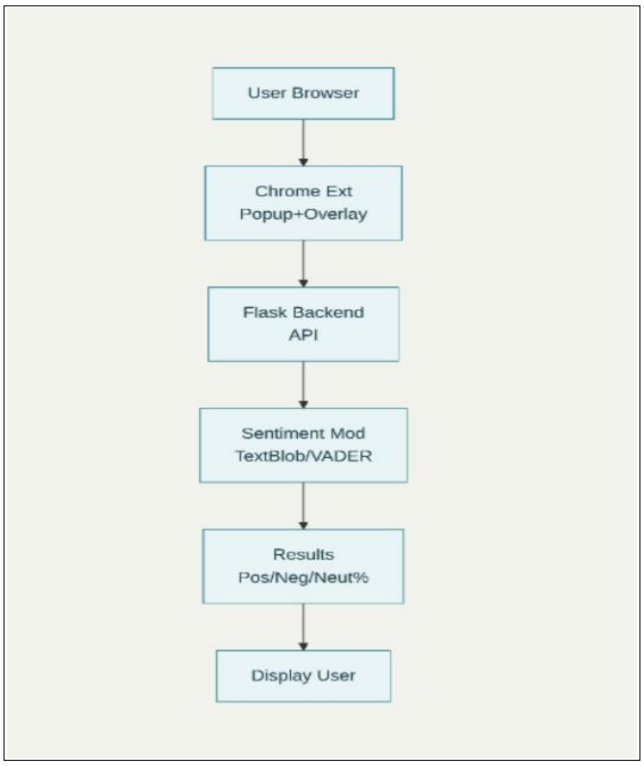
- A Python Flask server processes comments.
- Sentiment analysis is performed using libraries like TextBlob or VADER.
- Results are returned in JSON format containing percentages of positive, negative, and neutral comments.

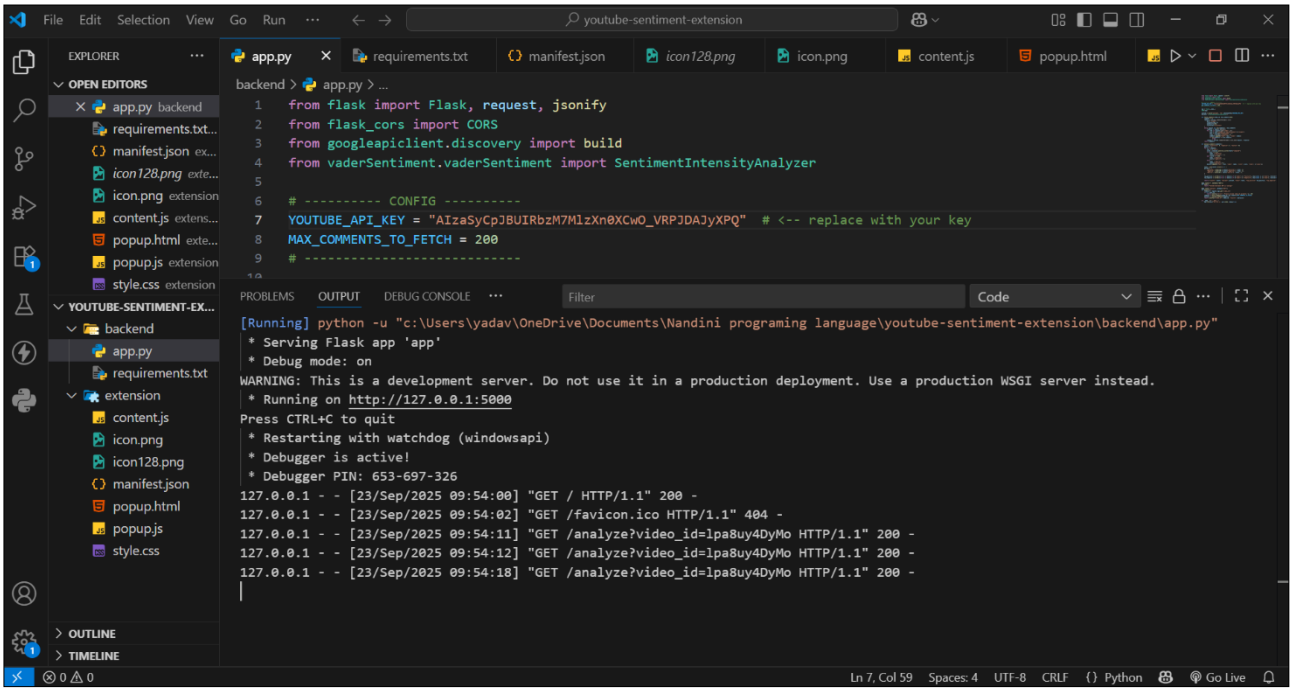
3. **Frontend (Chrome Extension)**:
   - A popup interface allows the user to request analysis of the current video.
   - Content scripts overlay sentiment summaries directly onto the YouTube video page.

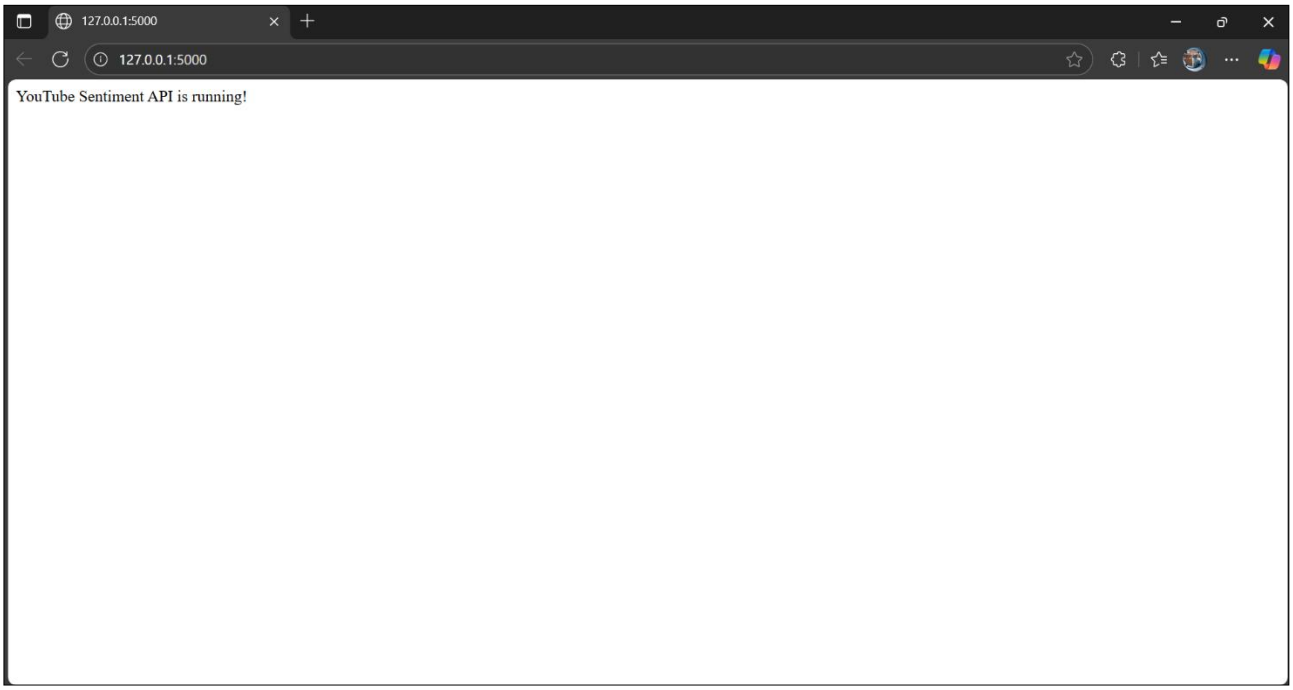


3.2 Methodology Steps

1. Fetch comments from YouTube API.
2. Preprocess text (remove special characters, convert to lowercase, etc.).
3. Perform sentiment analysis using polarity scoring.
4. Categorize sentiment into Positive, Negative, Neutral.

5. Send results back to Chrome Extension.
6. Display results in both popup and overlay panel.





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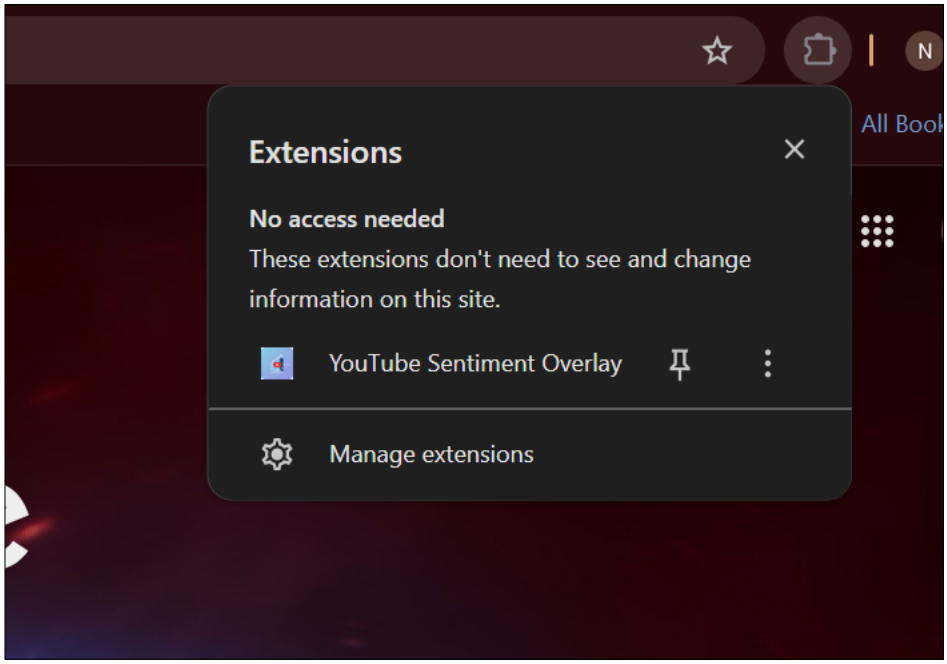
4. Results and Analysis

The system was tested on multiple YouTube videos from different categories such as tutorials, entertainment, and news. Results show accurate classification of comments into positive, negative, and neutral sentiments.

Example Result for a Tutorial Video:

- Positive: 81.4%
- Neutral: 6.8%
- Negative: 11.9%



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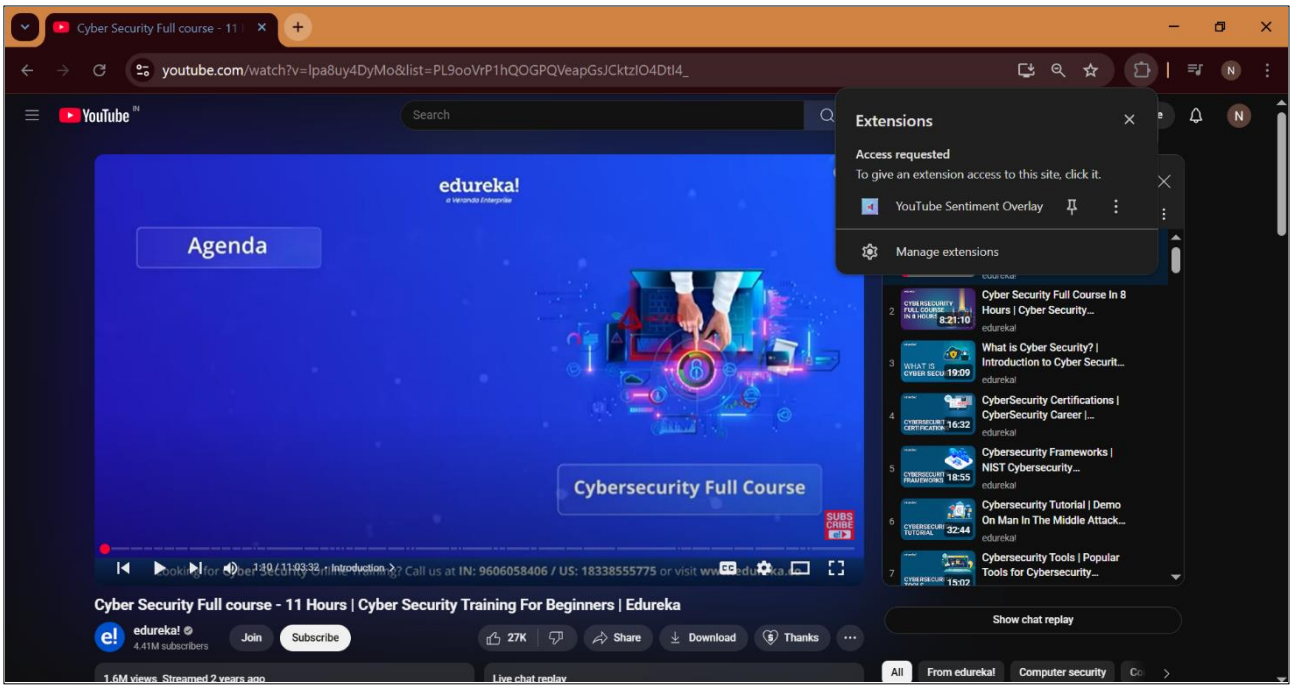

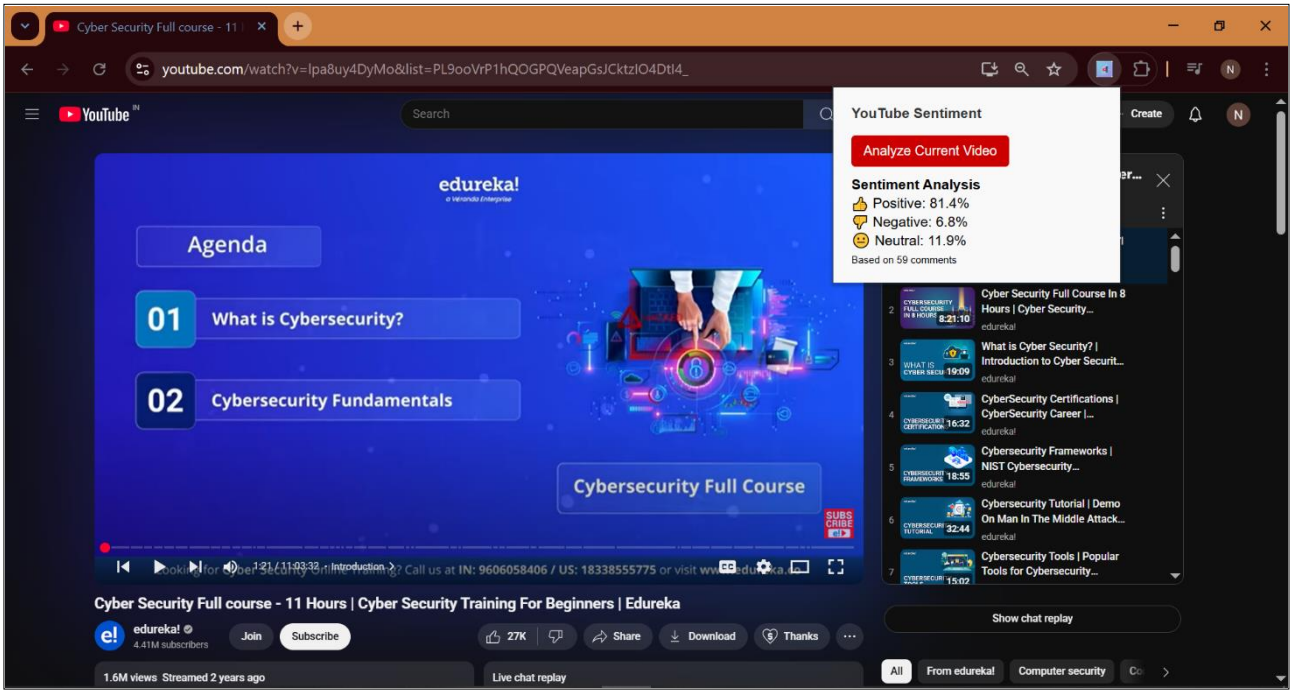

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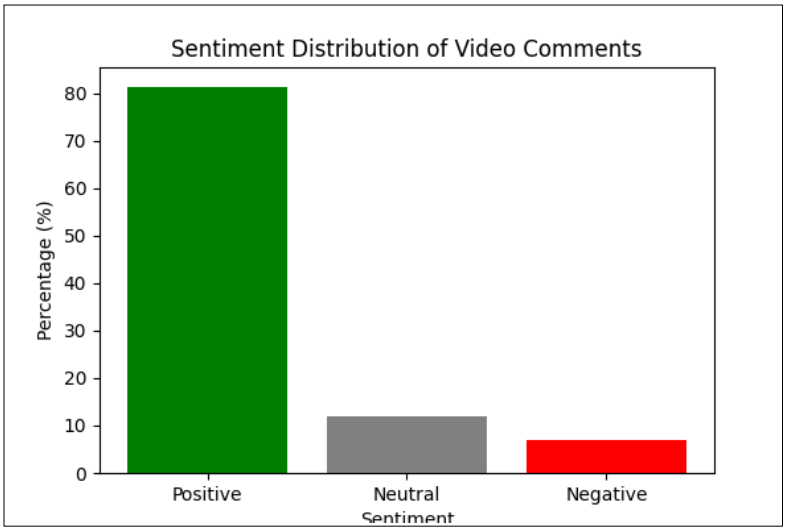
Charts can also be plotted for better visualization:



5. Applications

The proposed system can be applied in multiple domains:

1. **Content Creators** – Quickly understand audience sentiment towards their videos.
2. **Marketing & Branding** – Companies can measure public opinion towards advertisements or brand campaigns.
3. **Academic Research** – Useful for studying online behavior, opinion mining, and social influence.
4. **Media Monitoring** – Track sentiment trends across topics such as politics, entertainment, or education.

6. Conclusion and Future Scope

This project successfully demonstrates a real-time sentiment analysis tool integrated into YouTube through a Chrome Extension. It eliminates the need for manual data collection by directly interfacing with the YouTube API. The results provide quick and accessible insights into audience perception.

Future Scope:

- Integrating **advanced NLP models** such as BERT for higher accuracy.

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- Supporting **multi-language sentiment analysis**.
- Expanding to other platforms (Twitter, Instagram, Reddit).
- Adding **trend comparison dashboards** across multiple videos.

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