How to Interpret an Economic Index?
Generating Reports with Topic Sentiment Analysis

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Abstract—This paper presents our ongoing work on generating a monthly economic report to enhance the interpretability of a news-based business sentiment index. In our previous work, we developed a framework to provide a timely and quantitative measure of economic confidence. However, it lacked clarity on the underlying factors influencing the index values. To tackle the issue, we propose a topic-centered summarization approach which explains key events and trends during a specified period. Preliminary experiments show a promising result, producing a concise and comprehensive summary of the economic situation.

Keywords-topic analysis; summarization; large language models; sentiment analysis.

I. INTRODUCTION

A Business Sentiment Index (BSI) provides a quantitative measure of business confidence in the current/future economic climate. Traditionally, BSIs are derived from surveys conducted across various sectors. However, these survey-based methods often suffer from high costs and delays, limiting their utility for real-time economic analysis.

To address these challenges, our previous work [1] developed a framework that automatically nowcasts a monthly BSI using online news articles. While this approach showed strong correlation with a traditional survey-based index and offered significant improvements in timeliness and cost-efficiency, it lacked interpretability. Specifically, understanding why a particular index value, such as "BSI=0.26," was obtained remained unclear.

To bridge this gap, we propose a framework that generates an economic report to explain the factors behind the BSI values. Our method leverages topic and sentiment analyses and a two-step text summarization to analyze and synthesize relevant economic events from news articles. A preliminary experiment on October 2024's news articles demonstrated promising results, producing a concise and comprehensive summary of the economic situation for the given period.

The remainder of this paper is organized as follows: Section II describes our proposed approach, while Section III presents the empirical results. Finally, Section IV concludes with a summary and future directions.

II. METHODS

For generating monthly economic reports, we take advantage of the news articles we have been collecting on the Web to compute the business sentiment index. As a pilot study, we propose the following two-stage summarization framework.

```
The following news sentences belong to the same topic
according to the results of topic analysis. The number at the
end of each sentence indicates its impact on the economy.
Please generate an appropriate and concise label for each
topic, and then summarize approximately three key points that
are particularly important from the perspective of economic
impact.

Output in JSON format following the structure below.

### Output Format
{
  "label" : "Topic Label",
  "points" : [
    "A sentence describing a key point",
    "A sentence describing a key point",
    "A sentence describing a key point",
  ]
}

### News Sentences
- 1st news sentence (sentiment score)
- 2nd news sentence (sentiment score)
- ...
- n-th  news sentence (sentiment score)
```

Figure 1. First prompt to generate a topic summary.

1) Data Preparation: Compile the news fragments (sentences) for a selected month, each assigned a business sentiment score using a fine-tuned Bidirectional Encoder Representations from Transformers (BERT) regressor [1]. The news articles were collected in advance from the Sankei Newspaper website.

2) Topic Identification: Apply the neural topic model, FASTopic [2], to identify k latent topics in the news data.

3) Topic-Based Summarization: For each topic,

   a) Identify n sentences with the highest absolute topic-sentiment scores, computed as $s_i \cdot p(t|d_i)$, where s_i is the sentiment score for sentence d_i, t is a topic, and $p(t|d_i)$ is the sentence-topic distribution from FASTopic.

   b) Generate its descriptive label and three-point summary based on the n sentences, using a Large Language Model (LLM). Specifically, we utilize Generative Pretrained Transformer 4-omni (GPT-4o) mini through the OpenAI Application Programming Interface (API). Figure 1 shows the English-translated prompt.

4) Overall Summarization: Combine the k topic labels and summaries to generate an overall monthly summary using GPT-4o mini with a prompt shown in Figure 2.
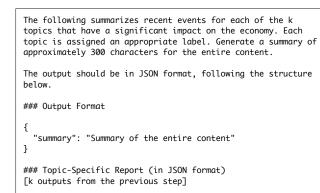
```
The following summarizes recent events for each of the k
topics that have a significant impact on the economy. Each
topic is assigned an appropriate label. Generate a summary of
approximately 300 characters for the entire content.

The output should be in JSON format, following the structure
below.

### Output Format

{
  "summary": "Summary of the entire content"
}

### Topic-Specific Report (in JSON format)
[k outputs from the previous step]
```

Figure 2. Second prompt to generate an overall summary.

III. EXPERIMENTS

A. Settings

We set $k = 5$ and $n = 100$ for the number of topics and selected sentences per topic, respectively. For the document embedding model used by the FASTopic model, we adopted "paraphrase-multilingual-mpnet-base-v2". Sankei news articles (in Japanese) from October 2024 were used as the input document set, with prompts (Figures 1 and 2) modified to generate English output. For reference, this month's news-based BSI is -0.17.

B. Results

The proposed framework identified the five topics with 100 news sentences per topic. The results were concatenated to the prompt in Figure 1 and were passed to the LLM. The following shows the generated labels for the topics, where the numbers in the parentheses indicate the topic-sentiment distribution, defined as the expected value of topic-sentiment $s \cdot p(t|d)$ over all documents D, i.e., $\mathbb{E}_{d_i}[s_i \cdot p(t|d_i)] = \frac{1}{|D|} \sum_i s_i \cdot p(t|d_i)$. The topic-sentiment distribution indicates the overall business sentiment of each topic. Note that the prompt also generated a three-point summary for each topic but omitted here due to the page limitation.

- Crime and Security Issues (-0.64)
- Economic Performance Overview (-0.19)
- Despair and Isolation (-0.41)
- Energy and Infrastructure Development (-0.20)
- Security and Geopolitical Tension (-0.58)

These outputs were then concatenated to the second prompt in Figure 2 and were given to the LLM, generating the following summary explaining the underlying factors of the month's BSI:

Recent events have revealed a troubling intersection of crime, economic performance, and geopolitical tensions affecting public sentiment. Rising violent crime and failures in police oversight have heightened societal fears, while economic data shows strong sales juxtaposed with declining consumer confidence due to rising costs. Alongside this, feelings of despair and isolation are on the rise, impacting mental health and productivity. In the face of mounting energy demands

driven by digital advancements, there's a pressing need for sustainable infrastructure, notably nuclear power, despite the historical challenges faced. Finally, Japan's complex security environment calls for robust foreign policies as geopolitical tensions escalate, particularly due to the implications of Russia's actions and China's assertiveness, threatening both regional and global stability.

For comparison, we devised a simpler baseline which sent m news sentences with the highest absolute sentiment scores to the LLM without topic sentiment analysis, where we set $m = 500$ such that the same number of sentences as our framework were considered. The baseline summary is as follows:

The news articles present a mixed picture regarding economic impacts. On one hand, some reports indicate a significant increase in consumer activity and investment, such as in advertising and sales of certain products, along with a strong recovery in tourism from abroad. Conversely, there are alarming signs of economic decline, with a dramatic rise in bankruptcies, particularly among small businesses, and growing concerns over rising costs and declining consumer confidence. Overall, while some sectors appear to thrive, many are struggling under pressures of financial instability and societal challenges.

The baseline produced a concise but narrower economic overview, focusing on immediate trends. In contrast, our approach by design offered a more comprehensive analysis, incorporating societal, geopolitical, and infrastructural factors. Together with the three-point summary for each topic (not shown), our report would be particularly valuable for stakeholders seeking a holistic perspective on economic conditions.

IV. CONCLUSIONS AND FUTURE WORK

This paper presented a framework for generating concise yet comprehensive economic reports to enhance the interpretability of a news-based business sentiment index [1]. By integrating topic sentiment analysis with LLM-based text generation, our two-step summarization approach produced more comprehensive summaries compared to a simpler, one-step method. Preliminary experiments demonstrated the potential of this approach in capturing diverse factors influencing economic sentiment, offering valuable insights for policymakers and analysts.

In future work, the proposed framework will be integrated into our web-based business sentiment nowcasting system.[1]

REFERENCES

[1] K. Seki, Y. Ikuta, and Y. Matsubayashi, "News-based business sentiment and its properties as an economic index," *Information Processing & Management*, vol. 59, no. 2, Article 102795, 2022, Article No. 456.

[2] X. Wu, T. T. Nguyen, D. C. Zhang, W. Y. Wang, and A. T. Luu, "FASTopic: Pretrained transformer is a fast, adaptive, stable, and transferable topic model," in *Proceedings of the Thirty-eighth Annual Conference on Neural Information Processing Systems*, 2024.

[1] https://sapir.apir.or.jp