

# Angry Birds - Gadar Chidiya

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## ABSTRACT

This paper describes the Gadar Chidiya agent for Artificial Intelligence of Angry Birds. Our approach combines ideas from Supervised Machine Learning and WeakPoints Strategy. We briefly describe our approach towards implementing the strategy using Linear Regression towards the aim of scoring more.

## INTRODUCTION

Angry Birds is a game where the player controls a number of birds of various types. The objective of the game is to kill all the pigs protected under structures made using different material blocks in different shapes. The objective is to be completed by taking control of a limited number of birds having different capabilities according to the material of the blocks of the structure, which are to be launched from a slingshot. Points are given to the player according to the number of pigs killed, to the destruction caused to the structure and the number of unused birds. A basic platform is provided that makes use of chrome version of Angry Birds and has defined various modules including computer vision, trajectory planner, a game playing agent - the Naive Agent, which targets the pig using a parabolic path.

We have used the Linear Regression algorithm of Supervised Machine Learning for implementing our strategy. To implement this algorithm we coded a Random Agent which randomly selects a block from all the given blocks on the screen and also randomly selects an angle which will help to hit the center of the block selected. We have collected data by running the agent approximately 2300 shots across all levels and then this data is feeded into a software - Weka, which gives us a linear equation using the linear regression algorithm. We then use this linear equation in our agent to determine the release point of the bird according to the maximum score attained at various angles. But this strategy fails in some cases as we were not clear about consideration of few attributes, so we implemented the WeakPoint strategy which targets the weak points of the structure to complete its objective.

While collecting data we considered 6 attributes namely:

- Type: The impact of birds depends on the type(material) of the objects, so we choose 'Type' as one of the attributes.

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- Angle: The release point of the bird is needed to launch the bird, the release angle and the release point is related to each other, hence we decided to choose 'Angle' as one of the attributes.
- Personal Weight: The selection of the object to be hit is dependent on the weight of the object because if we consider a TNT, although the weight is not high but the points scored by hitting this will be high(we multiplied its personal weight with a factor of 10), similarly for a pig. We multiplied the personal weight of stone with a factor of 0.5 because destroying the stone is very difficult and thus urge the agent to choose an object which maximises the score.
- Above Weight: The selection of the block to be hit depends on the weight of the objects placed above the chosen object. The higher the above weight the more destruction is caused by the objects above the chosen object which helps in increasing the overall score.
- Minimum Pig Distance: The distance of the pigs surrounding the objects plays a role in increasing the overall score as the impact of the bird on the object may affect the pig which is nearest to the chosen object.
- Weakness: All objects have different weakness levels depending on the bird. So an object with a lower level of weakness will be given higher priority. ...

## APPROACH

Our approach was to use the Linear Regression algorithm of Supervised Machine Learning.

Supervised Learning: It is one of the approaches of machine learning where the machine learns from the provided datasets. Machine is given with the previous experiment results and it learns to act from that data.

Linear Regression: It is one of the algorithms where machine is provided with the data and it tries to find a linear equation between an dependent variable and few independent variables. The idea is to find a curve which could fit the data such the data points provided when plotted on a graph. The fitting graph would help machine predict output when provided with the set of those independent variables. In our case the attributes/independent variables selected like angle, minimum pig distance etc are the independent variables and score is the dependent variable. In linear regression a linear equation is found by regressing over the data.

$$y = ax_1 + bx_2 + cx_3 + \dots$$

where y is the dependent variable and  $x_i$  are the independent library

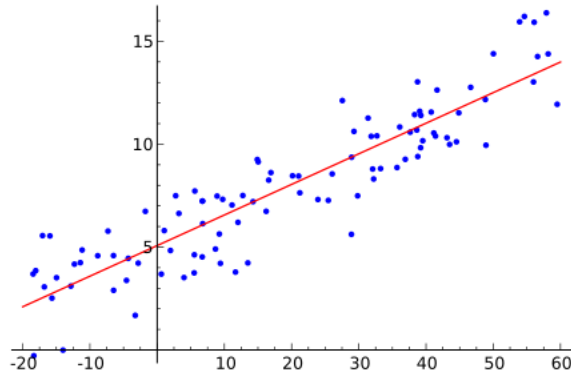


Figure 1. Simple Linear Regression

Regressing over the data provides us with the the coefficients such that there is minimum error in prediction. The objective is to minimize the root mean squared error between the actual score and the score predicted while finding the coefficient.

### IMPLEMENTATION

For implementing the same, we collected data by creating a Random agent which randomly chooses an object. After completing the shot, few attributes were recorded in database to train the model. Certain parameters which affect the score in a shot were chosen as the attributes or independent variables for Linear Regression. The attributes were: Type, Personal Weight, Above Weight, Minimum Pig Distance, Weakness. The Random agent chooses an object (blocks and pig) from the screen and estimates the various launch points possible to hit the center of the randomly selected object, the final launch point to be used by the bird was also selected randomly. We collected the aforementioned attributes by running the Random agent approximately 100 shots from each level, resulting in a total of approximately 2300 shots. We then feeded this data into a Data Mining library - WEKA, which gave us the following linear equation:

$$\text{SCORE} = -2046.0067 * \text{TYPE=Stone,Pig} + 7540.1106 * \text{TYPE=Pig} + -5824.481 * \text{ANGLE} + -1622.5479 * \text{PWEIGHT} + -1264.6563 * \text{AWEIGHT} + -989.9095 * \text{DISTANCE} + -4738.9017 * \text{WEAKNESS} + 13956.9713$$

When WEKA was feeded with the data recorded(in .csv), it regressed over it to find the equation. We then used this equation in our agent. We iterated all objects present on the screen, for each object all the attributes except angle were calculated. Then we estimate all the launch points available for the bird to hit the center of the selected object, we get the corresponding angles of these launch points. Now we calculate the score by iterating all the values of angles and get scores corresponding to each angle. Now we choose the object, release angle of the entry which has the highest score and launch the bird from this point.

As we were not clear about the considerations of the various attributes(Obstacles like hill in a trajectory etc.) of the objects, this strategy failed at one or two stages, so we implemented a WeakPoints strategy which targets the weak areas of the structure. In the WeakPoints strategy, we divided the

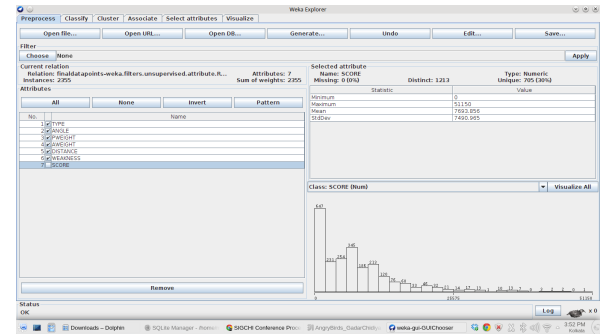


Figure 2. Attributes selected for the linear regression equation - WEKA

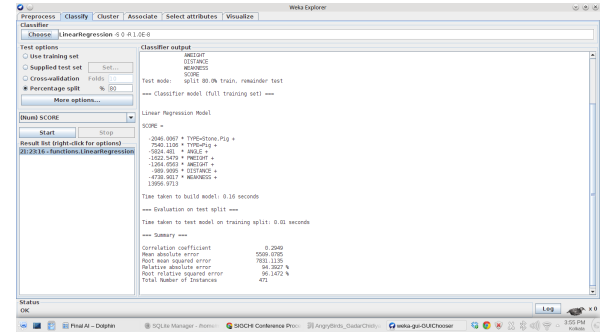


Figure 3. Equation generated using Data Mining Library - WEKA

cases according to the position of the pig. If the pig is located on a hill or stone and has an obstacle on the left side, the bird is launched such that it hits the top left of that obstacle and if there is no obstacle on the left side then the bird takes a parabolic path to hit the pig directly. In the second case, if the pig is located on blocks(except stone) and has an obstacle on the left side then the bird hits the bottom left of that obstacle and if there is no obstacle on the left side then the bird takes a parabolic path to hit the pig directly.

### Results

Teams	Total Score
Gadar Chidiya	885650
Naive Agent	858730
Plan A+	1002380
DataLab Birds	981120
AngryHex(2013)	974670
WISC	963160
AngryHex(2014)	960320
Angry Concepts	954030
Beau Rivage	952390
Hungry Birds	951440

Table 1. Score comparison to Naive agent and top 8 teams