

Aalto University

MS-E2177 - Seminar on Case Studies in Operations Research

Inclus: Project Plan

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1 Background

Our client, Inklus, is a Finnish scaleup that provides SaaS solutions for collaborative risk analysis. Their primary question is “How can generative AI be utilized in participatory risk assessment?” More specifically, Inklus is interested in how large language models (LLMs), such as the GPT-models by OpenAI, could be utilized as part of their services. However, due to the breadth of the question, we will be approaching it in a step-like manner. In this project, our aim is to map out the first steps towards answering Inklus’s primary question by focusing on some subproblems that we assume to be shared across utilizations of potential interest.

To understand the AI’s potential use cases and the related subproblems, it is important to understand Inklus’s product and the data it gathers. Inklus provides a platform for virtual workshops in which a group’s views on risks are elicited and stored. In the workshops, the participants identify a set of risks and then answer questionnaires about the risks. In the questionnaires, participants rate the risks along some predefined set of dimensions (e.g. likelihood, impact, etc.) first numerically and then in writing by answering a question like “Do you want to explain more?” or “What actions could mitigate this risk?”

It should be immediately clear that LLMs offer an enticing solution for handling unstructured data since it can be quite laborious for a human to do. However, the presence of quantitative data poses difficulties for LLMs as they might not be able to properly interpret it or its relation to the qualitative data. Also, LLMs are widely known to “hallucinate” or make up their own facts, might not understand certain questions, or not reliably give output structured according to specifications.

Currently, Inklus’s platform can provide AI-generated summaries of the risks. Our objective is to improve the AI prompting to allow for extensions in the future.

2 Objectives

Inklus has set a high-level goal of using AI to improve the risk management process by being able to predict whether a project will succeed or not based on the associated risk data. This end goal is beyond the scope of our project and we will focus on a subset of this target. To be able to predict the success of a given project, the AI must be able to understand both the quantitative and qualitative data related to the risks of the project.

This project aims to provide recommendations on how quantitative and qualitative risk data should be combined in prompts for the generative AI to ensure that the AI model understands both aspects of the data better. This way we can help the AI to interpret the project risks better. Two main approaches through prompt engineering have currently been determined, 1. by turning all of the numerical data into text and providing a text-only prompt to the LLM, and 2. by using the LLM to turn all of the quantitative data into numerical/categorical data. These are discussed more thoroughly in Section 3.

As a secondary objective, this project aims to provide considerations to avoid AI hallucination. This concept of AI hallucination refers to instances where the used AI model generates outputs that are unfaithful to given data. These outputs can contain incorrect or entirely fabricated information based on the model’s training data and algorithms. Lastly, we will summarise what kind of problems generative AI is most reliable and useful for in terms of Inklus’ risk analysis.

3 Tasks

There are 5 main tasks in this project including a literature review, conducting experiments to find possible solutions for two approaches in constructing AI prompts (to be discussed in detail later), testing and evaluating the validity of results provided by LLM, studying the limitations of our solution and final reporting of our results.

3.1 Literature review

During the literature review step, we should answer the following questions:

- a) How can we prevent LLM from hallucinating results so that it can provide answers based only on the provided input?
- b) How to access the accuracy of the prompts results and what are the possible ways to control or improve them?
- c) How to construct efficient prompts that are not ambiguous for LLM? Here we need to find some advice about formulating prompts: in which format should we send requests, which keywords should be included, and how much context should we provide
- d) Justify that LLM can be used in risk assessment and in which setting.
- e) Study the ways how to get insights from the LLM about textual data (possibly in a quantitative format).

3.2 Construction of LLM prompts

Since our main objective is to study the ways how LLM can be applied during risk assessment, our group decided to concentrate on two different approaches. During the project, we refer to them as “Quantitative to qualitative” and “Qualitative to quantitative”.

3.2.1 Quantitative to qualitative

We will find a way how to construct a prompt with information about project contents (containing risk category, risk name, [risk description], average assessment scores on each criterion, and comments given), so that LLM can interpret the whole project and give insights about it. This will be studied by testing on a benchmark question e.g. “Given information about projects can you provide executive summary and mitigation actions”. Here we should ensure that the hallucination of results is avoided and all analysis by the LLM model is done only based on the provided data.

3.2.2 Qualitative to quantitative

The second approach tries to use LLM as a feature extraction model. We will come up with a set of features that will be insightful about the project and prompt LLM based on the provided text to assess these features. As a possible example, we can provide LLM with a comment from an expert about the project and prompt LLM to assess “positivity,” “negativity,” “criticism,” “uncertainty,” or other sets of features about comments. The output of LLM should be in a structured manner to parse it efficiently and construct a new dataset with quantitative data. Then, based on this quantitative data, we can build a traditional machine-learning model. The task includes studying the limitations of LLM. How can we be sure in the assessment of the LLM about the provided features?

3.3 Testing, limitations, and reporting

This task partially overlaps with the literature review. We will apply expert knowledge from previous papers to properly test our approaches. Once we get all of the results and testing, we will report our findings in a cohesive and clear manner.

4 Schedule

We have agreed to meet up as a team once a week every Friday at 12 pm. Additionally, we will arrange meetings with our client as necessary. The schedule is based on the course plan, which consists of three main goals. We have planned our own targets and goals to stay on schedule.

Task	Details	Week																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Problem research	Familiarizing with the topic																			
	Background research																			
	Setting objectives																			
Implementation	Literature review																			
	Prompt engineering																			
	Solving the objective																			
Testing	Discussing with the client																			
	Testing the model																			
Reporting	Project plan																			
	Interim report																			
	Final report																			

5 Resources

The team consists of five students enrolled in Aalto University's Master's degree program in Systems and Operations Research. Our extensive expertise in optimization and problem-solving is enhanced by proficiency in coding and data analytics, with several students minoring in computer science or data analysis. Each group member is committed to spending time to finish the project.

Inclus provides the group with data from previous projects that can be used for testing. The data is given as an Excel sheet and it can be accessed by all team members. Inclus also provides the group with GPT-license to make inquiries with the given data. All the testing will be done with Python-based programs and all the programs can be run with team members' computers and no further processing power is required.

We will collect literature concerning the project subjects and we will use the collected literature to increase our knowledge base about the project topic.

6 Risks

The possible risks of this project are presented in the table below. The table shows:

- The description of a risk that could impact this project.
- Description of risks affect.
- Risk impact and probability on the scale of low, medium, and high.
- The possible action to prevent the risk from happening.

In summary, these risks have a low probability of realization and most of the risks can be prevented with sufficient planning and commitment from all the team members.

Risk	Effect	Probability	Impact	Prevention
Insufficient scoping	An excessive workload and the client is unhappy about results	Medium	Medium	The team engages in regular meetings with the client and effectively strategizes and plans the project.
Unable to find literature for the project	Not enough justification of the LLM outputs validity. The team does not have enough expertise about the topic.	Medium	High	Try to find sources outside the commonly used platforms
Team member inactivity	Increased workload for other team members	Low	Low	Regular meetings and All team members contribute to every part of the project, if possible
Client stops communicating	Feedback for progress is harder to get	Low	High	Try to maintain active communication through the project and complete all assignments well before the deadline to endure possible communication delays.
Problem with the GPT-server	Testing becomes significantly more difficult	Low	High	Try to complete all tasks well before the deadline so possible delays can be endured
Information under the NDA is leaked to outside parties	Client is harmed and access to their resources can be restricted or the team faces potential legal consequences as specified by the contract	Low	High	Using only Inklus's GPT access point and getting Inklus's approval for presentations that potentially include sensitive data

Table 1: Risk Assessment Table