



Complete Data Analysis Report

DS- 464

Uni Pulse Analytics

Digital Business Analytics

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UniPulse Analytics: Sentiment & Discourse Analysis of Pakistani Universities Using Reddit Data

Abstract

UniPulse Analytics is a data-driven system that collects, processes, and analyzes Reddit discussions related to major Pakistani universities—GIKI, LUMS, and NUST. The project applies Natural Language Processing (NLP), sentiment analysis, topic modeling, and Retrieval-Augmented Generation (RAG) to uncover student sentiment, recurring issues, and comparative insights across institutions. A market-ready interactive dashboard built with Streamlit presents actionable insights for students and administrators.

1. Introduction

Student decision-making increasingly relies on peer-generated content on social platforms. Reddit hosts candid discussions on admissions, academics, and campus life, making it a valuable data source for understanding university sentiment. This project aims to transform unstructured Reddit data into structured insights that support informed academic and administrative decisions.

Objectives

- Scrape large-scale Reddit data from university-specific subreddits
- Perform sentiment analysis and thematic categorization
- Compare universities across engagement and sentiment metrics
- Build an AI-powered Q&A system using RAG
- Deliver insights via a professional, interactive dashboard

2. Data Collection

2.1 Data Source

Reddit subreddits:

- r/giki
- r/lums
- r/nust

2.2 Scraping Methodology

Data was collected using the **PRAW (Python Reddit API Wrapper)** library with authenticated credentials loaded via environment variables.

Key scraping characteristics:

- Up to **1000 unique posts per subreddit**
- Multiple listing strategies to bypass Reddit's single-listing cap:
 - Top (All Time)
 - Top (Year)
 - Hot
 - New
- Duplicate prevention using post IDs
- Comment expansion limited to top 15 comments per post
- Rate-limit handling via controlled delays

Each subreddit's data is saved as a separate JSON file.

2.3 Data Schema

Each Reddit post is stored using the following structure:

```
{  
    "id": "string",  
    "subreddit": "string",  
    "title": "string",  
    "body": "string",  
    "upvotes": "integer",  
    "timestamp": "ISO-8601 datetime",  
    "num_comments": "integer",  
    "comments": ["string"],  
    "url": "string"  
}
```

3. Data Preprocessing

3.1 Text Preparation

- Combined post title and body into a single text field
- Lowercasing and URL removal
- Removal of punctuation and non-alphabetic characters
- Stopword removal using NLTK

3.2 Feature Engineering

For each post, the following derived attributes were added:

- **Sentiment Score:** Compound score using VADER Sentiment Analyzer
- **Category** (rule-based):
 - Admissions
 - Academics
 - Campus Life
 - General

3.3 Temporal Processing

- Conversion of timestamps to datetime format
- Aggregation by date for trend analysis

4. Exploratory Data Analysis (EDA)

4.1 Engagement Metrics

- Average upvotes per university
- Average comment count (Community Vitality)

4.2 Sentiment Analysis

- Sentiment range: -1 (negative) to +1 (positive)
- Mean sentiment used as **Pulse Index**

4.3 Comparative Analysis

Universities are compared using:

- Pulse Index (average sentiment)
- Community Vitality (average engagement)
- Discussion focus distribution (Academics vs Campus Life vs Admissions)

5. Topic Modeling

Latent Dirichlet Allocation (LDA) was applied to identify dominant discussion themes.

Configuration:

- Vectorizer: CountVectorizer
- N-grams: Trigrams
- Topics per subset: 3

This approach highlights common complaint phrases and recurring discussion points.

6. AI-Driven Insights (RAG System)

6.1 Architecture

The project integrates a **Retrieval-Augmented Generation (RAG)** pipeline:

1. Reddit posts embedded using OpenAI embeddings
2. Stored in a **ChromaDB** persistent vector database
3. User queries embedded and matched via cosine similarity
4. Relevant Reddit context retrieved
5. Final answer generated using an LLM constrained to retrieved context

6.2 Use Case

- Student queries such as:
 - “How is hostel life at GIKI vs NUST?”
 - “Is LUMS academically stressful?”

Responses are concise, contextual, and data-grounded.

7. Visualization & Dashboard(Student)

7.1 Dashboard Overview

The UniPulse Analytics dashboard serves as the primary interface for presenting analytical insights in an intuitive and visually rich format.

Figure 7.1: UniPulse Analytics – Main Dashboard Interface(User)

The screenshot displays the UniPulse Analytics main dashboard interface for students. On the left, a sidebar shows the UniPulse Analytics logo, access level set to 'Student View', and a data last updated timestamp of '2025-12-24'. The main content area features several sections:

- UniPulse: Student Insights**: A header with a graduation cap icon, followed by a sub-header: "Navigate the university landscape with data-driven insights from real student conversations." Below this is a "Ask the AI" section with a text input field containing placeholder text: "Ask about hostel life, strictness, mess food, or merit..." and a "Try asking: 'How is the social life at LUMS vs GIKI?'" button.
- The Vibe Check**: A section comparing three universities: GIKI, LUMS, and NUST. It shows their respective scores: 0.27, 0.38, and 0.31, each accompanied by a green upward arrow icon labeled "Positive".
- University Performance Scorecard**: A section describing relative performance metrics based on student sentiment and community interaction.

7.2 Ask-the-AI (RAG Interface)

This section enables users to query aggregated Reddit knowledge using natural language. The system retrieves semantically relevant posts and generates grounded responses.

Figure 7.2: Ask-the-AI Interface with Example Query

Ask the AI

Aggregated knowledge from GIKI, NUST, and LUMS subreddits.

The screenshot shows a user interface for an AI system. At the top, there's a search bar with the placeholder text "Ask about hostel life, strictness, mess food, or merit...". Below the search bar is a button with a camera icon and the text "How is the social life at LUMS vs GIKI?". A large text box contains the AI's response, which includes a paragraph comparing the social life at LUMS and GIKI, followed by a detailed analysis of each university's social environment.

Based on the provided context, the social life at LUMS is portrayed as significantly better than at GIKI. At LUMS, there are numerous cafes and restaurants, creating a vibrant atmosphere that allows for socializing. The university hosts various events and concerts, attracting good artists, which enhances the social experience. In contrast, GIKI is described as isolated with limited social opportunities. The nearby options for dining and entertainment are minimal, and the campus culture is characterized by a negative ragging culture and an environment that can feel toxic. There's a mention of a poor girl-to-boy ratio, which impacts social interactions negatively. Overall, LUMS seems to offer a more engaging and lively social life compared to GIKI's constrained and challenging environment.

7.3 Vibe Check – Sentiment Snapshot

The Vibe Check provides an at-a-glance sentiment score (Pulse Index) for each university. Scores are color-coded to indicate sentiment health.

Figure 7.3: Vibe Check Sentiment Indicators for GIKI, LUMS, and NUST



7.4 University Performance Scorecard

This table compares universities using sentiment and engagement-based metrics.

Metrics include:

- **Pulse Index:** Average sentiment score
- **Community Vitality:** Average number of comments per post

Figure 7.4: University Performance Scorecard

The figure shows a screenshot of a dashboard titled "University Performance Scorecard". The title includes a trophy icon. Below the title, a subtitle reads "Relative performance metrics based on student sentiment and community interaction." At the bottom left, there is a "Pulse Index Guide" with three colored circles: green (> 0.15 Healthy), yellow (0.0 to 0.15 Neutral), and red (< 0.0 High Friction). The main content is a table with three columns: "University", "Pulse Index (Sentiment)", and "Community Vitality". The table has four rows, each representing a university: LUMS, NUST, and GIKI. The Pulse Index values are 0.38, 0.31, and 0.27 respectively, all falling into the "Healthy" range (green). The Community Vitality values are 11.2, 14.0, and 7.9. The table is presented in a light-colored grid format with thin borders between cells. There are also some small icons in the top right corner of the dashboard area.

University	Pulse Index (Sentiment)	Community Vitality
LUMS	0.38	11.2
NUST	0.31	14.0
GIKI	0.27	7.9

7.5 Advanced Visualizations

The dashboard includes multiple analytical visualizations for deeper insights:

- Sentiment distribution box plots
- Radar charts comparing institutional profiles
- Stacked bar charts for discussion categories
- Word clouds for dominant terms
- Time-series sentiment trend plots

Figure 7.5: Sentiment Distribution Box Plot

Sentiment Consistency

Shows the range of student mood. A concentrated box means a consistent 'vibe' across campus.

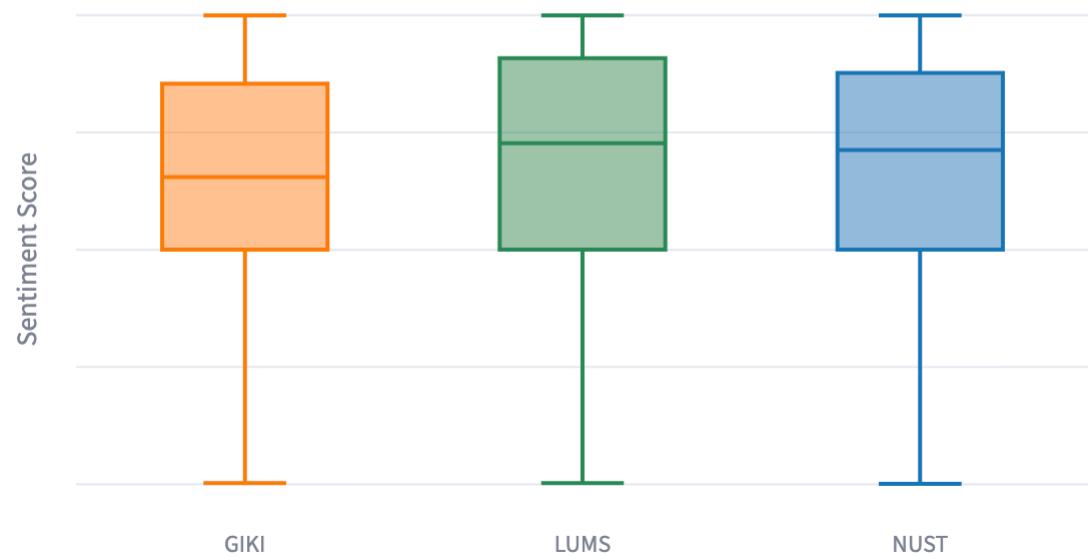


Figure 7.6: University Comparison Radar Chart

📡 360° Institutional Profile

Comparing strengths across Sentiment, Community, Academics, and Social Life categories.

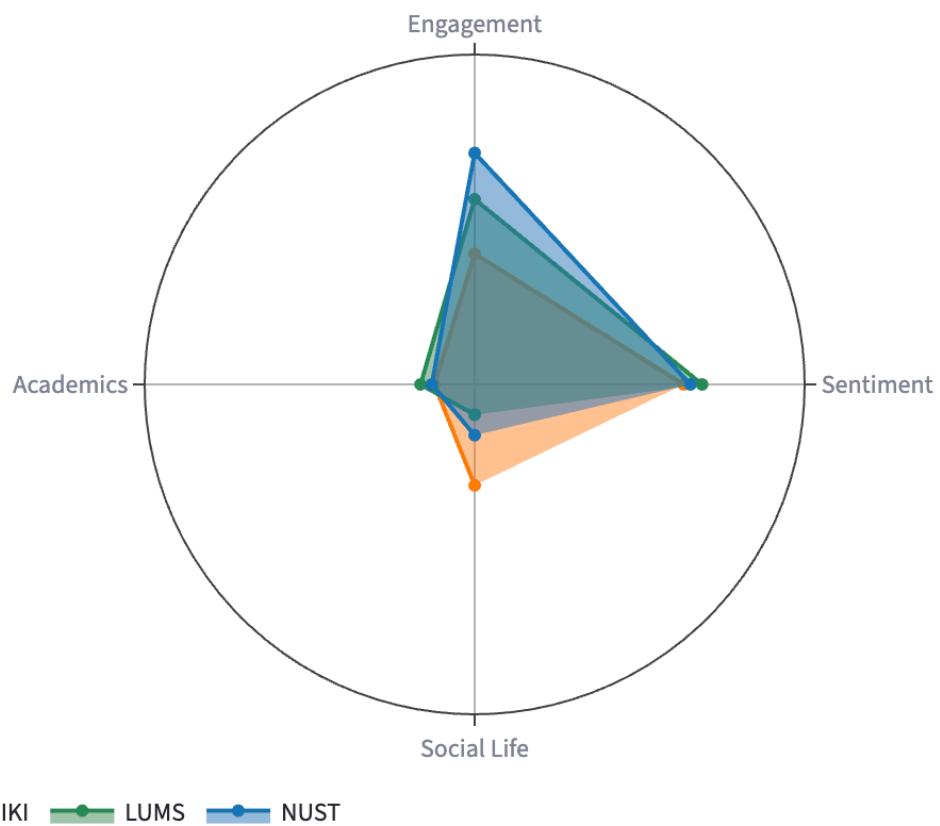


Figure 7.7: Discussion Category Distribution (Stacked Bar Chart)

🗣 Discussion Focus Area

Proportion of conversation dedicated to different aspects of university life.

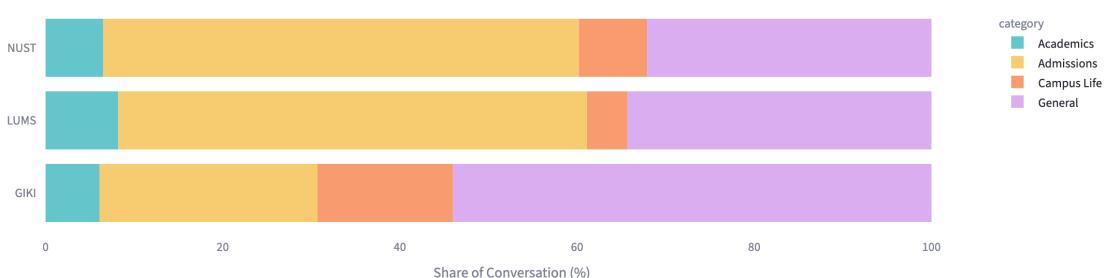


Figure 7.8: Keyword Word Cloud per University



Figure 7.9: Sentiment Trends Over Time

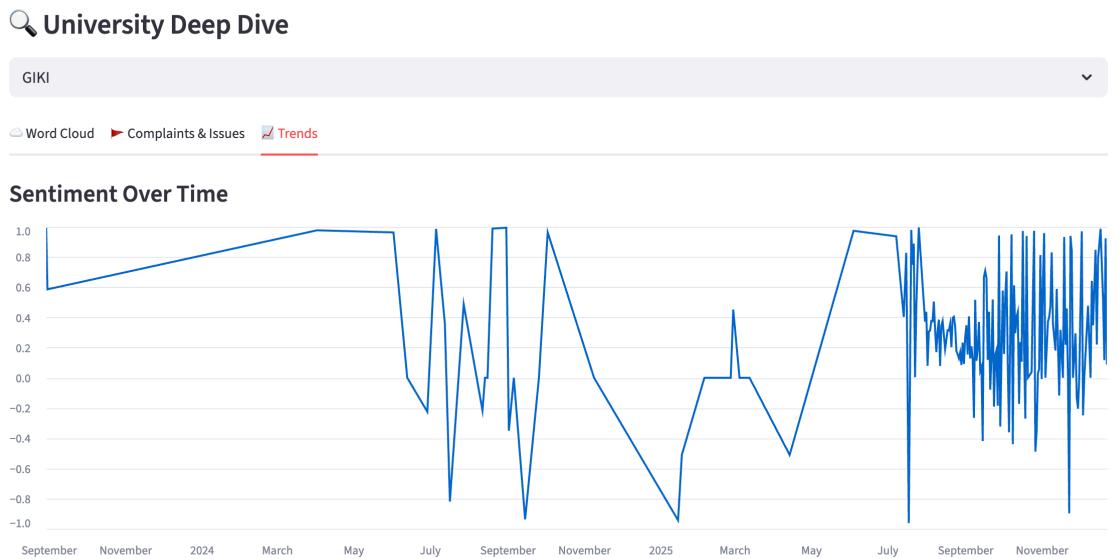
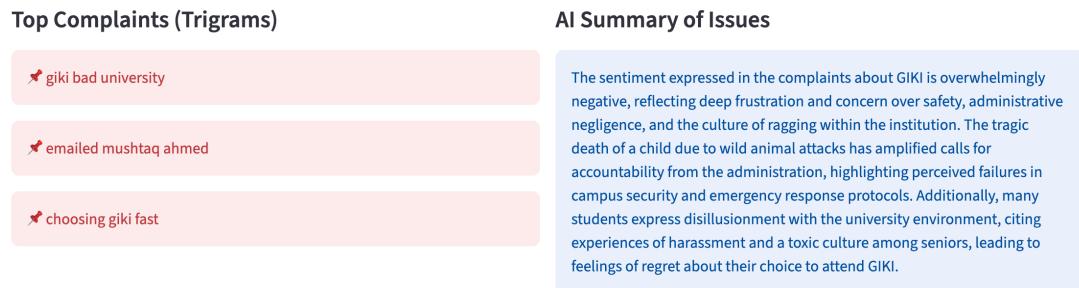


Figure 7.10: Complaints and Issues (AI Summary of issues)



7.6 Deployment & Accessibility

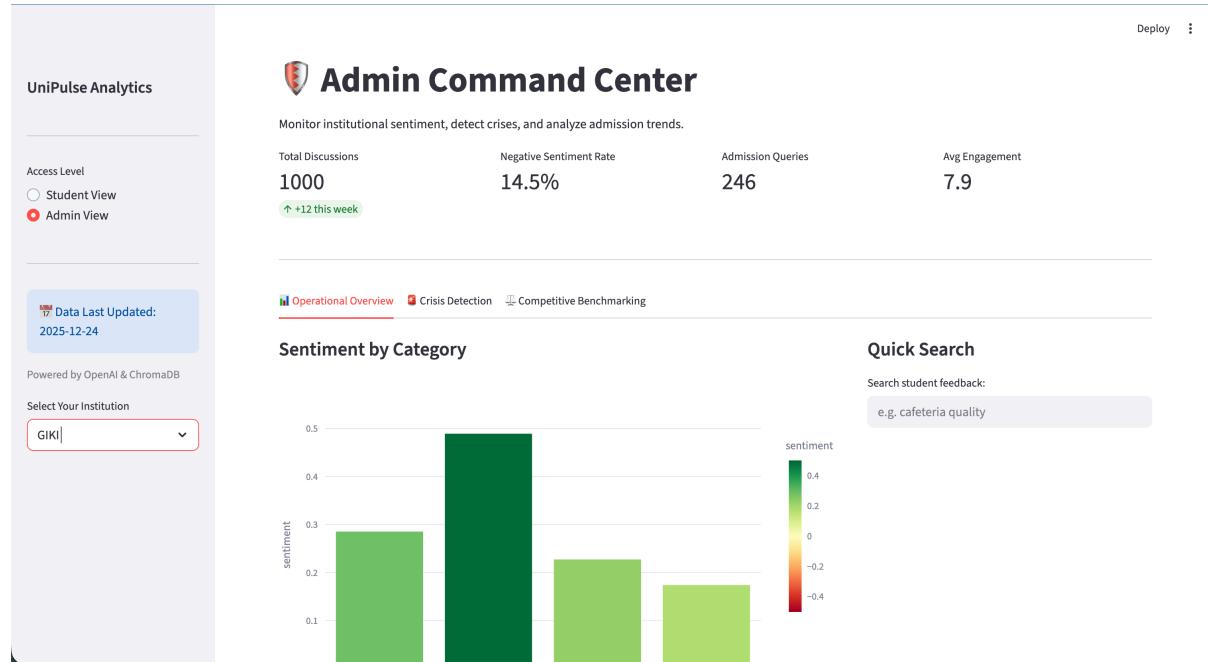
The dashboard is deployed using Streamlit and can be hosted locally or on cloud platforms. It supports modular extension for additional universities and analytics.

8. Visualization & Dashboard(Admin)

8.1 Dashboard Overview

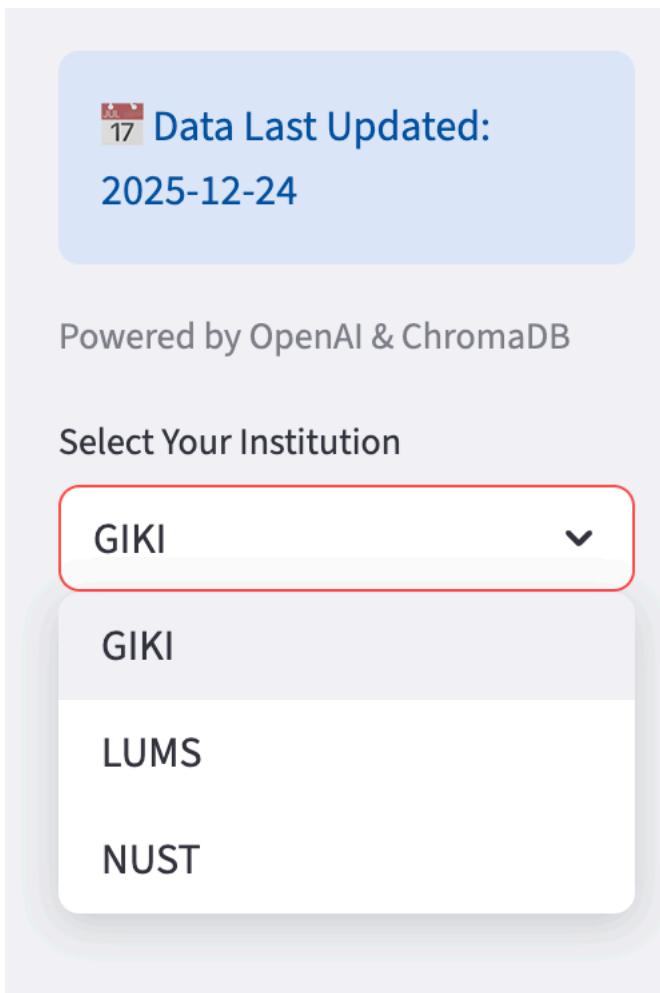
The UniPulse Analytics dashboard serves as the primary interface for presenting analytical insights in an intuitive and visually rich format.

Figure 8.1: UniPulse Analytics – Main Dashboard Interface(Admin)



8.2 University Selection for Admin.

Figure 8.2: Select university(Admin)



8.3 Monitor institutional sentiment, detect crises, and analyze admission trends.

Figure 8.3: Monitor institutional sentiment, detect crises, and analyze admission trends.(Admin)

Monitor institutional sentiment, detect crises, and analyze admission trends.

Total Discussions	Negative Sentiment Rate	Admission Queries	Avg Engagement
1000	14.5%	246	7.9
↑ +12 this week			

8.4 University Performance Scorecard

This table compares universities using sentiment and engagement-based metrics.

Metrics include:

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Figure 8.4: University Performance Scorecard(Admin)

The figure shows a screenshot of a dashboard titled "University Performance Scorecard". The title includes a trophy icon. Below the title, a subtitle reads "Relative performance metrics based on student sentiment and community interaction." A table follows, showing data for three universities: LUMS, NUST, and GIKI. The table has three columns: "University", "Pulse Index (Sentiment)", and "Community Vitality". The data is as follows:

University	Pulse Index (Sentiment)	Community Vitality
LUMS	0.38	11.2
NUST	0.31	14.0
GIKI	0.27	7.9

Below the table, a note says "Pulse Index Guide: > 0.15 (Healthy) | 0.0 to 0.15 (Neutral) | < 0.0 (High Friction)".

8.5 Advanced Visualizations

The dashboard includes multiple analytical visualizations for deeper insights:

- Sentiment distribution box plots
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- Time-series sentiment trend plots
- Sentiment By Category
- Crisis Detection

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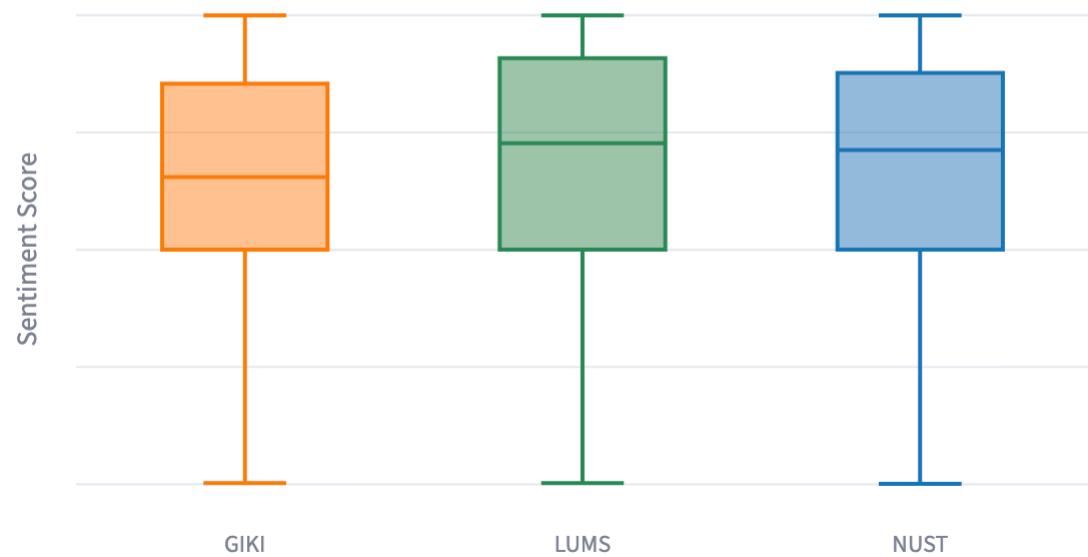


Figure 8.6: University Comparison Radar Chart(Admin)

360° Institutional Profile

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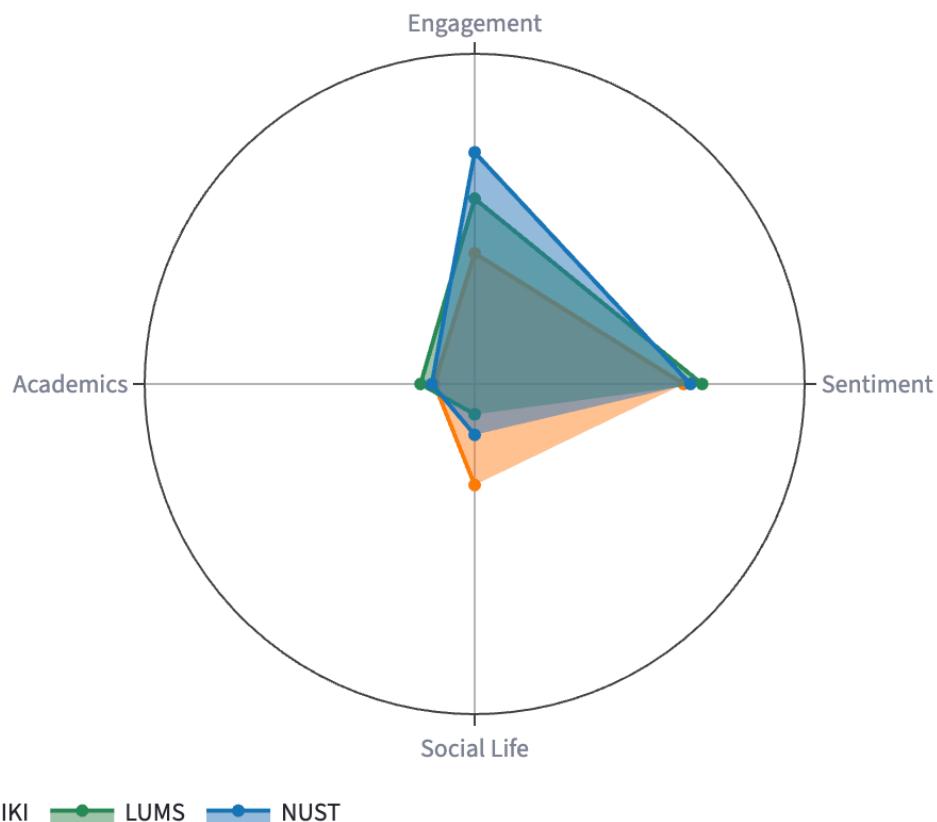


Figure 8.7: Discussion Category Distribution (Stacked Bar Chart) (Admin)

Discussion Focus Area

Proportion of conversation dedicated to different aspects of university life.

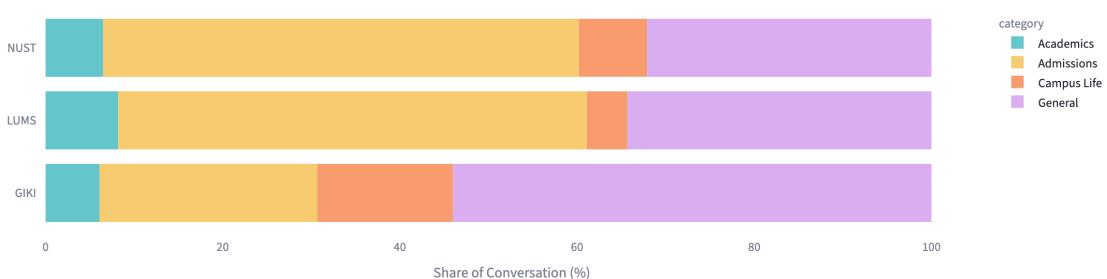


Figure 8.8: Keyword Word Cloud per University(Admin)

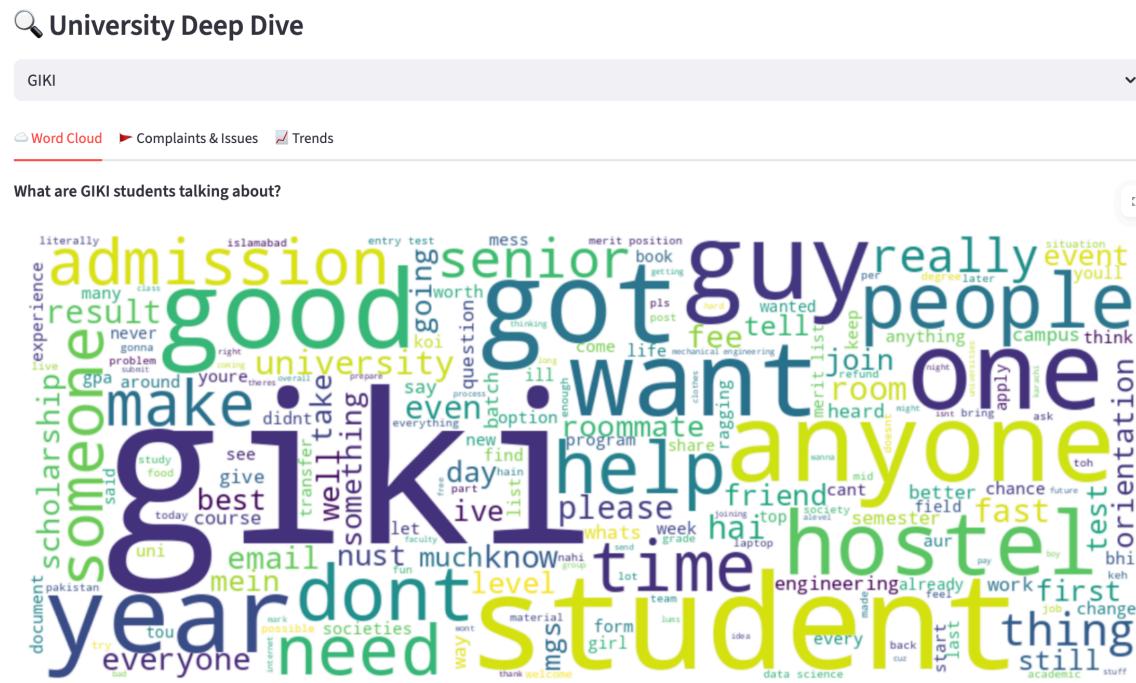


Figure 8.9: Sentiment Trends Over Time(Admin)

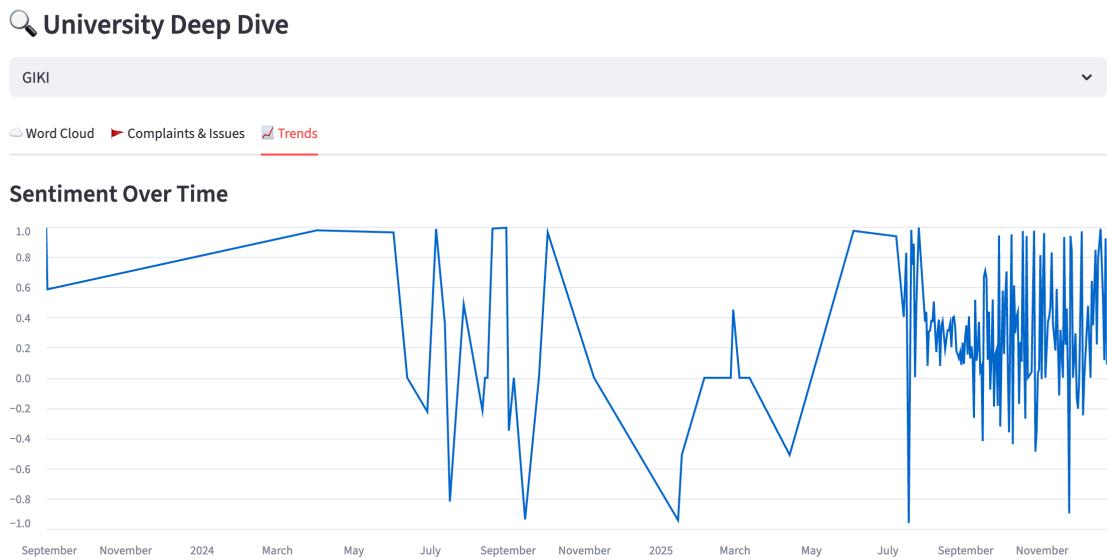


Figure 8.10: Complaints and Issues (AI Summary of issues) (Admin)

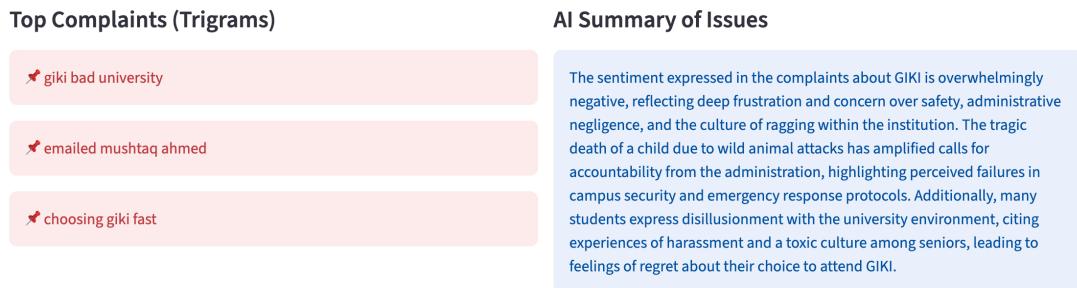


Figure 8.11 : Sentiment by Category(Admin)



Figure 8.12: Crisis Detection(Admin)

The screenshot shows a dashboard interface with three tabs at the top: 'Operational Overview' (blue), 'Crisis Detection' (red, selected), and 'Competitive Benchmarking' (grey). A large red callout box highlights 'High Priority Issues (Negative Sentiment < -0.3)'. Below it, a post from a user named 'Why no internet??' is displayed, dated 2025-12-23, with a timestamp of 05:30:07+00:00, categorized under 'Admissions', and 3 likes. The post content is: 'Why no internet?? Literally half the sites are disabled you can't even game here even after 6 Sirf Valo khel saktay hain NOT EVEN CLASH ROYALE OR COC. Epic ke servers bhi nahi chaltay na idhar data ch...'. Another post by 'Alvl equivalency' is shown below, dated 2025-12-04, with a timestamp of 17:35:40+00:00, categorized under 'Campus Life', and 2 likes. The post content is: 'Alvl equivalency i know iam late but i also think i messed up my form bcs i was applying for my alvl equivalency so i thought that a lvl and olvl equivalency both are made seperately but i guess that ...'. A third post by 'Can I send stuff to my frnds in giki using their id no or do I also need to put their room info on the box???' is shown, dated 2025-11-30, with a timestamp of 15:44:19+00:00, categorized under 'Campus Life', and 1 like. The post content is: 'Can I send stuff to my frnds in giki using their id no or do I also need to put their room info on the box??? ...'. At the bottom, a section titled 'Automated Issue Summary' contains a yellow box with text: 'The sentiment expressed in the text reflects a strong sense of frustration and dissatisfaction among students regarding various critical issues at their institution. Key concerns include unreliable internet access, unsatisfactory administrative responses to complaints, and negative experiences related to ragging and harassment. Additionally, students express anxiety over academic pressures and logistical challenges, highlighting a need for improved communication and support from the administration.'

8.6 Deployment & Accessibility

The dashboard is deployed using Streamlit and can be hosted locally or on cloud platforms. It supports modular extension for additional universities and analytics.

9. Results & Findings

Key insights observed:

- Universities exhibit distinct sentiment “signatures”
- High engagement does not always correlate with positive sentiment
- Academics-related discussions show higher sentiment volatility
- Campus life discussions tend to be more positive and expressive

10. Limitations

- Reddit users may not represent the entire student population
- Sentiment analysis may misinterpret sarcasm
- Topic modeling depends on sufficient text volume

11. Future Work

- Expand to additional universities (FAST, PIEAS, IBA)
- Integrate multilingual (Urdu/Roman Urdu) sentiment models
- Add anomaly detection for crisis monitoring
- Deploy dashboard on cloud infrastructure

12. Conclusion

UniPulse Analytics demonstrates how social media data can be transformed into meaningful institutional intelligence. By combining large-scale data scraping, NLP, and AI-powered retrieval, the system delivers transparent, student-centric insights in a professional, market-ready format.

13. GitHub Repository

GitHub Link: <https://github.com/HAK-04/NLP-Analytics-Dashboard>

Note: The repository includes scraping scripts, processing pipelines, json data files and this report.

References

- Reddit API Documentation
- NLTK & VADER Sentiment Analysis
- scikit-learn LDA Documentation
- ChromaDB Vector Store
- Streamlit Framework