Abstract

Since their introduction in 1975 by de Champeaux and Sint, Front-to-Front Heuristic search has been assumed to be more accurate than Front-to-End. Unfortunately, current algorithms show that they are much more expensive and hence less effective than Front-to-End. Now since the cost is so high there has not been any extensive studies on how much Front-to-Front can be improved in terms of runtime or might reduce the number of nodes expanded over Front-to-End even further. This research explores how much Front-to-Front heuristic search can reduce the number of nodes expanded and looks at an alternative, hopefully, a cheaper way to approach such high computational cost. In our experiments, when Manhattan heuristic is used, the Front-to-Front version expands only 40% of the total number of nodes expanded by Front-to-End version. On the other hand, when Abstraction heuristic is used, Front-to-Front expands 5% more base-space nodes than Front-to-End version, although this needs further investigation.

Furthermore, to understand runtime, we picture per-node cost. The per-node cost for both brute-force Bidirectional search and Front-to-End using Manhattan distance were roughly the same (this was expected), but it rose sharply as the length of optimal solution cost grew (this was unexpected). The difference between the per-node costs for Front-End and Front-Front using Manhattan distance by a factor of 20 (Front-to-Front being larger), same as when abstraction heuristic was used for base nodes. Surprisingly, Front-Front expands roughly half as many nodes in abstract space than Front-End. This suggests that computing the Front-Front values using an abstraction heuristic can indeed lower the cost. There are still many ways to improve current Front-Front using Abstraction algorithm which is why we need to explore it even further.

Summary

Front-to-Front Heuristic search has been assumed to be more accurate than Front-to-End. Unfortunately, they are also much slower and puts a heavy workload on the computer which makes it less effective than Front-to-End and hence there has not been any large-scale studies on how much Front-to-Front can be improved. In this research project, we look at an alternative, hopefully much better approach, and compare it to other traditional approaches to get an idea of the effectiveness on a very small domain. The domain had to be small because of the heavy workload in finding the desired solution. Although it shows some promising results, there is a need for further improvements and some more testing. There are still many ways to improve this alternative approach and make it much more cost effective and that is why it needs further development.