Step-wise Explanations for Constraint Solving

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Abstract:

Many real-world applications benefit from the use of constraint solving techniques to support decision making for complex problems, ranging from scheduling nurses' shifts in a hospital to scheduling jobs to be performed on machines in a factory.

By building a model-based representation of these constraint satisfaction problems (CSPs), AI practitioners harness the power of highly efficient solvers.

Advances in constraint solving techniques and hardware improvements allow such systems to consider many alternatives in a short period of time.

However, this complex reasoning makes it increasingly difficult to understand why certain decisions are made.

In this thesis, we decompose the process of explaining the maximal consequence (solution) of a constraint satisfaction problem into a sequence of inference steps.

Each explanation of an inference step should aim to be as simple as possible for a human to understand.

We propose using a metric to estimate the difficulty of an explanation, and address how to generate explanations that are optimal (easy) with respect to that metric.

However, we do not currently know how to characterise what is the most helpful explanation is for a user.

Therefore, we investigate how to learn the explanation preferences directly from users and incorporate them into our explanation generation algorithms.

Our findings show that we are able to stepwise explain the maximal consequence of a constraint satisfaction problem by providing at each step the most helpful explanation for a user.