Automated Social Media Feedback Analysis for Software Requirements Elicitation: A Case Study in the Streaming Industry

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Abstract: Requirements Engineering (RE) is crucial for product success but challenging for software with a broad user base, such as streaming platforms. Developers must analyze vast user feedback, but manual methods are impractical due to volume and diversity. This research addresses these challenges by automating the collection, filtering, summarization, and clustering of user feedback from social media, suggesting feature requests and bug fixes through an interactive platform. Data from Reddit, Twitter, iTunes, and Google Play is gathered via web crawlers and APIs and processed using a novel combination of natural language processing (NLP), machine learning (ML), large language models (LLMs), and incremental clustering. We evaluated our approach with a partner company in the streaming industry, extracting 66,168 posts related to 10 streaming services and identifying 22,847 as relevant with an ML classifier (75.5% precision, 74.2% recall). From the top 100 posts, a test user found 89 relevant and generated 47 issues in 80 minutes—a significant reduction in effort compared to a manual process. A usability study with six specialists yielded a SUS score of 83.33 ("Good") and very positive feedback. The platform reduces cognitive overload by prioritizing high-impact posts and suggesting structured issue details, ensuring focus on insights while supporting scalability.

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1 INTRODUCTION

Requirements Engineering (RE) is crucial in software development, encompassing activities such as elicitation, analysis, negotiation, documentation, and validation of requirements. A software product's success largely depends on this process's effectiveness, as requirements form the foundation of software quality. According to (Li et al., 2018), approximately 60% of errors in software development projects originate during the RE phase, and rectifying these errors later is costly.

Despite its importance, RE is often plagued by challenges stemming from poorly defined requirements and limited user involvement (Ali and Hong, 2019). User feedback is essential for success, aligning the RE process with end-users' visions and needs. However, involving end-users can be difficult due to their unavailability, uncertainty about their identities (particularly in market-driven development), and the high costs associated with traditional RE techniques, which are particularly burdensome for small startups (Ali and Hong, 2019).

Recent advancements in data-driven RE and Crowd-based RE (CrowdRE) have highlighted the potential of leveraging social media and other crowd-sourced data to address these challenges. Studies have explored using natural language processing (NLP) and machine learning (ML) to classify and analyze feedback, laying a foundation for integrating social media insights into RE workflows (Maalej et al., 2016b); (Groen et al., 2017). However, many of these studies remain theoretical, with limited practical applications or interaction with industry partners. There is a lack of end-to-end approaches applied in industrial environments.

This research extends these foundations by introducing an interactive platform that bridges the gap between feedback extraction and actionable requirements. Unlike prior works, our platform not only collects and processes social media feedback but also integrates directly with tools like GitLab, automating issue creation and pre-filling all relevant fields. Users can easily refine these fields, streamlining the transition from feedback to implementation.

In this case study, we applied the platform to gather feedback on various streaming platforms, providing our industrial partner with a clear picture of

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user expectations to improve their Over-The-Top TV platform. By analyzing social media feedback, the platform helped the company understand which features users are requesting and the most common issues they encounter, enabling them to make informed decisions to remain competitive in the streaming industry.

Contributions to the state of the art include an innovative end-to-end workflow and interactive platform for processing social media feedback, validated by industry professionals. This workflow uses advanced techniques such as Large Language Models (LLMs) and introduces new features like automated issue creation and requirement suggestions.

In addition to the introduction, this document is structured as follows: Chapter 2 discusses the state of the art regarding social media-based requirements gathering. Chapter 3 outlines the development of the feedback processing workflow. Chapter 4 explains the creation of the visualization platform. Chapter 5 presents the experiments to evaluate the platform. Chapter 6 discusses limitations, and Chapter 7 summarizes the findings. For further details, please consult (Silva, 2024).

2 STATE OF THE ART

This study seeks to address the lack of tools that not only extract and classify requirements from social media but also allow stakeholders to actively interact with and act upon these requirements. Our goal is to bridge the gap between academic research and practical application by creating an interactive platform that integrates automation and actionable workflows.

To develop this platform, we first needed to understand the current use of social media for RE. This exploration was essential to identify gaps and guide the design of our approach.

We started by asking:

RQ1: What works exist to extract requirements from social networks?

Several studies have explored mining user feedback from social media platforms, such as app stores, Twitter, Reddit, and Facebook (Iqbal et al., 2021); (Nayebi et al., 2018); (Oehri and Guzman, 2020); (Williams and Mahmoud, 2017). These studies highlight the potential of social media feedback to provide profound insights into user needs, including bug reports and feature requests (Iqbal et al., 2021). Most studies collect feedback from the product's page (in app stores), posts on the product's forum (like Reddit), or posts where users directly address the product's accounts (such as on Twitter). However, approaches that rely on manual intervention lack scalability or fail to capture diverse sources effectively, highlighting the need for automatic extraction, which led us to the following question:

RQ2: What works exist about automatically classifying candidate requirements extracted from social networks?

Initial efforts in this field were manual (Kanchev and Chopra, 2015); (Scanlan et al., 2022), but the volume of social media data required the development of automated or semi-automated mechanisms. Common workflows include data extraction (via scrapers or APIs), pre-processing, and classification using algorithms such as Decision Trees (DT), Random Forest (RF), Support Vector Machines (SVM), Naive Bayes (NB), and Multinomial Naive Bayes (MNB). These algorithms categorize feedback into relevant and irrelevant categories. The relevant feedback is divided into three typical groups: feature requests, bug reports, and other (Guzman et al., 2017); (Williams and Mahmoud, 2017).

Some studies introduced specific preprocessing steps to enhance performance, such as stemming, lemmatization, verb tense detection, sentiment analysis, and handling data imbalance. Others added post-classification techniques like clustering, topic modeling and summarization to improve the organization and interpretation of classified data (Guzman et al., 2017); (Williams and Mahmoud, 2017); (Iqbal et al., 2021); (Oehri and Guzman, 2020); (Ebrahimi and Barforoush, 2019); (McIlroy et al., 2016); (Panichella et al., 2016); (Maalej et al., 2016a); (Di Sorbo et al., 2017); (Villarroel et al., 2016).

However, many approaches stop at classification, failing to integrate workflows that connect extracted feedback to actionable tasks in real-world software development. This leads to the need for interactive interfaces, as addressed in our third research question:

RQ3: What works exist about the visualization of candidate requirements extracted from social networks?

While many tools focus on classifying and prioritizing feedback, fewer address interactive visualization. We identified five key works in this area:

- **ARdoc:** Offers a simple GUI for importing and classifying reviews into categories like "Feature Request", "Problem Discovery", "Information Seeking" and "Information Giving" with category-specific color highlights. It lacks automated feedback gathering, filtering and navigation, among other features (Panichella et al., 2016);

- **OpenReq Analytics:** Displays feedback trends via heat maps, sentiment analysis, and keyword searches, organized into problem reports and inquiries. ML models classify feedback, allowing refinement through user interaction. While comprehensive, it lacks dynamic feedback navigation and integration with social media platforms (Stanik and Maalej, 2019);
- **CLAP:** Automatically clusters and prioritizes user feedback into “Bug Report”, “Feature Request” and “Other”. However, reviews must be manually imported, and the tool does not include search or advanced filtering options (Villarroel et al., 2016);
- **SURF:** A command-line tool for summarizing user feedback stored in XML files, categorized by topic. It generates bar charts for intent distribution, but lacks built-in visualization or navigation capabilities, requiring external tools to display results (Di Sorbo et al., 2017);
- **The Automatic Classification Tool:** Retrieves app reviews automatically and visualizes trends via bar and pie charts but it is limited to app stores (Maalej et al., 2016a).

While these tools provide valuable functionality, they often lack dynamic interaction, task integration, or validation in industrial contexts.

The limitations identified in RQ1, RQ2, and RQ3 reveal a critical need for tools that integrate extraction, classification, and interactive visualization into actionable workflows validated in industrial settings. Building on these insights, our work addresses three key gaps:

- A lack of practical, end-to-end workflows that transition seamlessly from data extraction to actionable tasks;
- Limited interactive features to allow stakeholders to explore and refine extracted requirements;
- A disconnect between academic tools and their application in industrial settings.

To address these gaps, we developed and validated an interactive platform that integrates requirement extraction, classification, interaction, and GitLab issue creation. By bridging these gaps, we aim to enable stakeholders to transition smoothly from raw feedback to actionable tasks, improving decision-making and fostering collaboration.

3 SOCIAL MEDIA FEEDBACK PROCESSING WORKFLOW

Our goal is to automatically collect user feedback from diverse social media platforms related to a domain or product of interest (in this case, streaming services of interest to our industrial partner), and present processed user feedback to stakeholders in a way that facilitates the derivation of actionable issues (new features, bug fixes, etc.) for product evolution.

As such, our solution comprises two main components: (i) a social media feedback processing workflow implemented by modular Python scripts (described in this Section) and (ii) a Web-based user interface for generating actionable issues from the processed feedback (described in Section 4).

Figure 1 depicts the system and user workflows in our approach, distinguishing manual or interactive user tasks (pink), system tasks implemented by Python scripts (blue), and system tasks that rely on OpenAI’s GPT-3.5 Turbo model (green). The section of the paper where each task is described is indicated in parentheses.

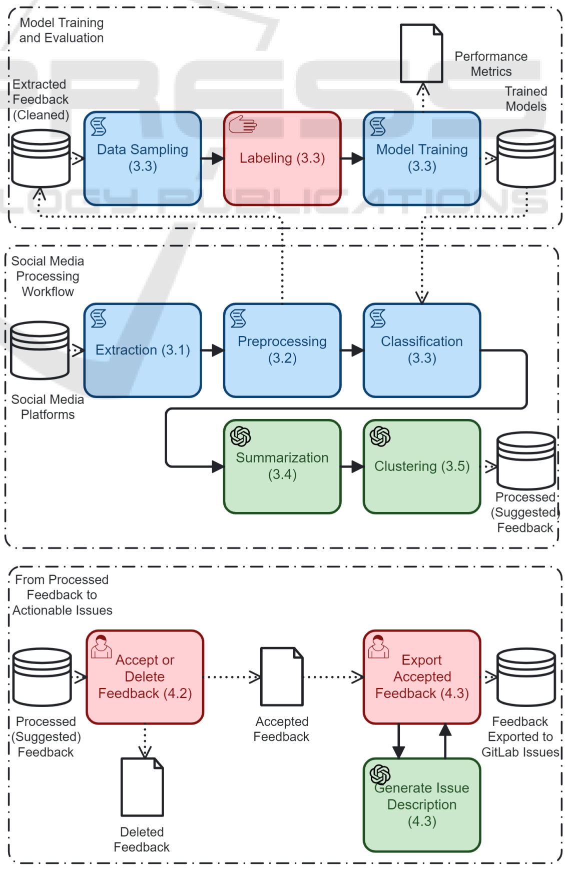
Model Training and Evaluation
Performance Metrics
Extracted Feedback (Cleaned)
Trained Models
Data Sampling (3.3)
Labeling (3.3)
Model Training (3.3)
Social Media Processing Workflow
Extraction (3.1)
Preprocessing (3.2)
Classification (3.3)
Social Media Platforms
Summarization (3.4)
Clustering (3.5)
Processed (Suggested) Feedback
From Processed Feedback to Actionable Issues
Accept or Delete Feedback (4.2)
Accepted Feedback
Export Accepted Feedback (4.3)
Processed (Suggested) Feedback
Feedback Exported to GitLab Issues
Generate Issue Description (4.3)
Deleted Feedback

Figure 1: Bpmn Diagram of the Processing Workflows.

We distinguish three sub-processes, which may occur with different frequencies:

- **Social Media Processing Workflow:** comprises the steps performed automatically by Python scripts to extract posts from selected social media platforms based on predefined keywords and a user-defined timeframe, clean the extracted data, classify the extracted posts regarding their relevance and type, and summarize and cluster the posts that were classified as potentially relevant;
- **Model Training and Evaluation:** comprises the steps conducted to generate classification models using supervised machine learning techniques; model training can be repeated as new labelled data is generated in the next sub-process;
- **From Processed Feedback to Actionable Items:** comprises the steps performed by the user, with system support, to generate actionable issues in an issue tracking system (currently GitLab) from the processed feedback.

3.1 Data Extraction

To capture a broad and representative sample of user feedback, we selected four key sources: iTunes, Google Play, Twitter, and Reddit. While existing literature typically relies on at most two sources, our approach reflects a strategic effort to combine structured app store reviews, real-time social media interactions, and in-depth forum discussions.

The selection of these platforms was guided by three main criteria:

- **Textual Feedback Availability:** We prioritized platforms with substantial user-generated textual content, ensuring suitability for NLP analysis;
- **Public Accessibility:** Only platforms with publicly available data, accessible via APIs or custom-built scrapers, were included;
- **Relevance to Streaming Services:** The chosen platforms provide rich datasets related to user experiences, feature requests, and issue reporting.

To further ensure the relevance and diversity of the collected feedback, we analyzed ten streaming services, selected based on the following considerations:

- **Service Relevance:** Four services were chosen due to their direct association with our industrial partner, aligning with their strategic interests;
- **Market Popularity:** The remaining six services were selected based on their global user base, subscription numbers, social media activity, and market presence at the time of the study. This approach ensured a balanced representation of widely used and emerging platforms.

Our data collection was limited to posts from January 2023 to March 2024, to focus on recent insights and maintain a manageable yet representative dataset. Feedback from app stores was collected directly from the apps' pages using APIs and custom scrapers.

On Twitter, we performed targeted searches combining the streaming service's name with keywords such as "feature," "option," "fix," "issue," and "bug" to extract posts specifically discussing features or problems. A similar approach was applied to Reddit, where we analyzed posts from relevant subreddits identified through prior research. These subreddits included:

- Official Subreddits dedicated to the streaming platforms, where available;
- Popular Alternatives with high user engagement for platforms lacking official subreddits;
- Subreddits focused on devices frequently used to access streaming services (e.g., smart TVs and streaming devices) to capture device-related user experiences.

In total, **73,214 posts** were extracted across the four platforms. These included app store reviews and social media posts, with replies on Twitter and Reddit counting toward the total. Table 1 summarizes the number of posts extracted per streaming service and social media platform. The last two rows are discussed in the next subsections.

Table 1: Statistics of Extracted, Cleaned and Relevant Posts.

Streaming Service	Social Media Platform (i)				Total
	iTunes	Google Play	Twitter	Reddit	
ACL Player	NA	NA	69	428	497
Gas Digital Network	52	NA	64	99	215
Itaú Cultural Play	5	3000	300	4	3309
RTP Play	15	199	1029	6157	7400
Netflix	1013	3000	2222	6636	12871
(HBO) Max	302	3000	1838	5432	10572
Hulu	1004	3000	1845	3032	8881
Prime Video	1008	3000	1492	4440	9940
Peacock	1008	3000	1788	3343	9139
Disney Plus	1008	3000	1109	5251	10368
Total Extracted	5415	21199	11756	34822	73214
Cleaned Total	5413	14230	11706	34819	66168
Classified Relevant (N_i)	2591	8623	2888	8745	22847

3.2 Preprocessing

We standardized the data formats and ensured uniformity across datasets using the following steps:

1. **Date Formatting:** Unified all date formats to "month day year time" (e.g., "May 01 2023

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04:43:01");

2. **Column Standardization:** Harmonized column names across datasets and removed irrelevant columns;
3. **Data Concatenation**: Merged titles and feedback text into a single string for iTunes and Reddit datasets, following a similar approach as (Oehri and Guzman, 2020).

Further data cleaning involved:

1. **Null and Duplicate Removal:** Eliminated null content, duplicate entries, and bot-generated content. The latter was primarily identified through explicit self-declarations (e.g., posts containing the phrase "I am a bot");
2. **Keyword and Content Filtering:** Removed extra whitespaces, unnecessary keywords, markdown tags, and content from official accounts;
3. **Connect Tweets with Their Replies:** Linked tweets with their replies to facilitate conversation analysis.

To standardize text and prepare it for classification models, we performed the following text processing steps:

1. **Text Normalization:** Converted text to lowercase and removed special characters;
2. **URL Replacement:** Replaced URLS with the marker *_link_*, as recommended by (Guzman et al., 2017);
3. **Word and Abbreviation Expansion:** Expanded contractions (e.g., "couldn't" to "could not") using a list of common English contractions[1] (McIlroy et al., 2016). Futhermore, replaced common abbreviations (e.g., "op" to "original poster") to improve readability and understanding;
4. **Verb Tense Identification:** Following (Tizard et al., 2019) and (Maalej et al., 2016a), we analyzed verb tense to understand the temporal nature of user feedback. Past tense often indicates reported experiences (e.g., bugs), while future tense frequently highlights feature requests or hypothetical scenarios. We used the Python library `nltk` to identify verb tenses by tokenizing sentences and applying a POS tagger. For composite future tenses and irregular verbs, we implemented manual rules, and for non-English posts, we translated them into English using `googletrans`. Out of 66,168 posts, 5,795 were non-English and translated for analysis. Additionally, for posts with multiple sentences, we calculated the ratio of past, present, and future tenses to gain insights into temporal patterns of user feedback;
5. **Sentiment Analysis:** We employed the `PySentiStr` library with the SentiStrength algorithm to perform sentiment analysis, discerning polarity (positive, negative, neutral) in user feedback. Sentiment polarity provides insights into user satisfaction, with negative sentiment often highlighting bugs or complaints, and positive sentiment indicating praise or successful features. Following (Villarroel et al., 2016), we averaged sentiment scores for each author's posts and systematically removed negations to improve accuracy;
6. **Typo Correction:** To address typos in social media posts, we used the `SpellChecker` library, verifying posts are in English before applying corrections. While this improves text accuracy, it is not flawless due to context-dependent errors, such as confusing "loose" with "lose."

After these processing steps, we obtained refined datasets that were ready for further analysis, totaling **66,168 posts** (second row from the bottom in Table 1).

3.3 Classification

To prepare the data for supervised classification, we manually labeled a statistical sample of 1% of the dataset (picking a random sample of 1% of the posts extracted from each social media platform). Posts were marked as relevant or irrelevant based on their potential utility to the industrial partner. Posts were considered relevant if they discussed features, bugs, or user experiences and excluded if they solely focused on content (e.g., specific shows).

We trained and tested classification models using supervised learning to predict the relevance of posts, with the target variable being "relevant." We used various algorithms, including DT, RF, SVM, NB, and MNB, alongside preprocessing techniques like stopword removal, stemming, and lemmatization. We selected widely used algorithms based on their prevalence in the literature and proven effectiveness.

For tokenization, stemming, and lemmatization, we used the `nltk` library. Feature engineering involved TfidfVectorizer, CountVectorizer (CV), post length, and word/sentence embeddings (Word2Vec, FastText, SBERT, USE). We tested models under different data balance scenarios using SMOTE, `GridSearchCV`, and `RandomSearch` for hyperparameter tuning and evaluated performance using metrics like precision (P), recall (R), F1-measure (F), accuracy (A), and area under the curve (AUC).

[1]https://www.yourdictionary.com/articles/contractions-correctly

The original scraped data, detailed variations, and corresponding results can be found in GitHub[2].

We selected the best model for each social media platform by comprehensively analyzing the values of F1-measure, accuracy, and AUC. Based on these metrics, we identified the combination of the model and technique that produced the best results. It is essential to acknowledge that our results might be subject to biases, such as overfitting, and that real-world performance could be lower than the training results due to these factors. Table 2 showcases the algorithms (models and techniques) chosen to predict the relevance of posts on each social media platform.

Table 2: Best Supervised Learning Algorithm per Platform.

Platform (i)	Algorithm	P_i	R_i	F_i	A_i	AUC_i
iTunes	SVM+CV+SMOTE	.80	1.00	.89	.91	.96
Google Play	RF+CV+SMOTE	.90	.90	.90	.86	.90
Reddit	NB+USE	.65	.57	.60	.76	.81
Twitter	NB+CV+SMOTE	.60	.67	.63	.78	.81

The last row in Table 1 summarizes the number of posts classified as (potentially) relevant from the cleaned dataset, totalling **22,847** posts.

Since we use distinct models for distinct datasets, the overall precision (P) and recall (R) for the union of the datasets can be calculated based on the number of retrieved instances from each dataset (N_i) and the precision (P_i) and recall (R_i) of each model, as follows:

$$P = \frac{\sum N_i \cdot P_i}{\sum N_i} \quad R = \frac{\sum N_i \cdot P_i}{\sum N_i \cdot P_i / R_i}$$

Using the precision (P_i) and recall (R_i) metrics from Table 2 and the number of retrieved instances (N_i) from Table 1, we estimate the **overall precision and recall of our classification models for the combined dataset as 75.5% and 74.2%, respectively**.

3.4 Summarization

Summarization condenses individual posts to highlight their key points, simplifying the visualization of user feedback. This enables stakeholders to quickly identify critical information, such as bugs, feature requests, or user experiences, without reading lengthy texts.

To achieve this, we adopted an LLM-based approach using GPT-3.5 Turbo via the OpenAI API[3]. The summarization was performed using the following prompt, which was refined over several iterations (where `text` represents the input to be summarized):

```
prompt = f"Concisely summarize this feedback,
capturing its main idea: '{text}'. Maintain the
original language style; avoid third-person.
Keep it under 20 words."
```

GPT-3.5 Turbo was chosen because it demonstrated superior performance compared to traditional summarization methods like TextRank, T5, and LexRank, and provided a better cost-benefit ratio compared to other LLMs. Table 3 shows that it achieved significantly higher ROUGE (Recall-Oriented Understudy for Gisting Evaluation)[4] scores for precision and recall across all metrics.

Table 3: Evaluation of Summarization Algorithms.

	ROUGE-1		ROUGE-2		ROUGE-L		ROUGE-Lsum	
Algorithm	P	R	P	R	P	R	P	R
Spacy	.24	.40	.14	.22	.21	.35	.21	.35
Pegasus	.26	.34	.13	.18	.24	.30	.24	.30
XLNet	.37	.37	.20	.21	.35	.34	.35	.34
GPT2	.37	.37	.20	.21	.35	.34	.35	.34
Txtai	**.40**	.42	**.23**	.23	**.36**	.37	**.36**	.37
SumBasic	.32	.59	.16	.32	.27	.51	.27	.51
TextRank	.31	.66	.18	.38	.27	.57	.27	.57
LexRank	.34	**.67**	.20	**.39**	.30	**.58**	.30	**.58**
BART	.37	.59	.22	.35	.33	.53	.33	.53
T5	.39	.58	.24	.35	.35	.51	.35	.51
GPT-3.5 Turbo	**.81**	**.84**	**.76**	**.80**	**.80**	**.83**	**.80**	**.83**

3.5 Clustering

Given the large number of user feedback posts, clustering is important to organize user feedback into thematic groups, revealing critical trends and recurring issues. This helps stakeholders identify high-priority topics, such as frequently reported bugs or common feature requests. By grouping similar posts, clustering improves data visualization and facilitates more efficient analysis of large datasets.

We initially experimented with DBSCAN and K-Means clustering methods, leveraging Principal Component Analysis, but these approaches did not produce optimal results. Consequently, we developed two custom algorithms inspired by ROUGE, prioritizing sentence similarity to group posts effectively.

The first algorithm assigns each post to the most semantically similar cluster using cosine similarity on sentence embeddings. A post is assigned to the cluster with the highest similarity, provided it exceeds a threshold of 0.7—determined experimentally by testing a selection of posts from the dataset to ensure coherent initial clusters reflecting underlying themes.

The second algorithm iteratively refines these clusters by re-evaluating post assignments. If a post has a higher similarity to another cluster (above a threshold of 0.5, also determined experimentally), it is

[2]https://tinyurl.com/yrhd4k68

[3]https://platform.openai.com/

[4]https://huggingface.co/spaces/evaluate-metric/rouge

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reassigned. This process, involving threshold-driven reassignment and finite iteration, maintains stability and convergence, ultimately enhancing the overall clustering quality.

We used GPT-3.5 Turbo to generate titles for each cluster, in order to improve visualization. The prompt crafted was:

```
prompt = f"Suggest a suitable title for this
cluster of user complaints or feedback:{text}"
```

With this approach, the 22,847 posts classified as relevant in our dataset were grouped into **1,184 clusters**, with an average of **19.3 posts per cluster**. This represents a significant reduction in the number of top-level items that require user attention. However, as this number remains substantial, the filtering and sorting features of our interactive platform, detailed in the next section, are crucial in helping users focus on the most relevant content.

4 FROM PROCESSED FEEDBACK TO ACTIONABLE ISSUES

To enable users to visualize feedback data generated by the processing workflow described in the previous section and transform it into actionable issues, we developed a web-based application comprising three main components: a PostgreSQL database for storing processed data, a Vue.js frontend for user interaction, and a FastAPI backend to facilitate communication between the database and the client.

4.1 Dashboard Page

The application landing page features a **Dashboard** for navigating feedback collections at various processing stages (Figure 2):

- **Suggested Feedback:** Contains all new and unreviewed feedback. Users can evaluate these posts for relevance and either move them to **Accepted Feedback** or **Deleted Feedback**. Filtering and sorting features help prioritise contents to review.
- **Accepted Feedback:** Includes posts reviewed and deemed relevant. Users can create issues from these posts or reclassify them as irrelevant, moving them to **Deleted Feedback**.
- **Deleted Feedback:** Contains posts marked as irrelevant, which users can still reclassify as relevant and move to **Accepted Feedback**.
- **Exported Feedback:** An archive of all posts that have been converted into issues, including links to their corresponding GitLab issues.

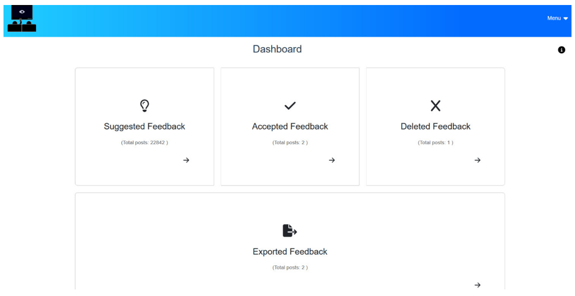
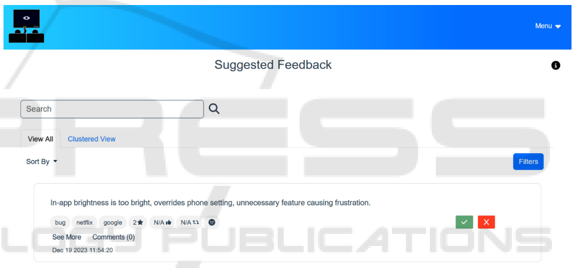


Figure 2: Dashboard Page.

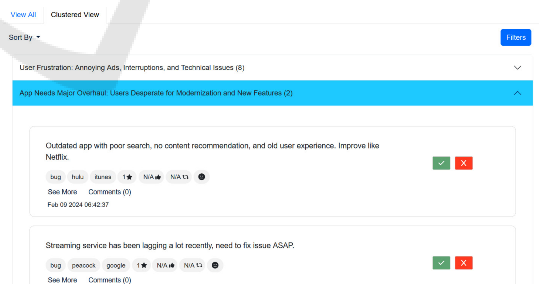
4.2 Accepting or Deleting Suggested Feedback

The **Suggested Feedback** page presents unseen feedback in two views: *View All*, which lists all posts (Figure 3), and *Clustered View*, which groups posts into clusters (Figure 4). Each post is displayed in a card format, containing a summary and details such as category, streaming service, social media source, rating, likes, reposts, sentiment, and comments.



In-app brightness is too bright, overrides phone setting, unnecessary feature causing frustration.

Figure 3: Suggested Feedback Page (Normal View).



User Frustration: Annoying Ads, Interruptions, and Technical Issues (8)

App Needs Major Overhaul: Users Desperate for Modernization and New Features (2)

Outdated app with poor search, no content recommendation, and old user experience. Improve like Netflix.

Streaming service has been lagging a lot recently, need to fix issue ASAP.

Figure 4: Suggested Feedback Page (Clustered View).

Users can classify posts as relevant or irrelevant using the green check and red cross buttons on each card. The user is prompted to confirm the category of posts marked as relevant (“Bug Report,” “Feature Request” or “User Experience”), a feature inspired by (Villarroel et al., 2016), and indicate the reason for marking posts as irrelevant (“Already Solved,” “Repeated” or “Out of Scope”), to improve the system’s classification accuracy. Posts are then moved to **Ac-**

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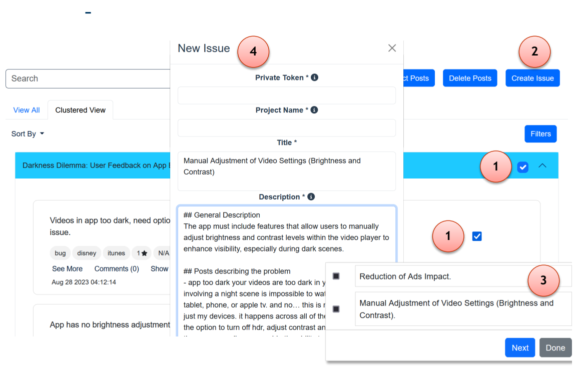

Private Token *

Project Name *

Title *
Manual Adjustment of Video Settings (Brightness and Contrast)

Description *
General Description
The app must include features that allow users to manually adjust brightness and contrast levels within the video player to enhance visibility, especially during dark scenes.

Posts describing the problem
- app too dark your videos are too dark in y
involving a night scene is impossible to wat
tablet, phone, or apple tv. and no… this is r
just my devices. it happens across all of the
the option to turn off hdr, adjust contrast an

Darkness Dilemma: User Feedback on App

Videos in app too dark, need optio
issue.

Aug 28 2023 04:12:14

App has no brightness adjustment

Reduction of Ads Impact.

Manual Adjustment of Video Settings (Brightness and Contrast).

Figure 5: Example of Issue Creation.

cepted or **Deleted Feedback** based on the user input.

To enhance navigation, users can search, filter, and sort posts. The search bar allows keyword searches within post text, while filters enable refinement by date range, category, sentiment, social media, and streaming service. Sorting options include date, sentiment, rating, likes, comments, reposts, and a default criteria prioritizing negative sentiment.

4.3 Generating Issues from Accepted Feedback

The **Accepted Feedback** page offers two visualization options, akin to the **Suggested Feedback** Page, but a different set of actions.

To generate one or more issues (new features, bug fixes, etc.) based on a single post or a group of related posts, the user has to perform the following steps (Figure 5):

1. Select complete clusters or individual posts as the source for the new issue(s), using the check mark on each post or cluster;
2. Press the "Create Issue" button and choose the exportation method – via an issue-tracking system API (currently GitLab) or as a CSV file;
3. Select one or more candidate requirements from a list suggested by the platform with the help of GPT-3.5 Turbo (based on the selected posts);
4. For each requirement selected in the previous step, review the suggested issue description (title, description, acceptance criteria, etc.) generated by the system with the help of GPT-3.5 Turbo and confirm exportation.

This way, users can combine multiple options into a single issue or create multiple issues from one or more posts, allowing flexibility in issue management

The system-generated form for issue creation contains fields for `Title` and `Description`, and additional fields like `Private Token`, `Project Name`, `Labels`, and `Due Date` when connecting to GitLab. The application suggests content for the first two fields, using Markdown templates[5] tailored for different post categories (*bug*, *feature*, or *user experience*). *Bug* templates explain the bug and the expected behavior, while *feature* templates include user stories and tasks. Furthermore, the full text of the selected post(s) and general description and acceptance criteria generated by the GPT-3.5 Turbo prompt are included in both templates to provide additional context for developers.

In summary, our platform improves upon existing solutions by analyzing feedback from multiple social media platforms, offering advanced filtering and sorting, and enabling issue generation and export to an issue tracking system (GitLab).

5 EVALUATION

Since the performance of the classification and summarization algorithms used in our approach was already presented in Section 3, this section focuses only on the user studies carried out to evaluate our interactive platform (described in Section 4) using two complementary methods:

- **User Feedback Evaluation:** Conducted through a structured usability and relevance questionnaire, along with qualitative discussions, involving 13 employees of the industrial partner;
- **Performance in Use Evaluation:** Monitored platform usage by an employee from the industrial partner specialized in requirement engineering to assess relevance identification and issue creation processes in different scenarios.

5.1 User Feedback

5.1.1 Design

This evaluation aimed to capture diverse perspectives on usability and relevance, employing:

- **Demographics Survey:** Collected participants' roles, tenure, and interaction frequency with user feedback to contextualize their responses;
- **Usability Questionnaire:** Participants rated 10 statements of the standard System Usability Scale (SUS) questionnaire (Brooke, 1996) on a 5-point Likert scale ("Strongly Disagree" to "Strongly Agree");

[5]https://tinyurl.com/md-templates

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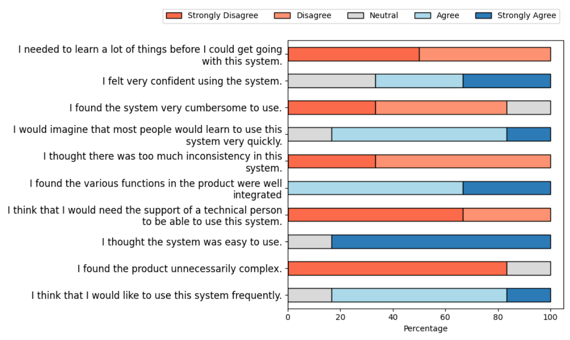

Figure 6: Platform Usability Survey Results.

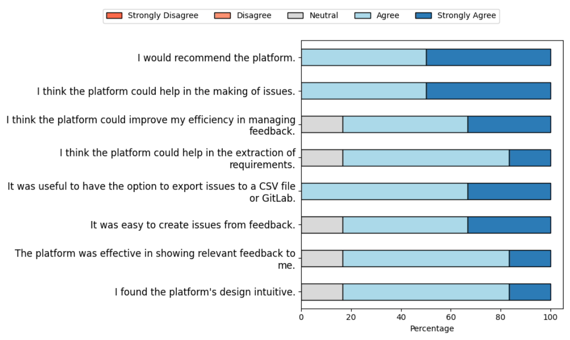

Figure 7: Platform Relevance Survey Results.

- **Relevance Questionnaire:** Used a similar 5-point Likert scale to measure participants' perceptions of platform relevance and features.

5.1.2 Execution

Thirteen participants were selected by the industrial partner based on their interaction with user feedback and experience in roles related to RE or customer interaction, including:

- Four participants with managerial roles: Chief Marketing Officer (1 year experience), VP of Digital Strategy (over 2 years experience), Sales Manager (2 years experience), and Sales Director (2 years experience);
- Nine participants with technical roles: five Software Developers (varied tenure), two Communication Specialists (1 and 2 years experience), and two Designers (1 and 3 years experience).

Participants were given a hands-on demonstration of the platform in an interactive workshop, allowing them to explore its features before completing the questionnaire.

5.1.3 Results

Demographics. We received responses from 6 participants. Regarding the frequency of interacting with user feedback, we used a 5-point Likert scale, where 1 means "Never" and 5 means "Very Often". The responses were equally distributed between 3, 4 and 5.

Usability. Figure 6 displays participant responses to the usability questionnaire. The platform achieved a SUS score of 83.3, categorizing it as Good according to established benchmarks (Bangor et al., 2009).

Relevance. Figure 7 displays participant responses to the platform relevance questionnaire. Relevance was assessed through positive statements evaluated on a 5-point Likert scale. Scores were averaged for each statement, with all items scoring 3 ("Agree") or higher. Statements on the platform's helpfulness in creating issues and recommendation likelihood scored the highest, averaging 3.2.

5.1.4 Discussion

Participants consistently rated the platform highly, underscoring its potential to streamline feedback management and issue creation processes. Qualitative feedback highlighted:

- **Strengths:** Effective aggregation of user feedback, actionable insights, intuitive interface, and potential for use in other domains;
- **Improvement Suggestions:** Enhanced correlation between feedback and platform changes, expanded audience segmentation, and features to analyze feedback trends over time.

5.2 Performance in Use

5.2.1 Design

We conducted three experiments with a RE expert to evaluate the platform's ability to identify relevant posts and generate actionable issues. More specifically, the objectives were as follows:

1. **Objective 1:** Assess the platform's impact on productivity;
2. **Objective 2:** Assess the effectiveness of the platform's sorting and filtering mechanisms for prioritizing relevant posts.

   The participant was tasked with:

- Reviewing posts on the **Suggested Feedback** page and classifying them as relevant or not;
- Creating issues from relevant posts using the **Accepted Feedback** page, leveraging the **Clustered View** to assess clustering effectiveness.

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Each experiment targeted different sets of posts:

- **Experiment 1:** Posts related to streaming services that utilize the industrial partner's platform;
- **Experiment 2:** The top 100 posts related to all streaming services, sorted by "Default Sort" (negative sentiment and descending likes);
- **Experiment 3:** 100 randomly selected posts related to all streaming services.

5.2.2 Results

The main results of these experiments are summarized in Table 4.

Table 4: Results of Platform Usage Experiments.

Dataset	Posts Analyzed	Posts Accepted	Precision (Relevance)	Issues Created	Duration (approx.)
1. Filtered set	55	47	85.4%	24	35 min
2. Top 100 sorted	100	89	89.0%	47	80 min
3. Random sample	100	68	68.0%	42	60 min

5.2.3 Discussion

Objective 1. Regarding the impact on **productivity**, the results demonstrate the potential for a significant reduction in the time required to process user feedback with our platform as compared to a manual process. In an initial feasibility study, we manually collected and classified hundreds of social media posts, creating detailed issues for some of the posts deemed relevant. The manual process required 2–3 minutes per post for collection and classification, plus an additional 8–10 minutes to create an issue for each relevant post. With only about a third of posts classified as relevant, this amounts to **14–19 minutes per generated issue in a manual process** — an order of magnitude higher than the times observed with our platform in the 3 experiments, with **1.4-1.7 minutes per generated issue with our platform**.

Objective 2. The **effectiveness of the platform's sorting and filtering mechanisms for prioritizing relevant posts** is demonstrated by comparing the percentage of posts accepted as relevant in experiments 1 (85.4%) and 2 (89.9%) to the baseline in experiment 3 (68.0%). Experiment 3 used a random selection of posts, while in experiment 2 posts were sorted by negative sentiment and the number of likes (default sorting criteria), yielding **21% more relevant posts than the baseline**. Experiment 1 used a filtered collection of posts, focusing on the streaming services of greatest interest for our industrial partner, yielding **19.4% more relevant posts than the baseline**.

The user found the application intuitive and particularly useful in creating issues and providing a clear overview of feedback. The user also used the platform to create issues from clusters and manually grouped posts that addressed similar topics but used different terminology, a task the clustering algorithm could not accomplish due to its reliance on sentence similarity. This highlighted a limitation in the algorithm, which lacks the context awareness needed to group semantically related but differently phrased posts. Addressing this requires models capable of deeper semantic understanding, such as LLMs, which can capture contextual relationships beyond surface-level wording.

Overall, the experiments demonstrated the platform's ability to efficiently identify relevant posts and generate actionable issues. However, future studies should focus on evaluating the quality of generated issues and developer satisfaction to ensure that issue trackers are not overwhelmed.

6 LIMITATIONS AND THREATS TO VALIDITY

While the platform has shown promising results in aggregating and visualizing social media feedback, some limitations and threats to the validity of our research should be acknowledged.

6.1 Platform Limitations

- **Contextual Understanding:** The current clustering algorithm relies on sentence similarity, which can miss posts that are contextually related but use different terminology. This limitation affects the precision of issue clustering and may require the integration of more advanced models like LLMs to improve context-awareness;
- **Domain-Specific Adaptation:** Although the platform is modular, adapting it to new domains requires modifications to data extraction scripts. This could pose challenges in domains with highly specialized or nuanced terminology;
- **Longitudinal Impact:** The platform's impact over extended periods has not been fully evaluated. Long-term studies are needed to understand how continuous use affects feedback management and product development processes;
- **Cost and Dependence on Proprietary APIs:** The platform uses GPT-3.5 Turbo for summarization and issue generation, enhancing automation but raising concerns about cost and reliance on proprietary technology. Future work aims to explore open-source LLMs and optimize API usage with caching and batching strategies.

6.2 Threats to Validity

- **Construct Validity:** The classification and clustering metrics used in our evaluation are standard in natural language processing. However, these metrics may not perfectly reflect the relevance or usefulness of the results to stakeholders. Incorporating qualitative feedback from users into future evaluations could provide a more holistic view;
- **External Validity:** The datasets used in our study were sourced from a specific set of social media platforms (e.g., Reddit, Twitter) and may not generalize to other feedback sources. Exploring other platforms and data types is essential for validating the platform's scalability and versatility;
- **Bias in Data Selection:** While we aimed to gather diverse feedback, the data collection process may inadvertently introduce bias. For example, some posts may have been excluded due to platform restrictions, potentially skewing the results;
- **Temporal Validity:** The platform was evaluated over a short timeframe, limiting the ability to study its long-term impact on the industrial partner's workflows. Metrics on real-world improvements, such as productivity gains or changes in decision-making processes, remain unmeasured. Long-term evaluations are necessary to assess the platform's sustained utility in industrial settings.

By addressing these limitations and threats, future research can improve the robustness of the platform while deepening our understanding of its long-term impact on RE practices.

7 CONCLUSIONS

This paper presented an approach and platform designed to leverage social media for gathering user feedback, offering stakeholders an intuitive visualization tool to interpret and act on this feedback. Validated through collaboration with an industry partner in the streaming domain, the platform demonstrated its potential to streamline feedback management, enhance decision-making, and provide actionable insights.

Key contributions of this work include:

- **Industry Evaluation:** The platform has been evaluated in a real-world industry context, offering insights into its practical utility and adaptability. This study contributes a focused exploration of integrating indirect social media feedback into actionable workflows, with direct stakeholder feedback affirming its relevance;
- **Automated Social Media Feedback Processing:** The platform automates data extraction across multiple social media platforms, utilizing innovative techniques such as LLM-based summarization and custom clustering algorithms. This approach enhances efficiency and scalability, aligning with but extending beyond traditional methods found in the literature;
- **Integrated Feedback Visualization, Issue Creation, and Requirement Suggestion:** Our platform integrates data aggregation, and actionable workflows, enabling stakeholders to move seamlessly from feedback interpretation to task implementation. It suggests requirements and acceptance criteria, directly aiding issue creation in tools like GitLab. This end-to-end approach represents a significant step toward bridging the gap between feedback collection and practical implementation;
- **Indirect Feedback Acquisition:** This platform captures user feedback on various streaming applications by searching for posts referencing products rather than requiring users to directly engage with specific accounts. This method provides a comprehensive view of multiple related products on the market, providing insights that traditional academic approaches often overlook.

The results of this work highlight the potential of leveraging social media as a scalable source of indirect feedback for requirements engineering. By demonstrating how automation and visualization can transform unstructured user posts into actionable insights, the study contributes to the growing body of research on data-driven and crowd-based RE.

Our findings suggest that platforms like ours can complement traditional feedback channels by integrating broader user perspectives from public discussions, which is particularly valuable for market-driven development. The platform's features, such as integrated issue creation and requirement suggestions, show promise for reducing cognitive load and improving team productivity.

Future enhancements include improving classification and clustering algorithms, adding post-refresh options, user notifications, and adapting the platform to other domains. Thanks to its modular design, adapting the platform requires only redefining search parameters to collect domain-specific data. Once configured, the platform follows standardized processing steps to analyze relevant user posts and extract actionable requirements, regardless of the application domain. Initially applied to a streaming platform, the methodology is scalable and generalizable to other industries where social media feedback is available.

Long-term studies are required to assess the platform's impact on feedback management and product development through qualitative user feedback analysis and usability testing.

In conclusion, this work addresses the need for automated, scalable tools to interpret social media feedback, enhancing the RE process and helping stakeholders meet evolving user expectations. Its contributions to integrating feedback workflows into issue management tools and expanding feedback sources highlight its relevance in dynamic software development environments.

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