Knowledge Graphs with Large Language Models

Assignment 2: Knowledge Graph Population

Introduction

In this assignment you are asked to develop and evaluate an LLM-based relation extractor for the purpose of populating a knowledge graph. The schema of the knowledge graph defines the following relations:

- **cities_of_residence:** relates a person to the cities they currently live or have lived in the past
- **employee_of:** relates a person to the organizations they are currently employees of or have been in the past
- **schools_attended**: relates a person to the schools they are currently attending or have attended in the past.
- **spouse:** relates a person to the persons they are currently married to or have been married to in the past

Task 1 (50%)

Using an LLM of your choice, implement a prompt-based relation classifier that takes as input a sentence and two entities, and determines if and which of the above four relations are true in the sentence. If the input sentence does not express any of these relations the system should return “Unknown”.

Use the provided dataset **relation_extraction_dataset.tsv** (available here) to evaluate the precision and recall of your classifier for each relation. In addition, inspect the errors the system makes and see if you can identify any systematic error patterns.

Important remarks:

- Do not try to fine-tune the LLM with the provided dataset, just use zero-shot or few-shot prompts.
- Experiment with multiple variations of prompts to see what seems to be working best, explaining your thought process. While you will not be graded on how well your final classifier will work, you must demonstrate a thoughtful and reasonable prompt design process.

Task 2 (50%)

Imagine that you present your classifier and its evaluation results to your team and one team member asks you how well your classifier deals with the following phenomena:

- **Uncertainty:** This is when the input sentence expresses the possibility or probability that a relation is true between two entities, without being sure that it is (e.g.: “It is possible that John is an employee of Apple.” or “It's possible that John lived in Palo Alto.”), **In such cases, the classifier should not suggest that this relation holds.**

- **Advice/Wish:** This is when the input sentence expresses the wish or suggestion that a relation is true, without that necessarily being the case (e.g. “It would be nice if John married Jane”). **In such cases, the classifier should not suggest that this relation holds.**

You check your evaluation dataset and you realize that the examples you have do not cover these phenomena. For that, you are asked to do the following:

- Generate a small evaluation dataset, in the same format as the dataset for task 1, for each of the above phenomena and for each relation. 10-15 sentences for each phenomenon and relation should be enough.
- Evaluate the precision and recall of your classifier on this dataset and present your results

Deliverables

- An implementation of your LLM-based relation extractor, either in the form of a Colab notebook or any other way you prefer, with clear instructions on how to run and evaluate it.
- A file with the dataset for task 2, in the same format as the dataset for task 1.
- A report describing the development process of the system as well as its evaluation results on the datasets of task 1 and task 2.