Coursework 1: Wall Following with a LEGO Robot

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1 Introduction

All of your courseworks are designed primarily to give you experience in developing intelligent control and/or cognitive systems. However, the course is also intended to give you experience and feedback in writing about research. To this end, you will be writing research reports of about two pages, using exactly this format.

The Introduction of a research report should give a brief description of what you you tried to do (your hypothesis), and the outcome. It should also give some idea about why you have done it (motivation). In doing this, you may also give a brief background argument. I expect you to cite a paper or two for this motivational context. For coursework 1, one of the papers you should probably cite is Brooks (1991), since you have been asked to take a fairly reactive approach to developing robot intelligence.

Coursework one requires you to construct a robot capable of circumnavigating rooms or other closed spaces (don't worry about doorways – just close or block them.) Ideally this should work in "natural" (unaltered) indoor environments with a variety of obstacles along the walls, but often people build up some barriers. However, the report should not be about the entire experience of building a robot, but rather it should present a single hypothesis you tested on your completed robot about how to improve its intelligence.

2 Approach

The approach describes in detail exactly what you have done. This section is longer, and should ideally include some experiments you set up, for example to determine in what conditions you could get better results from the robot. The approach should be in sufficient detail that another person could replicate your experiments. You may cite other papers here too if you are taking an approach from another paper, or modifying it only slightly.

Please do mention who shared your robot in the approach section, and the extent to which you worked together. The objective here is to learn. How much you work together is totally up to you so long as you each write your report independently.

Submissions should be in PDF or HTML, preferably derived from this latex format, certainly in 12 point font. I recommend making HTML by using latex plus htlatex, but you can construct your report using any tool you please. Note that this specification is exactly 2 pages long, so an HTML report should be no longer than this. Figures (both drawn plans and photos) are encouraged for marks and clarity and *do not count either for or against page length*. The 1–2 pages are counting text only (not citations). But remember, don't spend too much time on this coursework! You should spend about 19 hours total on each coursework, about 4 of which will be writing up. The coursework should be uploaded to Moodle by **11pm on Friday 3 March** at the latest, but feel free to submit it (much) sooner.

To quantify the outcomes of this coursework, you may want to think about questions such as contrasting the addition of extra control algorithms, changing the physical shape of the robot, or trying different target sonar readings for maintaining a particular distance from the wall in a variety of contexts. These can be quantified in terms of the circuit time for the robot, the success rate, or any other metric you can think of.

For coursework one, it is quite likely that you will not have initially thought of a hypothesis to test, but will rather just have tried to make the robot work. However, in your exploration (both with the robot and with your reading) you should always be looking to something that seems to make a difference in performance, and then try to capture what that something is. Can you describe it exactly? Can you replicate it with different robot configurations? Can you quantify how much improvement you get given how much change you make to some parameter on the robot? Don't forget to consider things such as the battery charge, operating in daylight, or proximity to other sonar-using robots as possible explanations for strange behaviour.

3 Results

The results section describes the outcomes. This should be purely factual descriptions, including qualitative outcomes, quantitative outcomes and possibly statistics. For example, you could report the average speed around a circuit in two conditions plus standard deviations and a significance test to tell whether you have evidence that the conditions lead to different results. *For coursework 1, this must include video.* Typically, the results section can be surprisingly short, since the Approach section is the one giving details. Results are purely and only factual outcomes (no alternative facts).

With respect to your *personal* results, if you describe a reasonably-well working system in a comprehensible manner you will pass. If you competently fill in all of these sections as described in this specification, you will get at least 55. Getting a mark over 70 requires demonstrating insight, creativity and / or understanding that goes beyond the basics laid out for you in this document. For example, an insightful comment about one or more cited papers supported by evidence from your experience might get you these extra marks. So might a particularly accurate and replicable account of your approach and results.

4 Discussion

The discussion is the most discursive part of your paper, it *may* include speculation. You should discuss the extent to which your results addressed the questions described in your introduction, and what the results imply about your own work and AI or robotics more broadly. You might suggest other experimental protocols that could have given different results and lessons learned. This can be a longer section, and may again include citations if you compare or contrast to other published accounts.

5 Conclusion

The conclusion is just one paragraph. After possible digressions in the discussion, you should come back to restate exactly what you tried to do (brief summary of the introduction), what the outcome was (brief summary of the results), and what you can certainly state as a result of this (the implications of the results in light of the introduction.)

References

Brooks, R. A. (1991). Intelligence without representation. *Artificial Intelligence*, 47(1–3):139–159.