How to Keep Three Dragons Alive in Practical World

Yilin Liu, Chengwei Wang*, Yue Zeng, Huimin Wang
School of Glasgow, University of Electronic Science and Technology, Chengdu, 611731, China

Abstract: In this article, we analyze the dragons physical characteristics, behavior, habits, diet, changes, energy consumption, area of their living region, their interaction with ecosystem as well as area of human community able to provide assistance. First, we apply Opencv to find out the actual size of dragons, including body length, head length, wing length and body height. Then, to analyze habits and diet of dragons, we compare them with dinosaurs by constructing regression BP-neural network. The ecological impact caused by dragons is analyzed by utilizing an original Game of Thrones Dragon Model, which is a combination and promotion of Box Model and Volterra Prey-predator Model. Although dragons do not exist in reality, our model can still be useful when dealing with real problems. It can be used to calculate the energy consumption of large animals; measure the damage resulted from invasive species; to estimate the possibility wild animals can get help etc.

Keywords: Opencv; Box model; Volterra prey-predator model; Monte carlo

1. Introduction

Dragons in the novel A Song of Ice and Fire as well as the TV series Game of Thrones never fail to attract audiences' eyes with their magnificent appearance and great strength. Except for their formidable size and physical strength, the ability to breath fire is another strong factor making them the most powerful creature in the seven kingdoms. However, powerful as they are, how to raise them and whether the land is rich enough to sustain their requirements of living can be a realistic problem which affect the viability of the story.

As we know, the dragons predate other large animals like deer and goat to survive, therefore causing impact to the environment and get feedbacks. For instance, when the number of preys shrink or the climate changes, dragons may move to another region to continue their lives. This paper focus on analysis of the dragons characteristics and then deduce their possible behavior, habits, and diet. Then the interaction between dragons and the environment will be modeled after considering several factors, including ecological impact, requirements of dragons, energy expenditure, living area, caloric intake and the help from community.

2. Simulating Dragons' Body Characteristics

2.1. Models based on BP-neural network

In this section, existing models will be introduced and then we modify and apply the models. To analyze the body characteristics and habits of dragons, we use BP-neural network to get results by comparing dragons with dinosaurs in terms of body length, weight and other physical features. The type of driving function is determined after comparing the training results, time needed to get certain degree of error.

Back Propagation Neural Network (BPNN) is a widely-used neural network which can approach any nonlinear function with any precision and has relatively simple structure. To deduce the body characteristics of dragons, it is reasonable to compare them with dinosaurs which also has large body size and reproduce by laying eggs. By listing several body characteristics of certain dinosaurs and compare them with those of dragons, we can apply the method of regression to decide which dinosaur is the most similar to dragons we study. This is practical because the relation between standards and the type of dinosaurs is nonlinear. Regular driving function applied in the network is Sigmoid function.

$$S(x)=\frac{1}{1+e^{-x}} \tag{1}$$

Here we search for the physical dataset of several kind of dinosaurs including Tyrannosaurus, Pterodactylus, Stegosaurus etc.(In the table below, SN represents sequence number)

Because the distribution of body size, height, length of head, weight are Gaussian distribution, which means X N (μ, σ), the average value should be the mean of samples.

There are 6 factors we need to consider. Therefore, the number of input layer neural cells should be 6. What we need is only the type of dinosaur, so there is only 1 output, corresponding to one neural cell at output layer. And we set one hidden layer with 5 neural cells according to the experience function.

2.2. Results and analysis

The output is 7.3702, which means Quetzalcoatlus is the most similar one to dragons in terms of physical data among those dinosaurs. Therefore, we can deduce that the habit and diet of dragons also have similarities with Quetzalcoatlus.

This result suggests that dragons mainly catch and feed on animals, both carnivores and herbivores, living on the land instead of in the air or sea. The reason is that, similar to Quetzalcoatlus, the claws of dragons are relatively small compared to other predators like eagles, which makes it difficult for dragons to catch preys in the air. Furthermore, the neck of dragons is too long to move flexibly, which cause poor ability to catch fishes living in the sea.

Dragons main lifestyle is formed on the land, which means they rest and feed on the land. Similar to Quetzlcoatlus, the climate most appropriate for dragons should be subtropical or tropical climate which is common at regions with low latitude where forest resource is rich, which provides enough food to sustain living.

They are able to fly long distance in order to find more food or appropriate climate. To adjust to flying, their body temperature is stable, and has relatively fast metabolism, advanced nervous system and high-efficiency circulatory and respiratory system. They have excellent vision in three-dimension as well as high speed of flying to find and locate objects.

In conclusion, dragons are large creatures of Pterosauria, which is about 20 meters long and 13 meters high with huge wings of 8 meters and weigh about 3 tons. They are endotherms and carnivores with high-level intelligence and vision who predate and live mainly on tropical or subtropical land but is capable of long-distance flying.

3. Simulating Ecological Impact to Dragons

In order to find the interaction between dragons and ecological environment, we take two aspects into consideration: food and climate. From above we have known that dragons feed on animals on land instead of in the sea or in the air, therefore we can construct a new model based on terrestrial food chain. The first thing to do is to construct a model of food chain in ecosystem. Then the energy needed by dragons will be calculated and the effect of environment will be measured. We will introduce two existing models and then a new model invented by us.

3.1. Original models

Because the dragon preys on both herbivores and carnivores, we can simplify the model by considering herbivores and carnivores as a whole layer in food chain. We suppose the predation relationship between herbivores and carnivores as a whole consumption and growth, without affecting its relationship with plants and dragons. The new relationship is determined as the following figure.

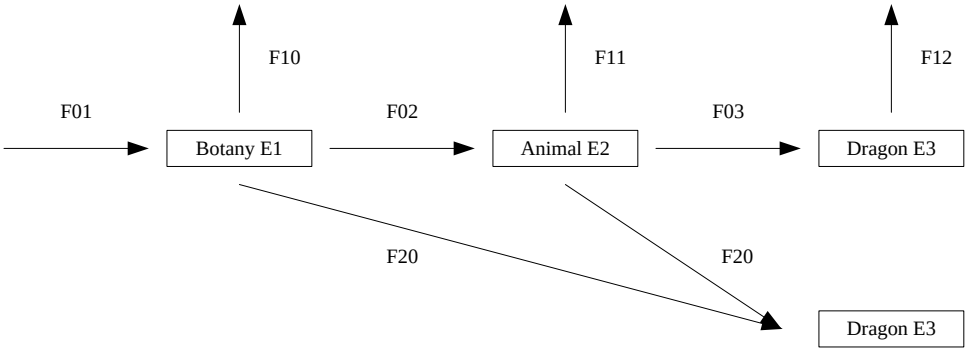

Figure 1. Original model of ecosystem with dragons

3.2. Result and analysis

Table 1. The data through our investigation

Item	L1	L2(A)	L2(B)	L3	L4(A)	L4(B)	L5
Value	1	0.015	0.01	1	0.02	0.0175	1

To make this ecosystem environment suitable for our dragon to live, we must make sure the rate of energy growth must be not lower than zero, so that the re-source can be abundant and the ecosystem balance can be maintained.

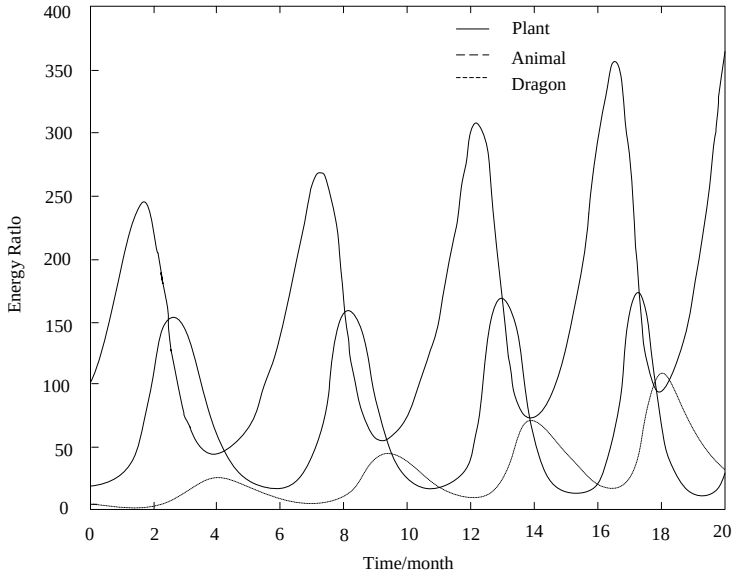

Figure 2. Energy ratio in ecosystem with dragons

From the figure above, we can see that when the initial energy of plant is ten times of that of animals and one hundred times of that of dragon, that is the total energy of area is no lower than (energy of the area feeding the dragon), then we can see if the energy of plants rises, the energy of animals will rise too, then, because energy of animals rise, the energy of plants will reduce accordingly, which totally lies with the principle of food chain. Only in this kind of environment, can dragons grows healthily.

4. Simulating the Size of Human Community based on Monte Carlo

To analyze the size of human community in offering assistance to dragons, the condition must be satisfied is that the dragons are able to get in the region where human live. We have made assumption that the community human live in can be simulated to be a circle. When dragons move, their behavior can be simulated as a two-dimensional Gaussian distribution, which means (X, Y) ~ N (μ1, μ2, σ1, σ2). Then to ensure assistance of dragons, the probability of encounter must be high enough. A model based on Monte Carlo is constructed to solve this problem.

In this case, we use a thousand points which confirms to two-dimensional Gaussian distribution to simulate the center points of the region where dragons move. Human communities distribute randomly (here they are represented by red circles) in the whole map. When the point appears inside the circle, our requirement will be met.

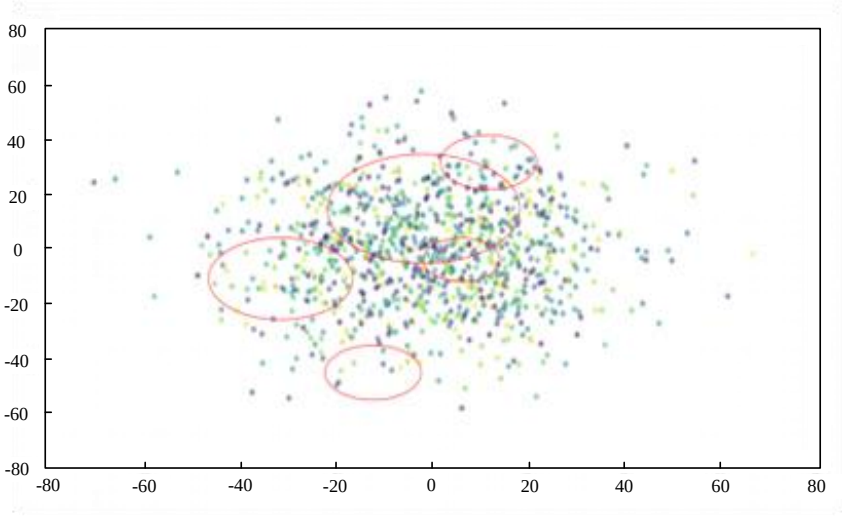

Figure 3. Monte carlo process

The results are shown as follow:

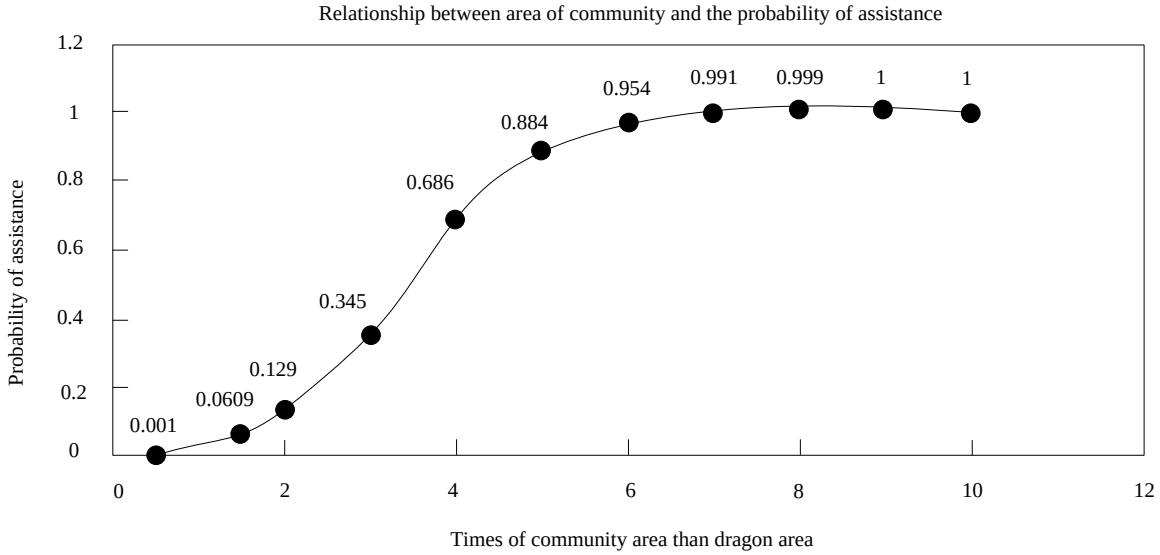

Figure 4. Simulating result of human community size

It can be seen that when human community is 9 times that of dragons moving area, the probability is approximately 100%, which means necessary assistance can be ensured in this case. Therefore, when dragons are not migrating, about $1.344*10^8$ hectares of human community can ensure assistance occur when necessary.

References

[1] Zhuang S.J. Relationship between body length and weight. Https://wenku. baidu.com/view/4d5c52ab900ef12d2af90242a8956bec0875a565. html.

[2] Wikipedia. Biography. Https: //en.wikipedia.org/ wiki/Portal: Biography.

[3] Meng S., Ming L. Measuring size of objects in an image with opencv. Https://blog.csdn.net/u010636181/article/details/80659700

[4] Jiang Q.Y., Ye J. Methemetical models. High Education Press, Fourth Edition. 2011, 1.

[5] Li Y.N., Zhang B.L. Research and application on canopy density and detection method. Global Forest Research. 2008, 23, 40-46

[6] Xu D.Q. The efficiency of photosynthesis. Shanghai Secience and Technology. 2002.

[7] Yuan G.X., Wang P. Monte carlo simulation and its applications in tolerance design.