Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 111 (2017) 58–63

Procedia Computer Science

www.elsevier.com/locate/procedia

8th International Conference on Advances in Information Technology, IAIT2016, 19-22 December 2016, Macau, China

An application of fruit fly optimization algorithm for traveling salesman problem

Hazim Iscan[a,*], Mesut Gunduz[a]

[a]*Computer Engineering Department, Selcuk University, Konya, Turkey*

Abstract

In this study, an application of fruit fly optimization algorithm (FOA) is presented. FOA is one of the recently proposed swarm intelligence optimization algorithms used to solve continuous complex optimization problems. FOA has been invented by Pan in 2011 and it is based on the food search behavior of fruit flies. The FOA has a simple framework and it is easy to implement for solving optimization problem with different characteristics. The FOA is also a robust and fast algorithm and some researchers used FOA to solve discrete optimization problems. In this study, a new modified FOA is proposed for solving the well-known traveling salesman problem (TSP) which is one of the most studied discrete optimization problems. In basic FOA, there are two basic phases, one of them is osphresis phase and the other is vision phase. In the modified version of FOA the ospherisis phases kept as it is and for vision phase two different methods developed. In vision phase, the first half of the city arrangement matrix is updated according to first %30 part of best solutions of the ospheresis phase. The other half of the city arrangement matrix is randomly reproduced because of the possibility that initial solutions are far from the optimum. According to the results, travelling salesman problem can be solved with FOA as an alternative method. For big scale problems, it needs some improvements.

Peer-review under responsibility of the organizing committee of the 8th International Conference on Advances in Information Technology

Keywords: Fruit fly optimization algorithm; metaheuristic; FOA; FFOA; traveling salesman problem; discrete optimization problem

* Corresponding author. Tel.: +90 332 223 37 30; fax: +90 332 241 06 35.
E-mail address: iscan@selcuk.edu.tr

1877-0509
Peer-review under responsibility of the organizing committee of the 8th International Conference on Advances in Information Technology
10.1016/j.procs.2017.06.010

1. Introduction

Travelling salesman problem (TSP)[1] is a problem in which there is a salesman which travels among cities and sells his goods in those cities. While travelling the cities, the salesman wants to visit every city in the shortest path and amount of time. The aim of the problem is to find the shortest path which allows visiting every city only once. TSP is an important problem in the literature because it has many applications in real life. Some of them are including but not limited to, logistics, route and vehicle routing problems etc.

Travelling salesman problem is one of the NP hard problems in combinatorial optimization. The computation cost of TSP increases exponentially depending on the number of cities that they will be visited. Finding optimum result for TSP consumes high amount of time by using classical mathematical methods. Therefore metaheuristic optimization is a good choice for solving this problem.

Metaheuristic algorithms are population based algorithms and, generally, they are developed by inspiring life and food foraging behaviors of living creatures in nature. Fruit fly optimization algorithm[2,3], FOA for short, is one of the recently proposed and popular metaheuristic algorithms. FOA is inspired by food foraging behavior of real fruit flies for finding optimum solutions. The application and implementation of FOA are easy to the problems and it is also stable and very fast algorithm in solving the problems when compared with other algorithms.

In literature, there are some applications which use FOA. Some of them are, PID controller tuning[4,5], autonomous surfaces vehicles applications[6,7], power load forecasting[8,9], multidimensional knapsack problem[10], GRNN optimization[11], scheduling problem[12,13,14], financial distress[15,16], vehicles routing[17], web service composition[18], supply chain network[19] and etc.

2. Basic foa

FOA is an evolutionary computation method firstly presented by Wen Tsao Pan in 2011[2,3]. FOA is inspired by food foraging behavior of fruit flies. Fruit flies find their food by using their smell and vision capabilities. The smell and vision capabilities of fruit flies are superior to other fly species. They can smell the food even if it is 40 km away. Figure 1 shows the food finding behavior of fruit flies.

Basic FOA is comprised of two phases. In the first phase, the flies use their smell capability to fly through food area. In the second phase they use their vision capability to get nearer. The steps of FOA are given below. As can be seen from the algorithmic steps, the smell phase of the algorithm is shorter than vision phase.

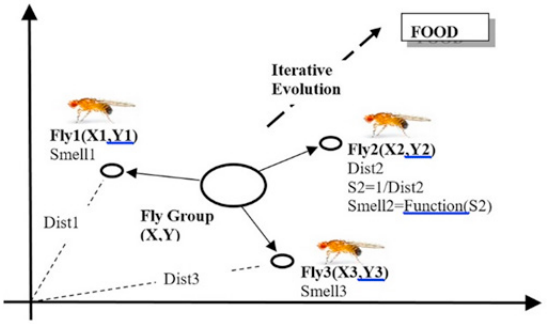

Fig. 1. Food searching of fruit fly.

The food finding steps of FOA;

1. Adjust the parameters
2. Position the fruit flies randomly.
3. Search the food source flying randomly by using Eq.1

$$X_i = X_{axis} + RandomValue$$
$$Y_i = Y_{axis} + RandomValue \quad (1)$$