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A new Fruit Fly Optimization Algorithm: Taking the financial distress model as an example

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ABSTRACT

The treatment of an optimization problem is a problem that is commonly researched and discussed by scholars from all kinds of fields. If the problem cannot be optimized in dealing with things, usually lots of human power and capital will be wasted, and in the worst case, it could lead to failure and wasted efforts. Therefore, in this article, a much simpler and more robust optimization algorithm compared with the complicated optimization method proposed by past scholars is proposed; the Fruit Fly Optimization Algorithm. In this article, throughout the process of finding the maximal value and minimal value of a function, the function of this algorithm is tested repeatedly, in the mean time, the population size and characteristic is also investigated. Moreover, the financial distress data of Taiwan's enterprise is further collected, and the fruit fly algorithm optimized General Regression Neural Network, General Regression Neural Network and Multiple Regression are adopted to construct a financial distress model. It is found in this article that the RMSE value of the Fruit Fly Optimization Algorithm optimized General Regression Neural Network model has a very good convergence, and the model also has a very good classification and prediction capability.

1. Preface

In recent years, the treatment of optimization problems has caught everyone's attention, for example, the production schedule optimization problem [1,9], the shortest route problem in the logistics industry [13,12] or the shift arrangement problem in the traffic transport industry [7,22], etc. should all be treated by the optimization algorithm. Until now, algorithms that are commonly used to treat optimization problems and data mining include: regression and classification [18–21], genetic algorithm [14,2], Ant Colony Optimization Algorithm [6,4] and Particle Swarm Optimization Algorithm [8,25]. However, the common disadvantages of these algorithms are complicated computational processes, difficulty of understanding for beginners and there are very many parameters in GA-base methods.

Therefore, this article author Pan [16] proposes a new optimization algorithm, which is called the Fruit Fly Optimization Algorithm or Fly Optimization Algorithm (abbreviated as FOA). Such an optimization algorithm has advantages such as a simple computational process, ease of transformation of such concept into program code and ease of understanding, etc. In this article, the way of finding maximal value and minimal value of function is first used to test repeatedly, the function of this optimization algorithm. In the meantime, the correlation between the population size and the optimization capability of the fruit fly group is investigated. Furthermore, this article refer to Ravisankar [17], Li [15], Cho [5] and Hadavandi [10] adopts the financial distress data of enterprises with stocks listed in the regular stock market and over-the-counter stock market from the years 2003 to 2004 as the test data. Meanwhile, fruit fly algorithm optimized General Regression Neural Network (abbreviated as FOAGRNN), General Regression Neural Network (abbreviated as GRNN) and Multiple Regression (abbreviated as MR) are used to set up a financial distress model. Finally, the classification prediction capabilities of these three models are compared to verify the feasibility of applying the Fruit Fly Optimization Algorithm in real cases.

The main structure of this article is as follows: The first section introduces the research motivation and objective of this article. The second section introduces the Fruit Fly Optimization Algorithm proposed by this article and the test of applying it in finding minimal and maximal value. The third section introduces the sample data used by this article and the real case analysis. The fourth section proposes the research conclusion and suggestions.

2. A new Fruit Fly Optimization Algorithm

2.1. The basic concept of the Fruit Fly Optimization Algorithm

The Fruit Fly Optimization Algorithm (FOA) is a new method for finding global optimization based on the food finding behavior of the fruit fly. The fruit fly itself is superior to other species in sensing

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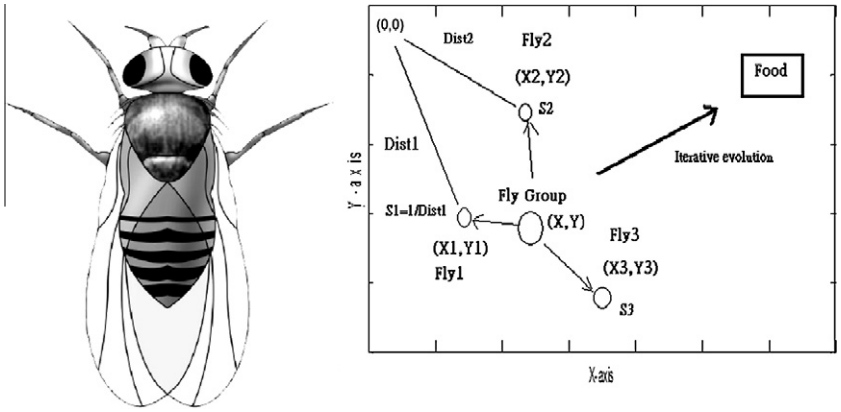

Fig. 1. Illustration of the body look of the fruit fly and group iterative food searching of fruit fly.

and perception, especially in osphresis and vision, which is as shown in Fig. 1. The osphresis organs of fruit flies can find all kinds of scents floating in the air; it can even smell food source from 40 km away. Then, after it gets close to the food location, it can also use its sensitive vision to find food and the company's flocking location, and fly towards that direction too.

In this article, based on the food finding characteristics of the fruit fly, it is divided into several necessary steps and a program example to be referred to by the readers. The steps are:

(1) Random initial fruit fly swarm location is shown in the figure to the right of Fig. 1.

$InitX\_axis; InitY\_axis$

(2) Give the random direction and distance for the search of food using osphresis by an individual fruit fly.

$$X_i = X\_axis + RandomValue$$

$$Y_i = Y\_axis + RandomValue$$

(3) Since the food location cannot be known, the distance to the origin is thus estimated first (Dist), then the smell concentration judgment value (S) is calculated, and this value is the reciprocal of distance.

$$Dist_i = \sqrt{X_i^2 + Y_i^2}$$

$$S_i = 1/Dist_i$$

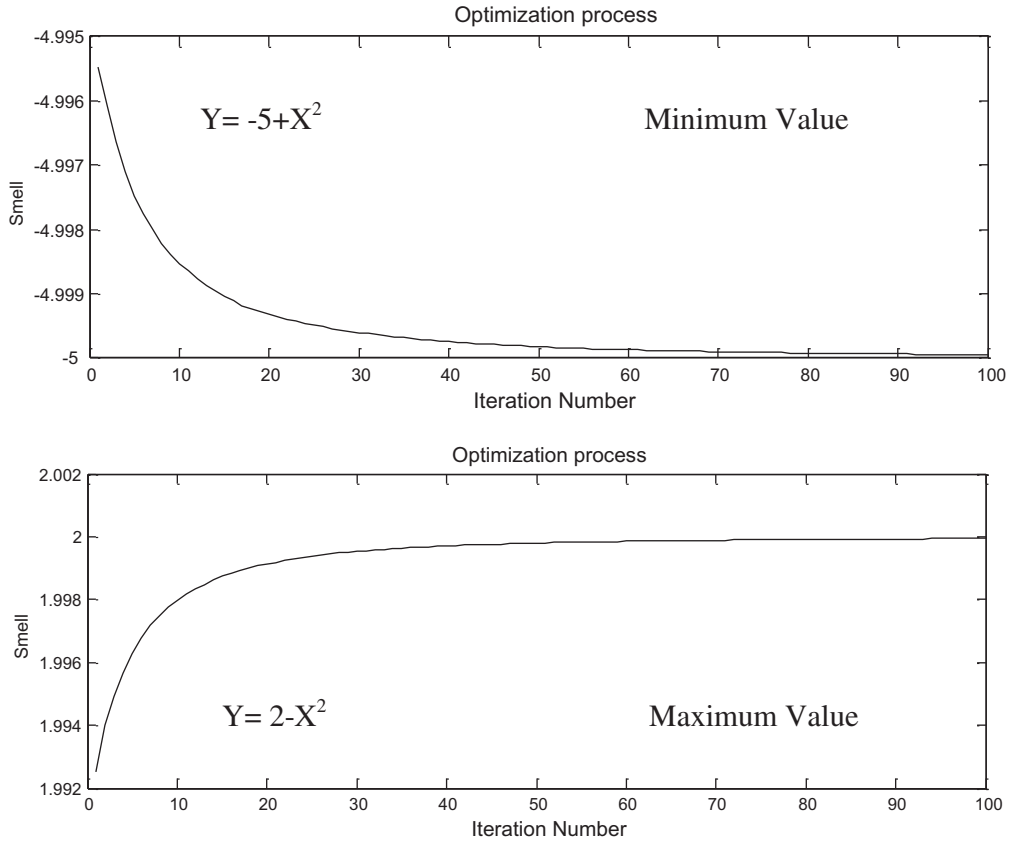

Fig. 2. Curve of extreme value solution of an iterative search solution.