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TB - LLMs for Hotel Booking Bots

Specifications

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1. Context

Tripla is an international technology company based in Japan that provides SaaS (Software as a Service) solutions for the travel industry. Their solutions help businesses in the hospitality sector reduce staff workload, streamline operations, and improve guest satisfaction. They simplify the process of booking a hotel, making payments, and facilitating communication between hotels and customers.

One of Tripla's services is called TriplaBot. It allows customers to ask queries about a hotel through a chatbot in one of Tripla's four supported languages: Japanese, English, Korean, and Chinese. This service enables customers to receive faster responses and reduces the customer support workload for hotel managers.

A crucial aspect of the chatbot is understanding the user. This includes not only identifying the intent of the current message but also recognizing the user's emotions. Are they irritated or frustrated? Is there an urgent issue? Are they satisfied with their stay? By addressing these questions, the system can better adapt the conversation flow to prevent any negative feelings that could lead to bad reviews or lost sales.

Machine learning and LLM (Large Language Model) technologies have been advancing and are the current focus of many tech companies worldwide. These technologies allow for the gathering and processing of large amounts of data. One application of such technology is sentiment analysis, via text classification models, which extracts the sentiment expressed by the writer from a small portion of text.

The aim of this project is to use machine learning and LLM technologies to process chatbot interactions, starting with sentiment analysis to add sentiment tags to chat traces. Following this, the project will attempt a more comprehensive analysis of entire conversations between users and the chatbot. This analysis will enable Tripla to modify the conversation flow when it detects that a user is dissatisfied with either the hotel services or the chatbot itself. Actions could include connecting the user to a human operator or proposing alternatives to address their issues.



Figure 1 – Tripla's logo

2. Objectives

2.1. Main Objectives

The following objectives are the primary focus of the project:

Objective 1: State-of-the-art sentiment analysis on chatbot traces

This sentiment analysis will add an extra attribute to each message in a chat trace, describing the current feeling of the user. This analysis must be compatible with all four languages in which Tripla offers services. Our initial aim is to optimize result for English and translate messages that are from other languages.

Objective 2: Prototype for analyzing the entire sequence of exchanges in the chatbot

After adding these extra tags to each message, we aim to gain a broader understanding of user interactions. This involves assessing whether the customer is satisfied, whether they might need help, or if they are likely to book the hotel. This analysis will use the sentiment tags from individual chat messages as well as patterns in the sequence of messages (e.g., repetition, similar queries, message length).

2.2. Secondary Objectives

The following objectives will be pursued depending on time constraints and the accuracy of the implementation of the main objectives:

Objective 3: Real-time actions based on chat analysis

We aim to use the results of the second main objective to take actions during chatbot interactions to improve the customer experience if they are not satisfied. We aim to first have a design and possibly an implementation of such actions.

Objective 4: Integration within Tripla's pipeline

If the system provides accurate results, we will proceed with integrating it into Tripla's pipeline.

3. Methodology

The chosen methodology for this project is agile. We will have three main iterations, and with each iteration, we will improve the current system. This choice is based on two main reasons:

- **Risk Management and Uncertainty:** The latter part of the project is more experimental, and it is uncertain whether the results of each step will be accurate enough to be used in the subsequent steps. Using an agile methodology allows us to quickly develop a first prototype and detect possible issues, providing opportunities to find solutions early on.
- **Flexibility:** Agile methodology offers a more open and flexible workflow, especially in the later stages, where we might need to shift our focus to either improving the analysis or designing actions based on this analysis.

The three iterations have the following objectives:

1. By the end of the first iteration, we aim to achieve the first primary objective, which involves developing a sentiment analysis capable of tagging every message in a chat trace.
2. By the end of the second iteration, we plan to have a prototype for the entire chat sequence analysis.
3. The final iteration will focus either on improving the analysis or on designing and possibly implementing actions based on the chat sequence analysis. The content of this iteration will depend on the results of the previous iterations.

4. Tasks

Here are the different tasks required to achieve each objective:

4.1. State-of-the-art sentiment analysis on chatbot traces

- T1.1 : Analyze the type of data available from the chat traces.
- T1.2 : Review the state-of-the-art techniques for sentiment analysis.
- T1.3 Implement a way to manage multiple languages, at first it will be done via a translation to English as it is the language with the most dataset, models, benchmark and documentation available. If needed, other solutions such as multi-language model or a model for each language will be explored.
- T1.4 Compare large multipurpose models such as ChatGPT api or Mistral against smaller model like bert finetuned on a dataset.
- T1.5 Implement the sentiment analysis, firstly on polarity and then using keyword searching / emotion palette extraction. Either use few shots learning or add annotation to existing dataset to train a model on it.
- T1.6 Define evaluation metrics and perform the evaluation. This will probably require to labelise a portion of the dataset manually, for example 100 chats.

4.2. Prototype for analyzing the entire sequence of exchanges in the chatbot

- T2.1 : Analyze the context and needs of Tripla.
- T2.2 : Design the inputs and outputs of the model according to the needs and technical possibilities.
- T2.3 : Prepare the data that will be used to train the model.
- T2.4 : Implement and train a model to provide valuable information about the flow of the conversation.
- T2.5 : Develop a method to evaluate the model and perform the evaluation.
- T2.6 : Iterate to improve the model's results and functionalities. One of the possible ways to improve a model is by finding false negative and false positive with the highest confidence rate and indicating those to the model. Also validate prompts by removing/adding portion of it and seeing changes.

4.3. Secondary Objectives

- T3.1 : Design and implement Real-time based actions according to the analysis
- T4.1 : Implement the result of previous task into Tripla system

4.4. General

- Integrate and collaborate with Tripla's machine learning team.
- Draft and define the project specifications.
- Document the project in a report.

5. Planning

The project spans 10 weeks from May 27, 2024, to August 2, 2024. It is divided into 3 iterations as described in the methodology chapter. Each iteration lasts 3 weeks, with the first one being a week longer to let time to start the project and get used to the new environment. The planning is detailed in the gantt available in figure 2. Here is the list of each milestone. Milestones M1 and M2 are guidelines and might get slightly changed.

- M1 (21.06): Have the prototype for message by message sentiment analysis with code and documentation.
- M2 (12.07): Have a prototype of the model that gather useful information about the customer on an entire chat. Also have a part of documentation done, especially on the analysis part.
- M3 (02.08): Final deadline of the project on the 2nd of August where the final report must be completed as well as the entire code

	27-31.05	3-7.06	10-14.06	17-21.06	24-28.06	1-5.07	8-12.07	15-19.07	22-26.07	29.07-02.08
Analyze available data										
Analyze SotA sentiment analysis										
Adress multilanguages issues										
Sentiment model vs full model										
Implement sentiment analysis										
Evaluation										
Analyze context and needs										
Design inputs/outputs										
Prepare data for inputs										
Implement and train model										
Evaluation										
Iterate										
Sprint 3 (depending on sprint 2 Results)										
Project specifications										
Report redaction										
Milestone				M1			M2			M3

Figure 2 – Gantt diagram