University of Essex Online

MSc Artificial Intelligence

Knowledge Representation and Reasoning

End of Module Assessment: Individual Reflection

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Reflection of Module

Introduction

The Knowledge Representation and Reasoning (KRR) module has significantly shaped my understanding of how knowledge and reasoning can be put from an abstract concept into a computable model that can be used by systems and services like artificial intelligence (AI). While I previously associated AI mainly with data-driven methods and approaches, this module introduced me to the world of symbolic reasoning and highlighted the importance of modelling knowledge through the use of classes, constraints, relationships, and interconnected networks of information. KRR requires a deep understanding of the underlying data and its context. It is a tool that gives information "life" by adding explainability, precision, and structure to it (Brachman and Levesque, 2004).

What?

The module covered key theoretical and practical topics including semantic networks, frame-based systems, rule-based systems, and ontologies. The most impactful component for me was the modelling assignment, where I built an OWL ontology in Protégé for a job-matching system. This hands-on experience clarified how formal logic translates into actual system design, helping me grasp the usefulness of domain modelling in representing complex relationships.
In particular, designing class hierarchies, object and data properties, and constraints such as cardinality or disjointness allowed me to simulate intelligent behaviour. By incorporating reasoning mechanisms within Protégé, I observed how new knowledge can be inferred automatically from explicitly stated facts. For example, if a candidate

had a skill within a subclass, the system could deduce relevance to a broader job category by using this information and the underlying ontology built.

Weekly readings and discussions strengthened my understanding of symbolic logic and its role in artificial intelligence. In Units 4 and 5, exploring logic programming and FOL challenged me to think formally. I found this area to be especially intellectually demanding but ultimately rewarding. Tools like Prolog introduced a different programming paradigm that emphasized declarative over procedural logic (Genesereth and Nilsson, 1987). The weekly tasks and seminar discussions also contributed significantly. I think the main learning point was to understand the difference between knowledge-based systems and data-driven systems, which helped me avoid confusion between ontologies and statistical models.

So what?

At first, I was overwhelmed by the ontology theories, the mathematical notations, and the sheer amount of information I had to process to understand what ontologies are, how they function, why we use them, and especially how to design them from scratch. Emotionally, I oscillated between frustration and fulfilment. I initially found the logical syntax difficult to master. However, this cognitive discomfort made me more persistent in deepening my understanding and gradually overcoming the initial complexity.

The use of Protégé allowed me to move from abstract understanding to practical implementation, which in turn deepened my theoretical comprehension by giving me

something tangible to explore and interact with. However, I also noticed limitations in usability and automation. Ontology engineering still feels manual and unnecessarily complex at times, despite its conceptual power (Blomqvist et al., 2012). I began to wonder how much of this process could be streamlined, possibly through integration with large language models or pattern-mining techniques, an area that is gaining traction in recent research (Santos et al., 2023).

Professionally, this has shifted my understanding of AI from being purely data-centric to something more hybrid. I now realize that data is only one part of the equation. Understanding data and getting from data to knowledge by implementing ontology is a key factor.

Now what?

This module has significantly shifted how I approach AI in my professional context. Until now, my focus has been almost entirely on machine learning and pattern recognition using data. I rarely considered how structured knowledge or ontologies could enhance these solutions. However, through this module, I've come to see the value of symbolic reasoning particularly as a complementary component in hybrid AI systems that require interpretability and semantic depth.

Moving forward, I will actively consider ontology design as part of my toolkit when developing intelligent systems. In fact, I already see potential use cases in current projects I'm involved in for example, in improving metadata governance, aligning business processes, or enabling more meaningful search and automation. Bringing

knowledge representation into those conversations could open up entirely new approaches.

In the short term, I plan to develop my Protégé-based ontology into a functional prototype and continue exploring the broader field of ontology engineering. More importantly, I intend to actively incorporate this knowledge into my professional work by keeping ontology-based approaches in mind whenever new information-driven projects arise.

References

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