

# **Real-time monitoring of social media sentiment for detecting operational incidents in banking**

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## **Problem Analysis**

According to the Basel Committee on Banking Supervision (2001), operational risks for banks are defined as "the risk of direct or indirect loss resulting from inadequate or failed internal processes, people, and systems or from external events". Managing operational risks is challenging due to its complex nature, which requires supervision on all organisational functions and business activities within a bank (Eceiza et al., 2020).

Traditionally, banks emphasised governance to address operational risks. They not only used "operational-risk capital models and risk-control self assessments (RCSAs)" to determine their exposure to these risks, but also developed rigorous "controls and control-testing procedures" (Eceiza et al., 2020). Nonetheless, reputational and financial losses have remained high (Eceiza et al., 2020). Huber & Funaro (2018) stated that operational incidents cost large banks about \$210 billion from 2011 to 2016, primarily as a result of poor client interactions and process management. This demonstrates that these procedures are insufficient and ineffective to address operational risks. With technological advancement and the development of more complicated products, operational risks become a pressing concern for the banking sector (Hong Kong Monetary Organization, 2022).

Banks may consider analysing client inquiries and complaints in addition to their internal controls to identify operational risks and incidents. Due to the rise of social media and the perception that customer services provided by banks are often inadequate or incompetent, customers now prefer to express their concerns and frustrations on social media platforms rather than directly contacting banks (Blanco, 2022). For instance, in December 2022, furious consumers bombarded Standard Chartered's Facebook page with complaints about unauthorised credit card transactions (Ma, 2022). As a result, this poses a significant problem as banks may miss out on valuable information and fail to address and respond to customer sentiment expressed on social media platforms promptly if they are unaware of the importance of social media as a source of customer feedback. Without a comprehensive system in place to monitor and analyse social media sentiment in real-time, operational incidents may go undiscovered until they are too significant to be resolved, leading to potential reputational damage and customer dissatisfaction.

## **Solution**

The incline in operational incidents and need for timely response calls for the adoption of real-time and data-driven solutions in operational risk management (Eceiza et al., 2020). Our group proposes a social media monitoring system that leverages real-time monitoring and NLP sentiment analysis of social media data mentioning banks in order to detect abnormal activity.

The system is composed of three main functions - (1) Real-time social media web scraping, (2) sentiment analysis, (3) automated dashboard and alert system.

### ***Real-time social media web scraping***

The system will scrap local social media platforms such as Facebook groups and LIHKG. The system will access the social media platforms and extra relevant data elements using tools for parsing HTML documents and web scraping spiders. Then, the scraped data will be preprocessed and undergo mutation to a suitable format for further analysis.

### ***Sentiment analysis***

The preprocessed data will then undergo categorisation and sentiment analysis. This project aims to explore various machine learning models to develop a sentiment analysis model which can accurately interpret a mix of Chinese, Cantonese, “Martian Language”<sup>1</sup>, English, and emojis.

### ***Automated dashboard and alert system***

The dashboard and alert system is a front-end system for banks and banking regulators to view insights and trends of social media mentions of banks.

Moreover, an alert system which will flag anomalies can be implemented to notify relevant parties of abnormal social media behaviour, such as sudden influx of negative comments, to trigger investigation to mitigate potential incidents in a timely manner.

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<sup>1</sup> “Martian Language”, also known as 外星文, is the unconventional portrayal of Chinese or Cantonese words using alphabets representing the pronunciation.

## **Methodology**

The initial stage of this project is twofold to formulate the final deliverables with Python and its libraries. First, all comments made between 1 Jan 2021 and 31 Aug 2023 from the official FaceBook pages of Hong Kong four major banks: HSBC, Bank of China, Standard Chartered, Hang Seng Bank will be sourced as raw data. Whereas on LIHKG, the threads with bank names and/or nicknames included in the headings will too be extracted. All data should at least includes dates of comment, textual comments, emojis and frequency of multimedia attachments, such as static and animated images, will be collected. Secondly, a list of incidents incurred within the same timeframe will be summarised, consisting of change in stock price, appearance in headlines of both positive and negative news and other related updates of those banks. These historical data become the foundation of the sentiment analysis and the alert system.

The next project stage is data pre-processing, until all features are reviewed and organised. For comments in text, several NLP models will handle their respective language contexts to then be categorised by classes. In such cases, unsupervised machine learning models like clustering will be implemented. Similarly, emojis will be classified to the same labels with existing libraries. Frequency of multimedia appearance will also be incorporated into the analysis. Once the data is ready, sentiment analysis and correlation analysis between the incident dates and various data features will be conducted, to unveil any hidden relationships.

After obtaining correlation metrics and once the relationship is evidently significant, appropriate machine learning models like Naive Bayes classifier and regression will then be formulated to give ratings. Splitted into training and testing sets, the algorithm can be trained as the back-end of the alerting system and an accuracy score can be referenced in the project. Graphical presentation will be utilised to highlight and visualise anomalies. Finally, the machine learning model should be able to generate cut-offs of the rating system, for suggesting necessary follow-up actions and spotlight anomalies if needed.

Towards the final phase of the project, the implementation will be updated to monitor the designated social media platforms. While scraping the new comments online, it shall be capable of updating ratings at the end of the day. By integrating all functionalities, the dashboard will visualise the ratings of all banks and alert users the particular irregularity.

## Schedule

In addition to weekly internal catch-up meetings on Fridays, actions items are listed below:

#	Deadline	Action Items
1	13 Oct 2023	Raw data collection
2	27 Oct 2023	First stage of data pre-processing: sentiment analysis on textual content with NLP models
3	3 Nov	Second stage of data pre-processing: remaining data types and cleansing of datasets
4	10 Nov	Completion on data pre-processing and classification
5	24 Nov	Correlation Analysis
6	22 Dec 2024	Interim result: discoveries from #5 and preparation of first presentation
7*	8-12 Jan 2024	First presentation
8	15 Jan 2024	Preparation of Phase 2 deliverables: <ol style="list-style-type: none"><li>1. Draft of interim report</li><li>2. Format preparation of preliminary implementation</li></ol>

9*	21 Jan 2024	Phase 2 deliverables:  1. Preliminary implementation  2. Interim report
10	23 Feb 2024	Construction of alerting system with machine learning model
11	1 Mar 2024	Training and testing for better accuracy
12	22 Mar 2024	Dashboard integration
13	1 Apr 2024	Draft of final presentation
14	8 Apr 2024	Draft of final report
15*	15-19 Apr 2024	Final presentation
16*	23 Apr 2024	Phase 3 deliverables:  1. Finalised tested implementation  2. Final report
17*	26 Apr 2024	Project exhibition

\* marked official deadline posted in Moodle

## List of Deliverables

<b>Deliverable</b>	<b>Description</b>	<b>Schedule</b>
Preprocessed and annotated dataset	A clean dataset of social media posts from LIHKG and FaceBook related to banks	10 Nov
Machine learning model	Developed a machine learning model capable of accurately classifying social media posts into different sentiment categories.	24 Nov
Social media monitoring system	Demo of a potential application of the system by a hypothetical bank	23 Feb
Final report	–	23 Apr
Exhibition Materials	–	26 Apr

## References

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