Reflective Report – Knowledge Representation and Reasoning Module

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Modul4: Knowledge Representation and Reasoning

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WHAT

Reflecting on the Knowledge Representation and Reasoning (KRR) module, one of the most valuable outcomes was building an ontology in Protégé for a job-matching use case. Initially, the idea of ontology seemed abstract and theoretical. But over time, and particularly during hands-on sessions with Protégé, it became clearer how deeply practical it could be in solving real-world AI problems.

One defining experience was when I attempted to model an individual (Paul) who had multiple overlapping classifications. This resulted in the reasoner returning owl:Nothing for several DL queries. That specific incident stuck with me – because I'd spent hours trying to figure out why none of my queries worked. It was frustrating but incredibly educational. That confusion forced me to dig into the logic of ontologies, disjoint classes, and domain/range errors in a way that no textbook could replicate. It made the importance of modelling choices and logical consistency starkly clear.

At the beginning of the module, I underestimated the complexity of formal knowledge representation. I assumed that a few class hierarchies and object properties would suffice. But as I delved deeper, especially during testing and debugging in Protégé, I realised how fragile and interconnected the ontology structure really is. One modelling error can trigger a cascade of reasoning failures.

SO WHAT

The incident with misclassifying individuals—specifically assigning Paul to conflicting classes—highlighted a fundamental point: ontology design is not just about naming concepts; it's about representing knowledge with logical precision. I had to go back and correct types, adjust domains and ranges, and reclassify instances like MasterDegree_Ind from Skill to EducationExperience. That process showed me the power of semantic reasoning—and how unforgiving it can be if the foundations aren't right.

It also forced me to engage more critically with the design principles behind ontology engineering. I learned how important it is to get the basics right: domain and range assignments, class hierarchies, disjointness, and object properties. During DL query testing, I had to revise the logic behind rules like "JobSeeker and hasSkill min 2

Skill", which didn't return results until I discovered that the individuals weren't typed properly or the property assertions were incorrect.

This hands-on challenge taught me more than any lecture could. It pushed me to refine not just my ontology but also my thinking. I became more attentive to detail, more sceptical of assumptions, and more capable of debugging semantic logic. These are not just academic skills; they're vital in AI-driven domains where reasoning accuracy is paramount.

Moreover, the late introduction of Protégé was a limitation. I truly believe that starting the module with Protégé in the first or second week would have allowed more time for iterative experimentation and deeper understanding. By the time I gained a grasp of its full capabilities—including DL reasoning, SWRL rules, OntoGraf, and SPARQL—I was already under time pressure. I hope that in future modules I can explore these capabilities more extensively, possibly applying them to my dissertation or other AI research.

NOW WHAT

Moving forward, I plan to use what I've learned not only in academic settings but in real-world applications. The awareness of how fragile and vital clear ontology structure is will stay with me. I now see how formal knowledge representation can support Natural Language Processing and AI model alignment. My goal is to incorporate ontology-based reasoning in prompt engineering, especially for structured semantic understanding in LLMs. This experience has sparked my interest in using OWL ontologies and SPARQL in NLP tasks.

In terms of skill development, this module pushed me to improve my IT literacy, time management (especially under pressure), and critical thinking. There were moments when I felt stuck, and it would've been easy to give up. But reflecting now, I can say that persistence and curiosity were the two traits that helped me pull through. I learned not just about DL syntax or class modelling, but about troubleshooting, iteration, and keeping focus when things don't work out immediately.

Throughout the group discussions and the tutor's feedback helped me to clarify misconceptions about ontology structuring.

My intention is to use OWL ontologies and the Protégé tool to my dissertation project for the final module, where I intend to explore the use of NLP and LLM techniques in financial model risk management and internal control frameworks.

From a professional development standpoint, this experience helped me understand how to document and structure a formal logic system from the ground up. That's a key skill in AI governance, model explainability, and risk mitigation. In my current role and future projects, I'll apply this structured thinking to ensure data, logic, and outputs remain verifiable and coherent.

CONCLUSION

This module has fundamentally changed the way I approach knowledge representation. I now see that building ontologies is not just about building a model—it's about constructing a logic-based language that machines can understand and reason with. Mistakes in that structure have real consequences, as I experienced firsthand. But those mistakes were also my greatest teacher.

I'm grateful that we were introduced to Protégé, even if late in the module. It's a tool I'll continue using. I hope to bring what I've learned into more advanced AI applications and contribute to more explainable, structured systems. If there's one key insight I'm taking away, it's this: formalism matters—not just for correctness, but for clarity, scalability, and ultimately for trust in AI.

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