

Enabling Infrastructure Subsystems Integration via Agentic Ontology Engineering

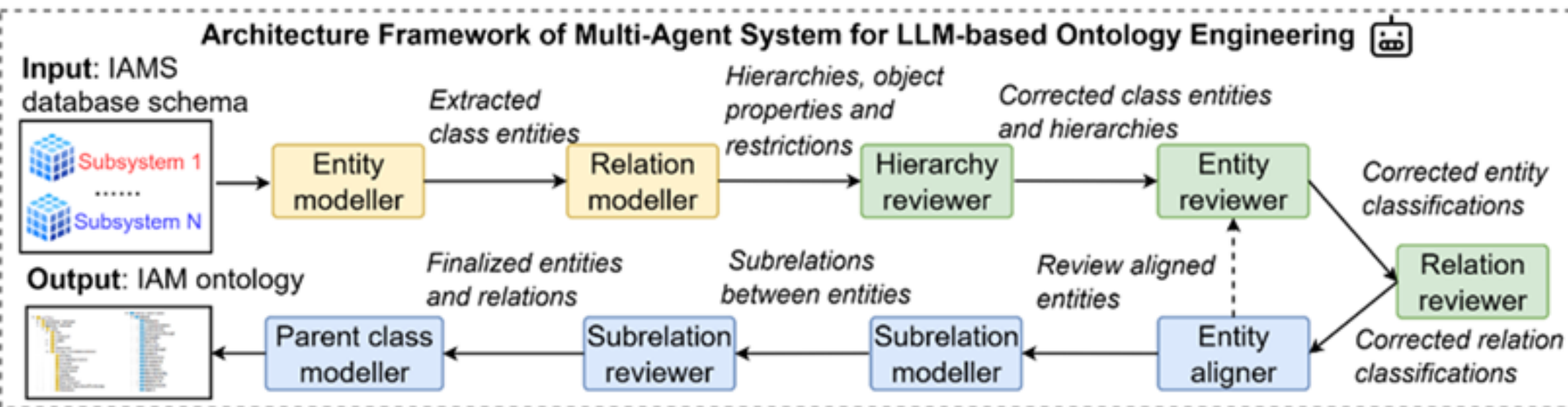
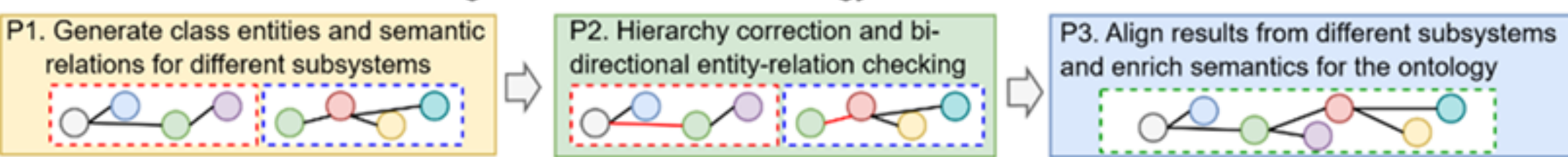
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Introduction

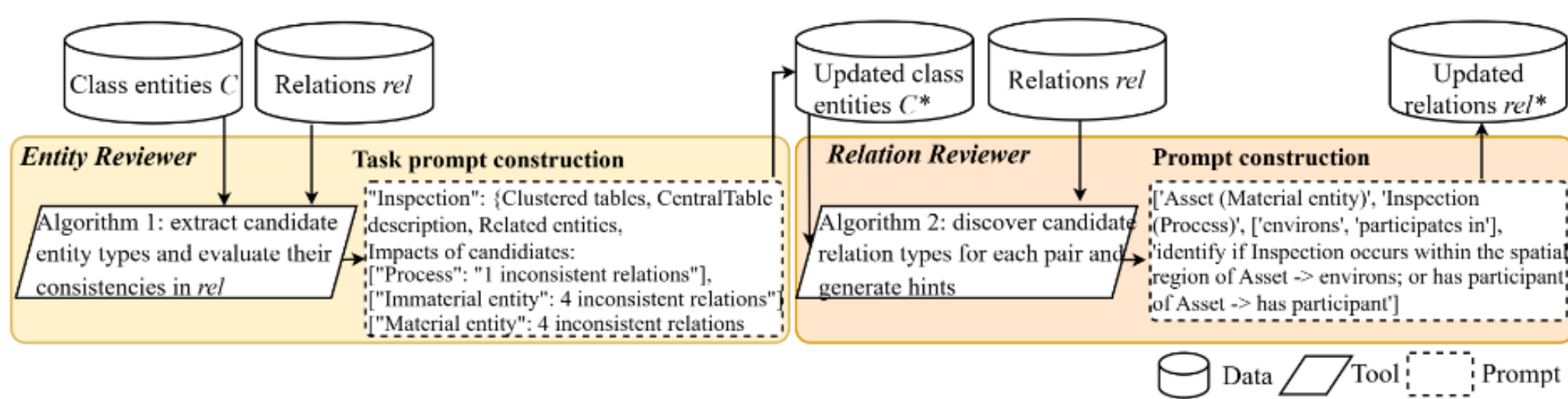
Fragmentation of infrastructure information systems hinders effective data integration and maintenance decision-making. This study proposes an agentic ontology engineering (AOE) framework that leverages multi-agent large language models to automatically construct organisational ontologies from heterogeneous infrastructure asset databases. The approach extracts entities, hierarchies, relations, and logical constraints, aligns concepts across subsystems, and performs automated semantic validation to ensure consistency and interoperability. Evaluations on real-world database schemas demonstrate that the method significantly reduces manual knowledge-engineering effort while producing high-quality ontologies that support integrated decision-making.

Agentic Ontology Engineering Workflow

Agentic AI-based IAM Ontology Construction Process

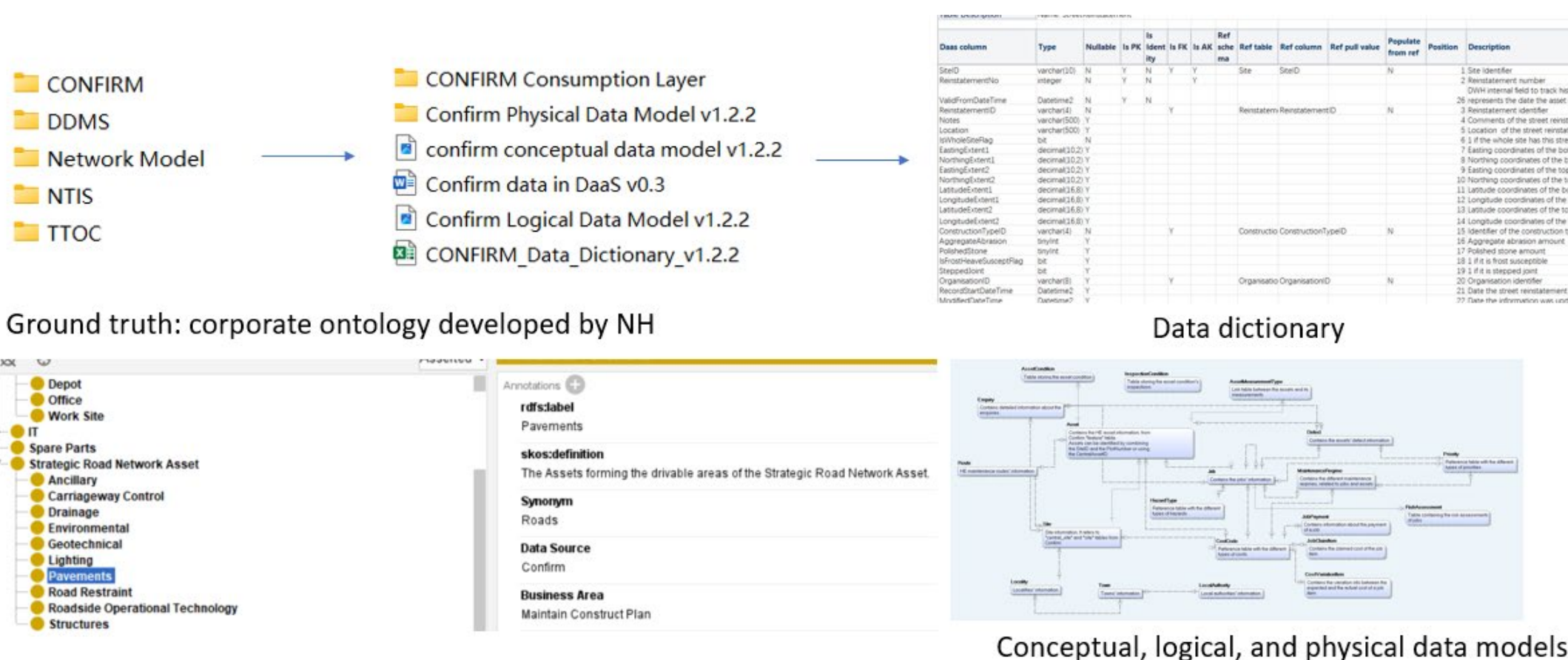


Agentic ontology engineering (AOE) framework

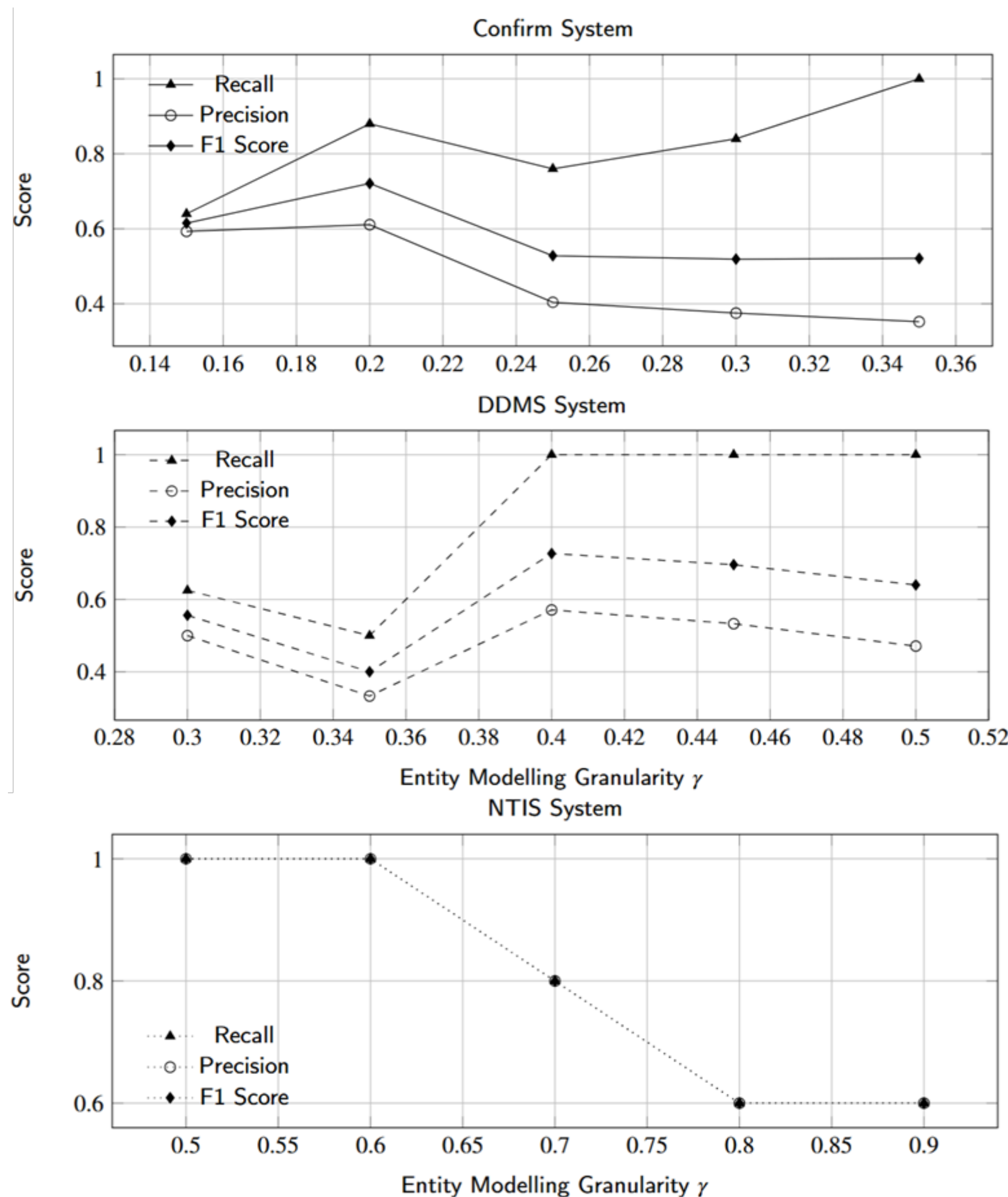


Bidirectional entity-relation checking and semantic correction.

Performance Evaluation



Experiment Results



What next?

- Optimising multi-agent architecture design
- Integrating more domain ontologies
- Developing graph-based data models and instance population mechanisms for Digital Twin applications

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