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, this coursework will take the form of a research reports of about two pages, using exactly this format.

The Introduction of a research report should most importantly state **a hypothesis** that you will test. It should also summarise the outcome—science is about communication, not mystery. The introduction should also explain briefly the **motivation**—the reason you thought the hypothesis was worth testing. This may include a *brief* background argument, possibly citing a paper or two. For coursework 1, one of the paper will likely be Brooks (1991), since the course steers you towards a reactive approach, so whether you go towards or away from that steer you should still address it.

Coursework 1 requires you to construct a robot capable of circumnavigating rooms or other closed spaces (don't worry about doorways—just 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 a narrative on the experience of building a robot. It should present a single hypothesis you tested on your completed robot about how to improve its intelligence.

For Coursework 1, your group should list all the members and what they contributed to the report and its outcome. You should also:

- either state clearly that all three members are happy to be judged as having contributed equally, with all three signing next this statement, or

- (exceptionally) ask to discuss how the mark should be allocated with one of the lecturers.

2   Approach

The approach describes in the procedure you followed for your experiments testing the hypothesis. The approach should be in sufficient detail that another person could replicate your experiments and get similar results. You may cite other papers here too if you are taking an approach from another paper, or modifying it only slightly.

Submissions should be in PDF or HTML, preferably derived from this latex format, certainly in 12 point font. If you use HTML, we recommend 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). 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 **1pm (lunch time) on Thursday 28 February** at the latest, but feel free to submit it sooner.

For Coursework 1, 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.

Further hints (if you can't think of anything based on the above): you may want to contrast "before and after" the addition of extra control algorithms, or changes to 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. The effects of such changes can be quantified in terms of the circuit time for the robot, the success rate, or any other metric you can think of.

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* results (your marks), 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, replicable, yet succinct and to-the-point 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. It is a very good place to show you have learned from the coursework, even if you didn't do so in time to 'teach' your robot much.

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 (a 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 rest of the report.)

References

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