Project: Knowledge Representation (100 points)

CS 6364: Artificial Intelligence

Due date: 4/27/2020 04:00 pm

N.B.: This project has been adapted from Problems 12.5 and 12.6 from the textbook [1]

Introduction and Problem Definition

For this project, you will use the Knowledge Representation paradigm presented in class to create a simple question-answering tool. Specifically, you will design and create a knowledge base in Prover9 or Prolog for shopping at a supermarket. Your mission is to capture, in logical form, enough knowledge to answer a series of questions about this domain.

Read carefully the project statement from 12.5 and 12.6. You can start by trying to represent the content of the sentence as a series of assertions. You should write sentences that have straightforward logical structure (e.g., statements that objects have certain properties, that objects are related in certain ways, that all objects satisfying one property satisfy another). Please refer to the description and examples provided in Problems 12.5 and 12.6 in the textbook to get an understanding of how knowledge is to be represented. You may also consult well-known hierarchies and ontologies like WordNet [2] and FreeBase [3].

Specifically, you will carry out the following tasks.

Task - 1: Design and Create a Knowledge Base (30 points)

Create by hand, a knowledge base, that captures general information about supermarkets. Create about 100 axioms and try to make the axioms as general as possible. You can follow the guidelines and general tips suggested in the problem statement and discussed in class to design your knowledge base. Try to be as creative as possible when you are constructing the knowledge base. Write these axioms in plain English and assess if enough information about supermarkets is captured. Your output for this task should be a list of axioms in plain English.

Task - 2: Convert your KB to First Order Logic (20 points)

Convert the axioms you created in Task 1 into first order logic. Note that if you are using Prolog to design your tool, you will have to convert all your axioms into Horn clauses. If you face difficulty converting your axioms to first order logic, go back to Task 1 and rephrase your axioms.

Task - 3: Question Answering (30 points)

Use either Prover9 or Prolog to design your question-answering system. Test your system on all 15 questions listed in problems 12.5 and 12.6. For evaluation, the TA will assess your system on 5 new questions. These questions will be in the same vein as the ones listed.

We do not expect your system to answer ALL questions correctly. A truly complete system is extremely difficult to design, probably beyond the state of the art of current knowledge representation. However, you should be able to put together a consistent set of axioms to be able to answer some simple questions around the domain.

Task - 4: Report (20 points)

1. Write and submit a report describing your system. Be sure to include your knowledge base description in plain English. Provide suitable justifications and examples wherever necessary. Additionally, also report your tool's performance on some questions that you have used to test your system.

2. A plain text file (or prolog file) containing your KB axioms (outputs of Task 1 and Task 2).

3. A readme file describing how to run your tool.

References

[1] Stuart Russell and Peter Norvig. *Artificial Intelligence: A Modern Approach.* Prentice Hall Press, 2009.

[2] Christiane Fellbaum. *WordNet: An Electronic Lexical Database.* Bradford Books, 1998.

[3] Kurt Bollacker, Colin Evans, Praveen Paritosh, Tim Sturge, and Jamie Taylor. Freebase: a collaboratively created graph database for structuring human knowledge. In *Proceedings of the 2008 ACM SIGMOD international conference on Management of data*, pages 1247–1250, 2008.