LUABAB: Leeds University Angry Birds Artificial Brain

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Abstract

This document gives an overview of the development and design principles behind LUABAB, the Leeds University Angry Birds Artificial Brain.

1 Background

There is a long tradition of research into representing and reasoning about space at Leeds [Randell *et al.*, 1992; Cohn *et al.*, 1997; Bennett, 2001]. The Angry Birds AI competition gives us an opportunity to put to use some of the ideas that we have developed in an applied setting which is both diverse in terms of the types of information involved and also limited in that it takes the form of a well-defined problem scenario, isolated from many extraneous difficulties that surround more open ended real-world problems.

2 The 'Team'

Development of the current version of the LUABAB software has been largely a solo effort by myself. However, I am very grateful to Sam Wilson (PhD student at Leeds) for his work in restructuring and testing large portions of code. Several undergraduate students have also contributed to AI-oriented Angry Birds investigations at Leeds — in particular: Johnathan Cook, Vilius Narbutas and Ed Worthy have all done projects in this area. It is expected that further development will be carried forward in the coming year by both undergraduates and postgraduates at Leeds.

3 The Approach Taken to Angry Birds AI

The approach taken centres on the use of qualitative spatial relations to define the characteristics of a good target point. Basic properties and relations (such as a plank being horizontal, or one block being directly above another), can be fairly easily defined by simple geometrical computations. Once this has been done, more complex characteristics can be defined by combining the simple ones using Boolean operations and iterators. Currently, the definitions are quite limited, the most complex identifying features such as the left end of a horizontal beam that is both above and below one or more pigs. However, the set of characteristics is easily extensible.

4 Implementation and Architecture

The system is very much founded on the *basic game playing software* provided by the `aibirds.org` team. The basic framework has been mainly extended with respect to the mechanism used to select shots. Small tweaks have been made to the Vision module (including background detection) and an imperfect model of yellow bird trajectories has been implemented.

Shot selection proceeds as follows:

1. Find a bunch of 'good' places to hit.
2. Evaluate how good each target is likely to be.
3. Use a weighted random choice to pick a target.
4. See if you can hit it: calculate possible trajectories to the target and see if they are blocked by any obstacles.
5. If blocked, forget that target and go back to step 3.
6. Otherwise, fire away!

The method is quite efficient since the set of good targets is fairly small, so not too many trajectories need to be calculated and analysed. Target evaluation is currently done using *ad hoc*, hand-coded heuristics. This could be replaced by a learning mechanism.

The current system analyses each situation in a purely static way. An obvious avenue for further development would be to add a planning module that can reason about the effect of sequences of shots.

References

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