

# s-birds Avengers: A Dynamic Heuristic Engine based Bot for the Angry Bird Problem

Sourish Dasgupta  
DA-IICT  
DA-IICT Road  
Gandhinagar, India  
sdg.daiict@gmail.com

Vishwa Modi  
DA-IICT  
DA-IICT Road  
Gandhinagar, India  
vishwa9694@gmail.com

Savan Vaghela  
DA-IICT  
DA-IICT Road  
Gandhinagar, India  
savan.vaghela@hotmail.com

Hitarth Kanakia  
DA-IICT  
DA-IICT Road  
Gandhinagar, India  
hitarthk@gmail.com

Dhruvi Shah  
DA-IICT  
DA-IICT Road  
Gandhinagar, India  
dhruvi9499@gmail.com

## ABSTRACT

The paper briefly describes the approach taken in developing *s-birds Avengers* for solving the AI Bird problem. *s-birds Avengers* is an enhanced version of the *s-birds* bot that participated in IJCAI AI Birds competition 2013. There has been major modifications in the heuristic engine that was developed last year to emulate the actual physics of the structure. Certain additional features are also added to the newer bot.

## 1. INTRODUCTION

*s-birds Avengers* is an automated Angry Bird agent developed by the Agent Research Lab at DA-IICT, India. The team comprises of undergrad Computer Science students under the supervision of Dr. Sourish Dasgupta (Assistant Professor, currently at DA-IICT).

## 2. APPROACH OVERVIEW

*s-birds Avengers* is built on top of the *s-birds* bot that participated last year in IJCAI AI Bird 2013 competition. The primary modification has been done in the heuristic engine (see last year's team description paper). We fine-tuned the "bottom-up approach" followed last year where a set of candidate target blocks were chosen based on the possibility of maximum destruction caused to the pigs due to gravity. The philosophy behind the approach was that gravitational force is capable to create large collateral damage to structures apart from killing pigs, thereby increasing the net score. However, *s-birds* was only considering blocks that were exposed directly to the trajectory of the bird. Therefore, it missed a very important factor called *degree of penetration* - i.e. the ability of a bird to hit a chosen target block through penetration. In *s-birds Avengers* this has been rectified. Also, *s-birds* gave equal importance to all the factors

that govern bottom-up approach: (i) degree of lateral displacement and (ii) degree of support to the pigs. In contrast, *s-birds Avengers* has a mechanism of adjusting weights given to each of the three factors through an initial training period based convergence and then updating the converged weights during the competition. Another significant addition to the heuristic engine is a new strategy called *top down* that either utilizes the crushing effect of a bird trajectory or the rolling effect of a block on pig/s (using gravity) or the toppling effect of a slender block over a destroyable pig sub-structure. Finally the bot creates two rank-list of candidate target blocks - one for bottom-up and one for top-down. Then it creates a combined rank-list by looking into relative ranking of each target block in both the rank-lists.

Another very important feature that was missing was re-attempting a level so as to improve a previous score (either in round 2 or if left with time in a particular round). Lack of this feature made *s-birds* play round 2 qualification round in exactly the same way as round 1 qualification, thereby bringing the rank down from 5 to 11. In *s-birds Avengers* this feature has been added where, depending upon how much time is still left, the birds first takes a greedy approach by trying to solve a level that it has done worst and then gradually takes a no-risk approach by trying to solve levels that are assumed to be easy (i.e. less birds used to solve in previous attempt). For re-attempting it uses the next best chosen target block in the combined ranked list. *s-birds Avengers* bypasses the rote-learner that was incorporated in *s-birds*. The rationale being that new and similar structures will rarely be encountered in a competitive environment<sup>1</sup>.

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<sup>1</sup>It is to be noted that *s-birds* uses a holistic grid-based structure representation and hence, sub-structure match based rote-learning is absent.