Combining LSTMs and Symbolic Approaches for Robust Plan Recognition

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Motivation

- Recent approaches to goal and plan recognition have improved performance under partial and noisy observability, however, dealing with these problems remains a challenge.
- Recent work on goal and plan recognition use machine learning to assist planning-based approaches in modeling domains.
- We develop a novel approach to solve plan recognition tasks by combining planning and machine learning techniques to mitigate problems of low and faulty observability.

Predictive Plan Recognition (PPR)

- We solve the plan recognition problem by computing a sequence of intermediary states achieved by a plan π.
- We develop an algorithm capable of rebuilding the sequence of states induced by a plan by iterating through the sequence of observations and filling in any gaps due to partial observability.
- We use an LSTM and landmark heuristics to predict the most likely next state.

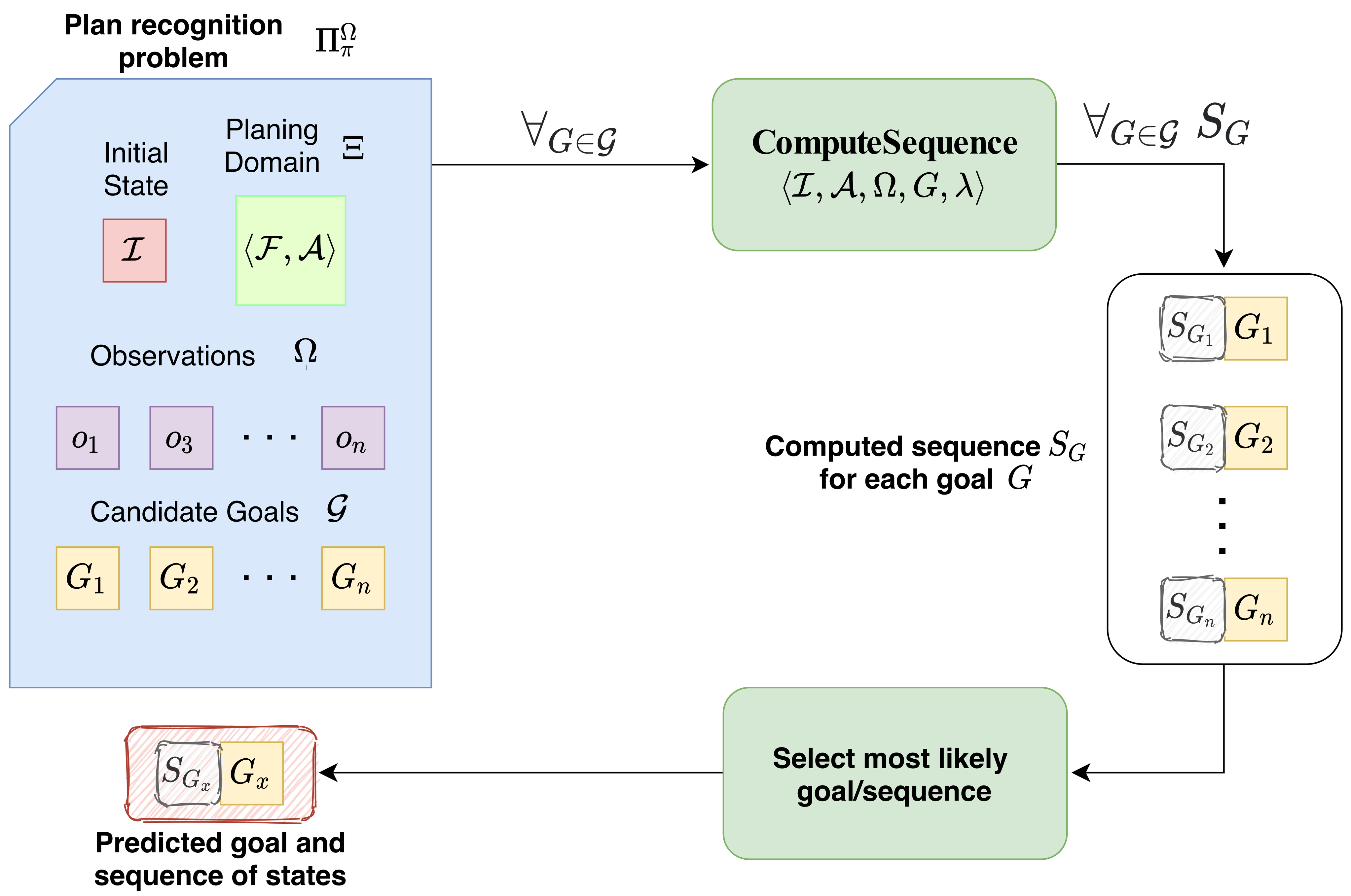

Figure 1: PPR Overview.

Dealing with noise

- We create a mechanism to skip missing observations, allowing us to deal with noise.

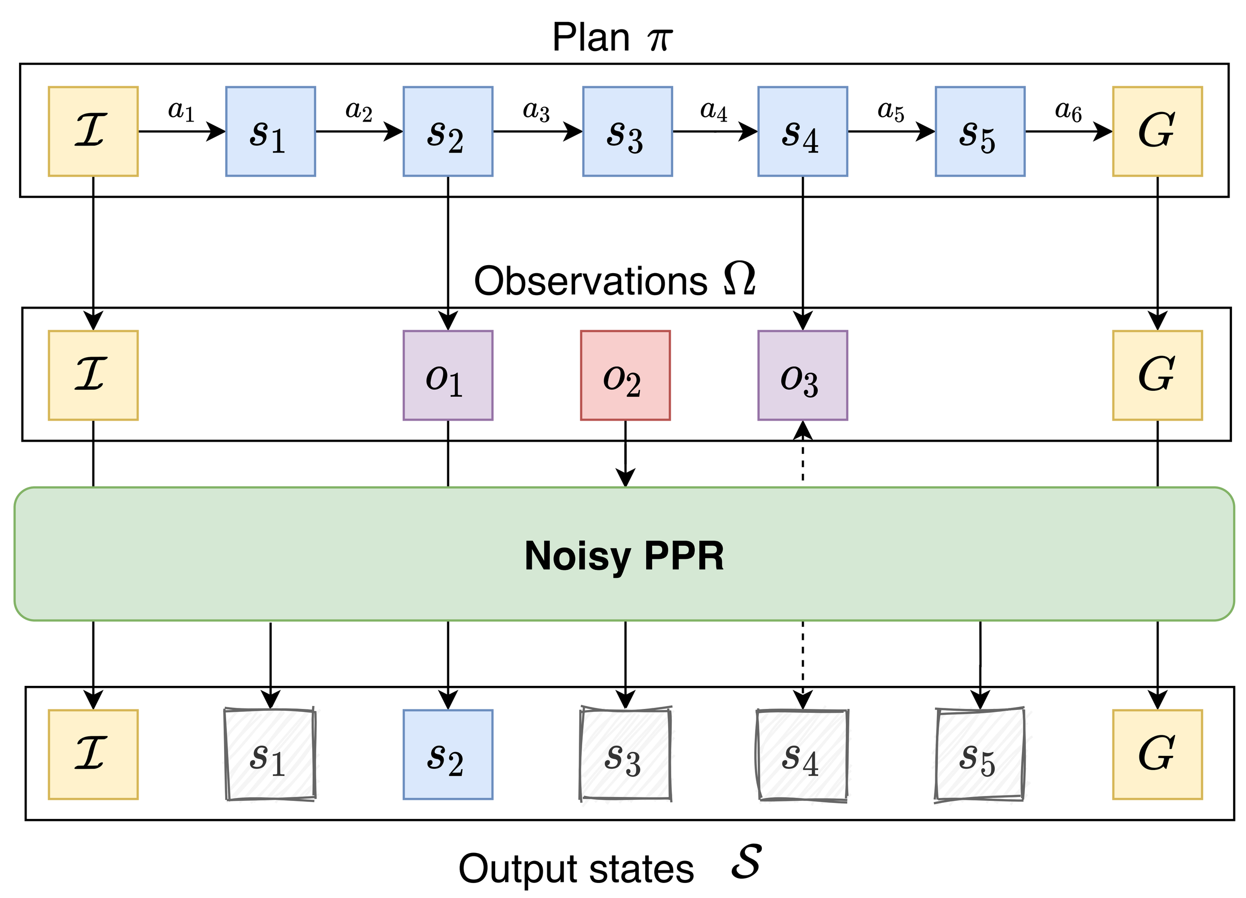

Figure 2: Dealing with noise.

Results

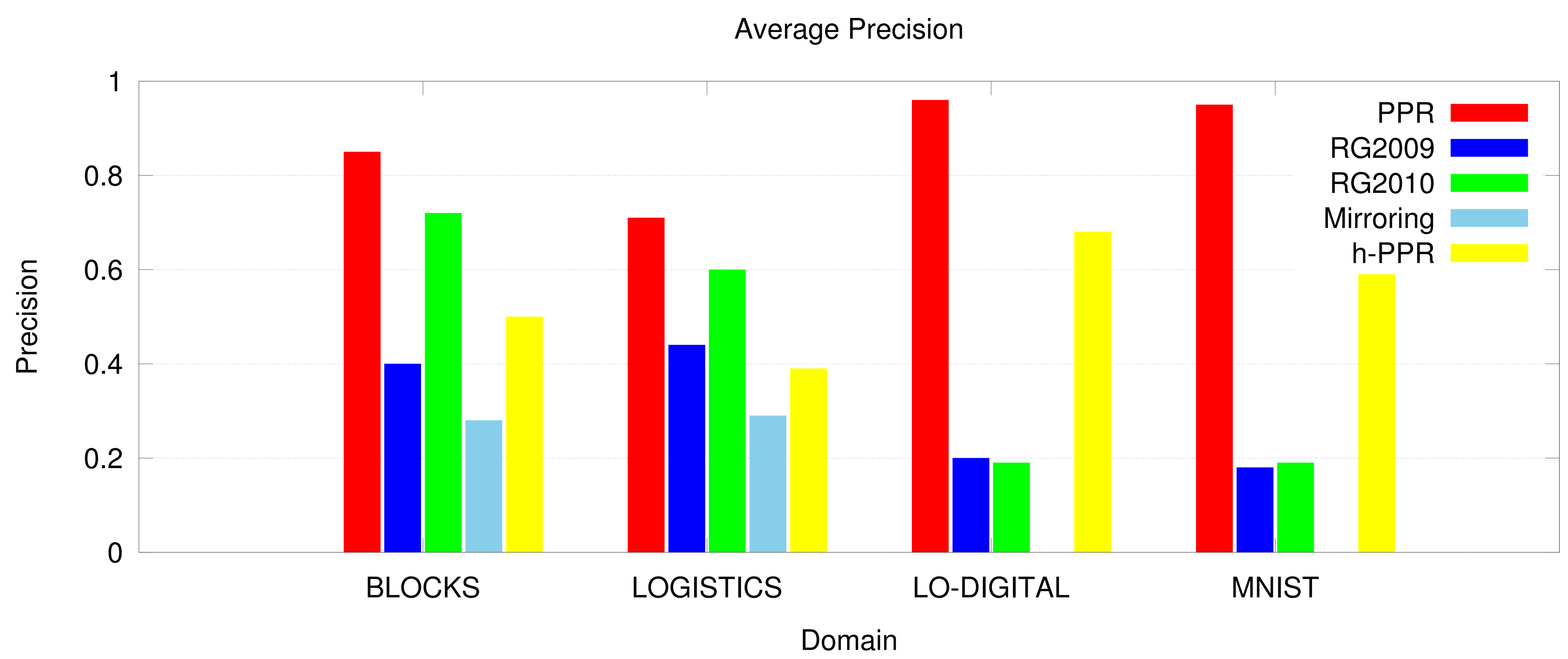

Figure 3: Results with missing observation.

Conclusions

The main contributions of this paper are:

- A novel approach for plan recognition with very high precision both in handcrafted and automatically generated domains.
- Our approach can recognize plans even when dealing with noisy observations, achieving high precision in noisy scenarios.
- The predictor function can be replaced, working as a black-box. Any predictor function can be applied, even a entirely symbolic function.