Projects for the LAAI course, module I

December 28, 2021

There are two kind of project works for the exam: i) Traditional projects: the students must deliver a solution to a given problem, or to a problem formulated by them, by using Prolog, CLP, MiniZinc, or any other logic based or constraint language. The document produced by the students must contain the code which implements the solution, as well as its description. The overall length of the document should be in the range 3-5 pages, program listings excluded. ii) Research project: the students must deliver a document which contain an analysis of the state of the art in one of the topic listed below, or in any other relevant topic proposed by the student, and should contain also some personal comments and insights (of course, no original scientific results are required). The overall length of the document should be in the range of 5-10 pages.

Both kind of projects can be done in groups. The standard size of a group is three persons.

Each group will have 15 minutes to present and discuss the project, in one the dates announced on Alamesami. The project must be delivered, by using the Virtuale platform, at least one week before the date for the discussion.

1 Traditional projects, Prolog

1. Projects from Bratko book. The Bratko book contains several proposals for projects (explicitly indicated with the keyword "Project" in the text. Select on project, study the related chapter and implement that project.

2. Argumentation model. Argumentation is the discipline of debate and many different models of argumentation have been defined. Typically, arguments can be divided into categories such as premises and claims, and will have relationships between them such as support and attack, or relationships between arguments and other relationships, such as undercuts. Take an existing argumentation scheme used in literature and encode it in Prolog language. Present also examples of knowledge base and queries. You are NOT asked to encode the processing of natural language in Prolog.

Examples of argumentation models can be found in the following papers, but you are free to look at other resources:

- Argument Mining: A Survey by Lawrence and Reed, pages 777-778
- Parsing Argumentation Structures in Persuasive Essays by Stab and Gurevych
- Argument Mining with Structured SVMs and RNNs by Niculae et al.

3. Original project You can propose your own project in Prolog, modeling a problem and implementing a knowledge base and examples of queries. Possible inspiration can be found in Chapter 4 of the Bratko book, which contains examples of interesting applications.

2 Traditional projects, constraints

1. Constraint programming for sustainability. Today companies are requested to satisfy specific KPI connected to SGGs and sustainability, see for example the document at

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https://assets.website-files.com/5ee61e86d8a739006abca943/
608e3f4abe192a44cb0ff762_Archlet%20Sustainability%20White%20Paper.pdf
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for some some sustainability metrics. Provide a parametric tool based on constraint programming which optimize the sustainability KPIs of a company, on the basis of the given metric and of some constraint on the production (for example, the company need to achieve a given profit in the year). Only the constraint based part of the tool is needed (no interfaces and similar fancy hings).

2. Propose a program which solves a coding game puzzle such as

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https://www.codingame.com/training/expert/the-resistance
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Similar puzzles can be considered. The puzzle must be solved by using constraint programming or Prolog.

3. Propose a program which solves one (or more) of the puzzles in https://giochimatematici.unibocconi.it/ d-autunno/170-gli-allenamenti-ai-giochi-d-autunno

4. Original project. You can propose your own project in any constraint based language, modeling a problem and implementing a knowledge base and examples of queries. The problem can be either a CSP or a COP.

3 Research projects

1. Explainable AI. How logic based languages and tools can be used to provide explanations for the behaviour of AI systems.

2. Integration of symbolic and sub-symbolic computation methods. Both systems (composed of separate modules) and new languages (which integrate the two models) can be considered.

3. Logic based languages for modelling law and legal reasoning.

4. Green AI. How constraint based tools can be used for sustainability and for achieving the SSG objectives.

5. Application of constraint programming for SDN and 5G.

6. You can propose your own research topic, provided it is connected to logic or constraint based languages.