University *of Ljubljana*
Faculty *of Computer and Information Science*

Integrating Structured Knowledge into Large Language Models

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Abstract

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Keywords
Keyword1, Keyword2, Keyword3 ...

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Introduction

In recent years, Large Language Models (LLMs) have demonstrated remarkable abilities to understand and produce human-like text. However, despite their impressive performance, these models often struggle with tasks that require deep, structured knowledge, such as answering complex questions that rely on precise factual reasoning. Knowledge Graphs (KGs), with their structured representation of entities and relationships, offer a promising solution to this limitation. By integrating the rich, explicit knowledge contained in KGs into LLMs, we can potentially enhance their ability to reason, infer and provide accurate answers to complex queries.

This project aims to explore advanced techniques for integrating structured knowledge in the form of knowledge graphs into LLMs. The primary objective is to evaluate and compare different methods for incorporating KGs, and to assess their effectiveness in improving model performance in complex question-answering tasks. Through this research, we aim to bridge the gap between unstructured textual data and structured knowledge, paving the way for more robust, knowledge-aware language models capable of handling real-world challenges with greater accuracy and reliability.

Methods

Use the Methods section to describe what you did an how you did it – in what way did you prepare the data, what algorithms did you use, how did you test various solutions ... Provide all the required details for a reproduction of your work.

Below are LaTeXexamples of some common elements that you will probably need when writing your report (e.g. figures, equations, lists, code examples ...).

Equations

You can write equations inline, e.g. $\cos\pi = -1$, $E = m \cdot c^2$ and α, or you can include them as separate objects. The Bayes's rule is stated mathematically as:

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}, \tag{1}$$

where A and B are some events. You can also reference it – the equation 1 describes the Bayes's rule.

Lists

We can insert numbered and bullet lists:

1. First item in the list.
2. Second item in the list.
3. Third item in the list.

- First item in the list.
- Second item in the list.
- Third item in the list.

We can use the description environment to define or describe key terms and phrases.

Word What is a word?.

Concept What is a concept?

Idea What is an idea?

Random text

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Figures

You can insert figures that span over the whole page, or over just a single column. The first one, Figure 1, is an example of a figure that spans only across one of the two columns in the report.

On the other hand, Figure 2 is an example of a figure that spans across the whole page (across both columns) of the report.

Tables

Use the table environment to insert tables.

Table 1. Table of grades.

Name		
First name	Last Name	Grade
John	Doe	7.5
Jane	Doe	10
Mike	Smith	8

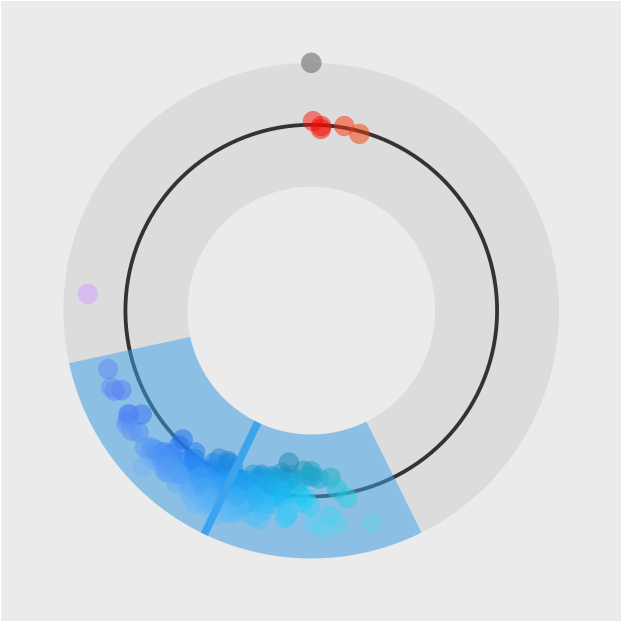

Figure 1. A random visualization. This is an example of a figure that spans only across one of the two columns.

Code examples

You can also insert short code examples. You can specify them manually, or insert a whole file with code. Please avoid inserting long code snippets, advisors will have access to your repositories and can take a look at your code there. If necessary, you can use this technique to insert code (or pseudo code) of short algorithms that are crucial for the understanding of the manuscript.

Listing 1. Insert code directly from a file.

```
import os
import time
import random

fruits = ["apple", "banana", "cherry"]
for x in fruits:
  print(x)
```

Listing 2. Write the code you want to insert.

```
import(dplyr)
import(ggplot)

ggplot(diamonds,
           aes(x=carat, y=price, color=cut)) +
  geom_point() +
  geom_smooth()
```

Results

Use the results section to present the final results of your work. Present the results in a objective and scientific fashion. Use visualisations to convey your results in a clear and efficient manner. When comparing results between various techniques use appropriate statistical methodology.

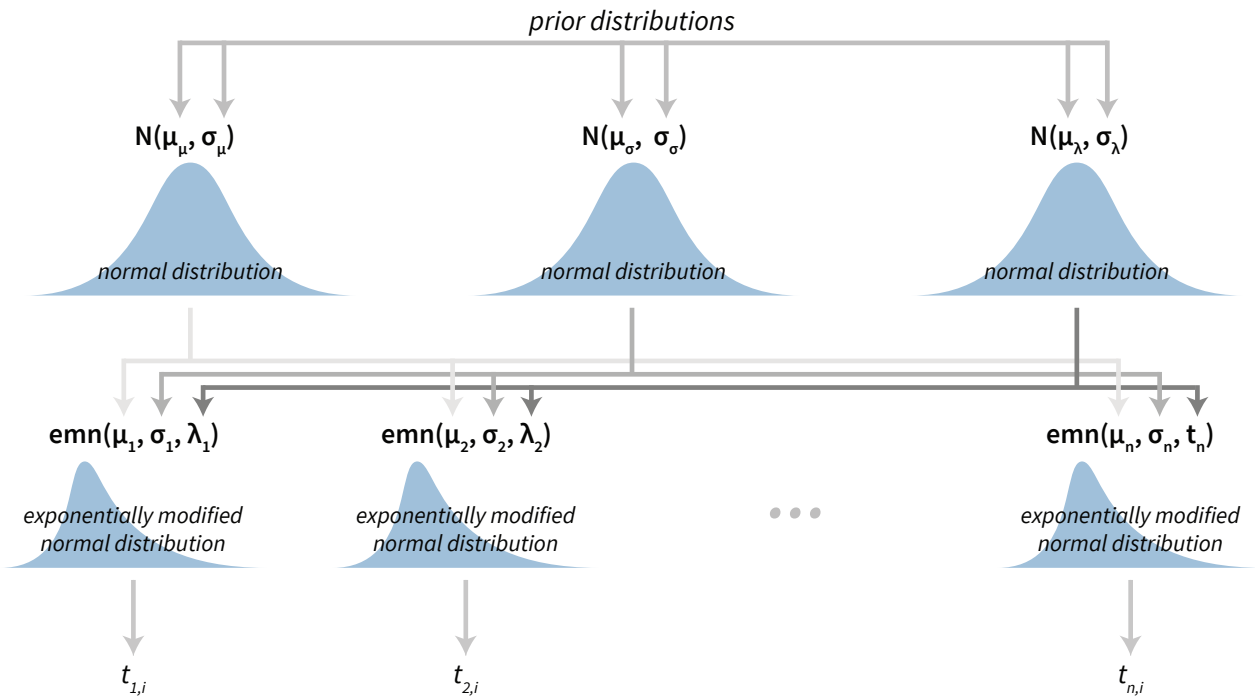

Figure 2. Visualization of a Bayesian hierarchical model. This is an example of a figure that spans the whole width of the report.

More random text

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Discussion

Use the Discussion section to objectively evaluate your work, do not just put praise on everything you did, be critical and exposes flaws and weaknesses of your solution. You can also explain what you would do differently if you would be able to start again and what upgrades could be done on the project in the future.

Acknowledgments

Here you can thank other persons (advisors, colleagues ...) that contributed to the successful completion of your project.

References