Formal Explanations for LLM-Based Schema Matching

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Large Language Models (LLMs) have shown strong performance on schema matching [4], the task of discovering semantic correspondences between elements of different schemas, even when only element names and descriptions are available [2]. They can also justify their decisions in natural language, but such explanations are informal: their correctness cannot be checked automatically and must be judged by domain experts [1].

Building on our earlier work [3], we ask the LLM to ground each match decision in a *formal explanation expression*: a logical combination of similarity predicates capturing syntactic and semantic relationships between schema metadata. Because these expressions are executable, correspondences can be verified automatically: a correspondence is accepted only if the LLM predicts a match *and* its explanation evaluates to true. The expressions also give humans concise, standardized artefacts to inspect.

Across nine benchmarks and three LLMs, we find that (i) asking for formal explanations matches or improves matching accuracy; (ii) the explanations are compact and largely valid; and (iii) enforcing verification involves a trade-off between the number of matches retained and the guarantees offered for them. Finally, the LLM cannot be replaced by a simple rule over the valid predicates: its value lies in selecting which combinations of them make a convincing explanation.

References

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