Experience-Based Prediction of Unknown Environments for Enhanced Belief Space Planning
Supplementary Material

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This document provides supplementary material to the paper [1]. Therefore, it should not be considered a self-contained document, but instead regarded as an appendix of [1].

Appendix A: Extended BSP Simulation Results

In this paper, we extend the results of BSP in unknown environments simulation (see section IV.b in [1]). Fourteen scenarios of planning sessions are tested. Each scenario includes a different environment and three actions that lead to an unknown area (see Fig. 1). In our work, the planning mission is to choose the best action that leads to the goal by the least uncertainty. Our approach suggests to leverage experience to predict the unknown area around the candidate actions given the partial map observed in the inference stage. The solution by a standard BSP method, denoted `baseline`, is to ignore the unknown future measurements (in our case point clouds) and take into consideration only the motion model. The non-realistic solution, denoted `GT-map`, is to use the ground truth maps to generate the expected future measurements and take them into consideration in the objective function calculation. Fig. 2 showed the objective function calculation by these three BSP approaches. We can see that with our approach, actions ordering is closer to the `GT-map` BSP method compared to `baseline`.

References

[1] O. Asraf and V. Indelman. Experience-based prediction of unknown environments for enhanced belief space planning. *IEEE Robotics and Automation Letters (RA-L)*, 2020. Submitted.

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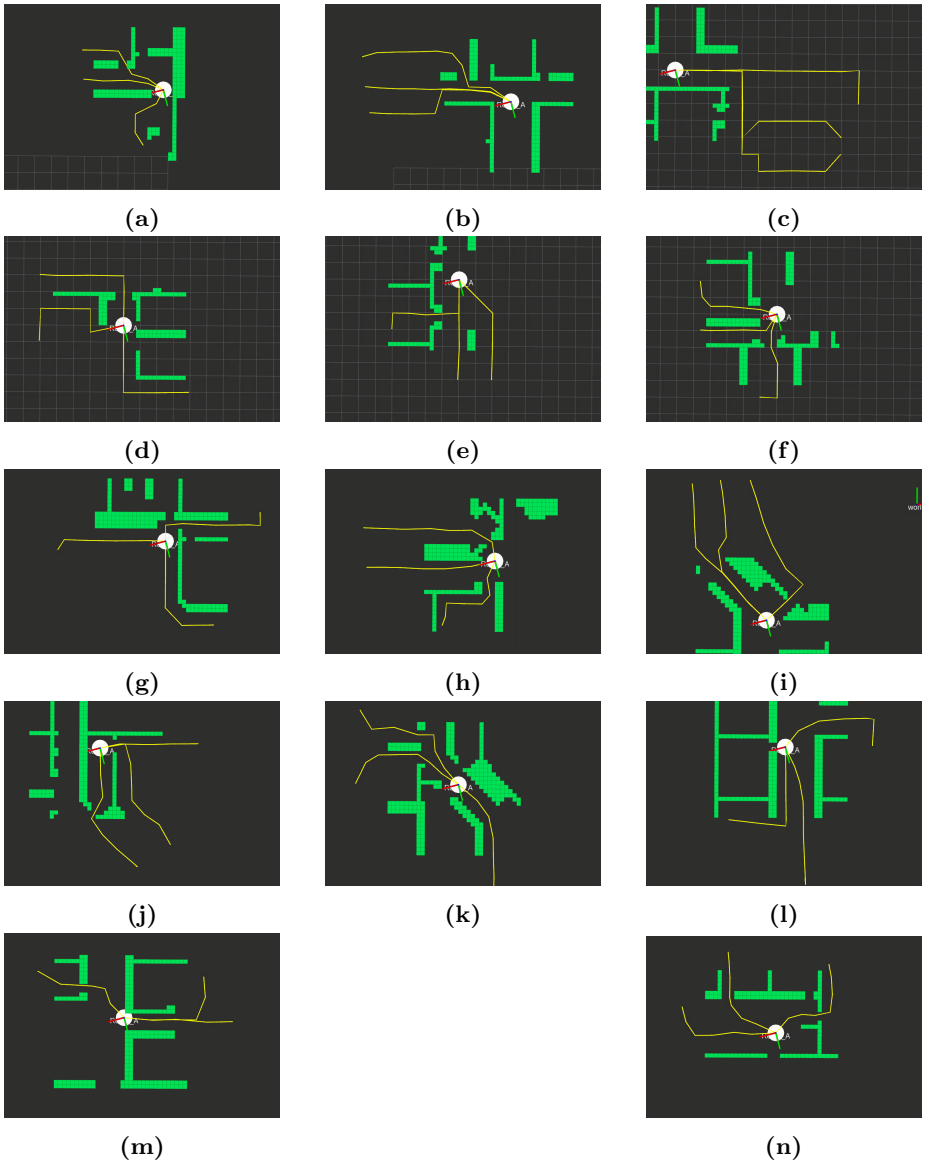

Figure 1: Light green - coditional map, yellow - three candidate actions. figures a-n accordingly to planning scenarios 1-14 from Table 1 in [1].

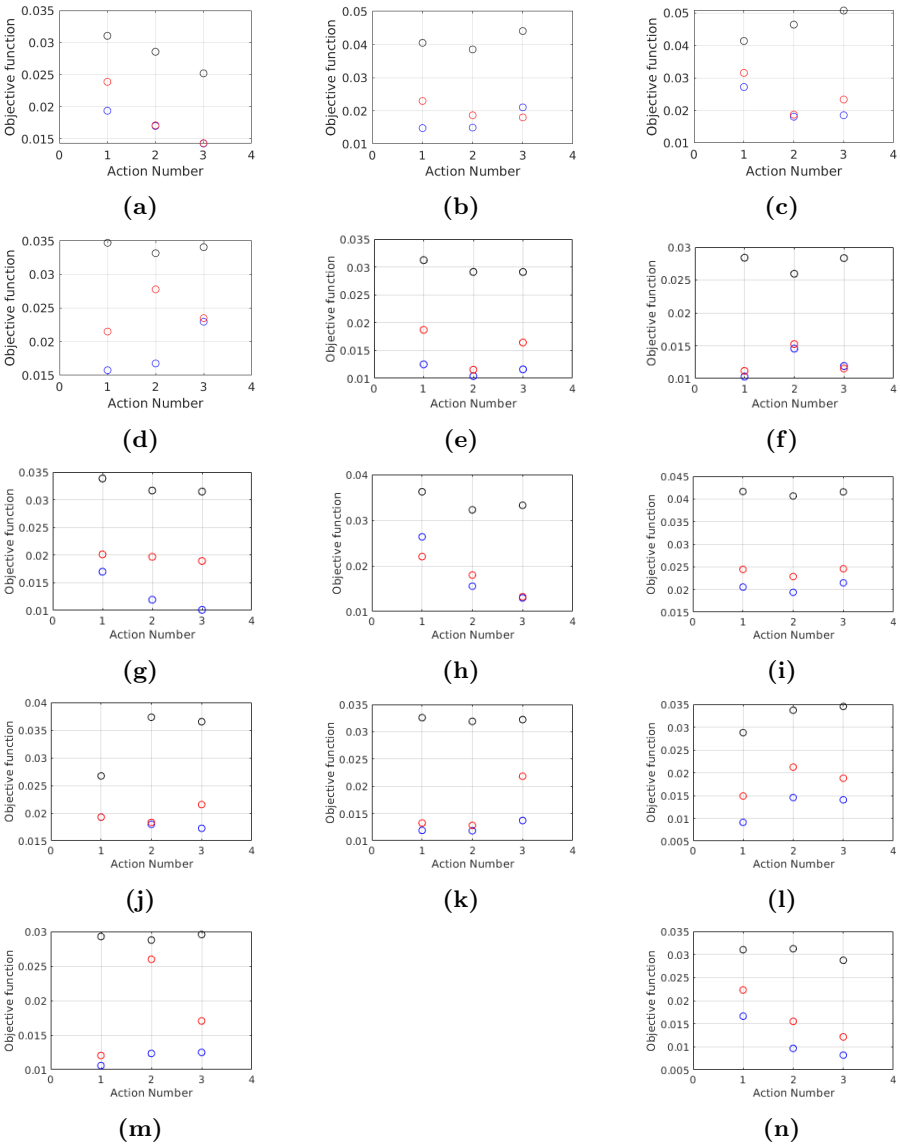

Figure 2: Objective function values for the three BSP methods. `baseline` in black, `our approach` in red, `GT-map` in blue. Figures (a)-(n) according to planning scenarios 1-14 from Table 1 in [1].