Proposal

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1 Abstract

We propose a two-stage ontology mapping approach that combines DragonAI and BERTMap to improve alignment quality and efficiency. In this design, DragonAI serves as a retrieval-augmented LLM for completing and enriching incomplete ontology data by inferring likely synonyms, semantic relationships, and parent links. The enhanced data is then processed through BERTMap, which applies structure-aware graph matching to generate reliable mappings across ontologies. This pipeline aims to improve recall and contextual accuracy while reducing manual intervention and ensuring consistent, reproducible results.

2 Objectives

- Achieve high-precision, high-recall, along with confidence intervals.
- Use RAG to enrich only where evidence is weak, then constrain search space before BERTMap.
- Support 1→N mappings when granularity differs, with principled adjudication and coherence checks.

3 Pipeline Overview and Reasoning

3.1 DragonAI (RAG)

- To handle edge cases (missing data in SNOMED, FMA) and make a more generalized pipeline.
- Use Vector DB to facilitate RAG approach.
- Use LLM (fine-tuned or otherwise) to impute missing data.

3.2 Candidate-set generation and Pre-cleaning

- Initial lexical top-k and/or embedding top-k, interleaved for diversity.
- Pre-clean to drop disjoint/type-incompatible candidates following approaches similar to BERTMap.

3.3 Matching Score

- Generate the source-target mapping probability score for each pair using BERTMap.

3.4 Thresholding

- Keep top matches with either top-n or probability threshold for all pair mapping.
- This is especially the case for probability scores like $(L_s : L_{t1} : 0.51, L_s : L_{t2} : 0.50)$

3.5 Sanity-Check

- Use LLM to generate context on scores, use the gold standard data to find the accuracy/other metrics.
- Check for clear mismatches in the bioregistry.

4 Pipeline Flowchart

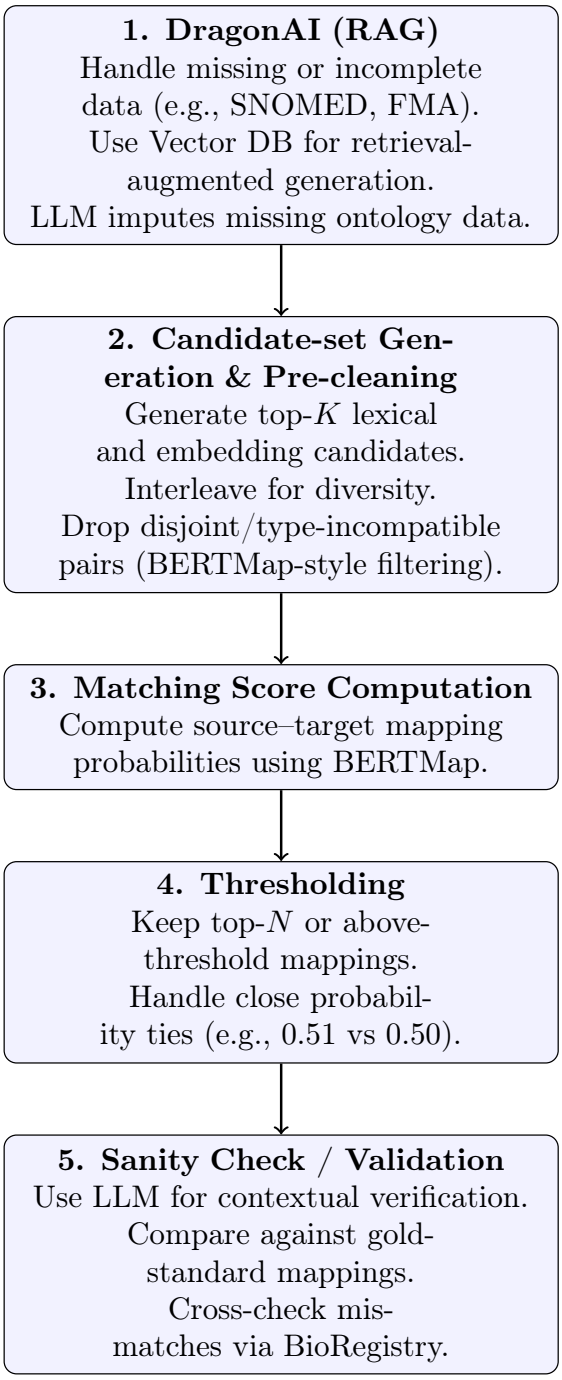

Figure 1: Overview of the hybrid DragonAI–BERTMap pipeline showing data completion, candidate generation, scoring, thresholding, and LLM-assisted validation.

5 Evaluation Plan

Gold sets: standard ontology mapping benchmarks (e.g., OAEI tracks relevant to the chosen domains) and a hand-labeled development set tailored to the target ontologies.
Confidence Interval Primary metrics: P@1, R@1/3, F1, and accuracy.
Secondary: count of new unsatisfiable classes and cycles after reasoning; expert acceptance rate for 1→N mappings.

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