2-D SWARM MEERKATS BEHAVIOR MODELLING

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ABSTRACT: The foraging behavior of Meerkat is studied and the parameters for simulation of Meerkats foraging behavior is designed. The designed parameters including the number of agents, number of groups, range of perception and number of foods. However, there are not much works done on Meerkats therefore, survey form is used in designing these 14 sets of parameters. Only the choices that have higher percentage is focused in designing the 14 sets of parameters for simulation. The performance of each 14 sets of simulation are compared based on the result obtained from the simulations such as the highest mean quality of food can be achieved, and the time required to reach the highest mean quality of food. The higher the mean quality the better the performance. The smaller the number of ticks required to reach the highest mean quality the better the performance.

KEYWORDS: *Meerkat; Foraging behavior; Flocking behavior; Swarm Intelligence.*

1.0 INTRODUCTION

The suricate or more known as meerkat is one of the species that belong to the mongoose family. Its scientific name is Suricata Suricatta. The meerkat is belonged to mammal class which mean they are a warm-blooded vertebrate animal and they are omnivores. Meerkats are mostly found in Kalahari Desert in Botswana, southwestern Angola, South Africa and Namib Desert in Namibia.

Meerkats only active during daytime and the average weight of male meerkats is about 731 grams, for the female meerkats the average weight is about 720 grams. The height of the meerkats is between the range of 25-35 centimeters and the length of their tail is about 17-25 centimeters. While standing, the meerkats will use their tail to balance their body and their eyes are surrounding by the black color. The black color surrounds their eyes helps meerkats to inspect a thing very clearly even though the surrounding is very bright, and the meerkats can even see the sun directly without any damage to their eyes. This characteristic is very important to meerkats because they can detect the predators that fly in the sky easily and prevent their clan from being the food to the predators.

Besides that, meerkats are social and living in colonies which can contain up to 40 meerkats. Meerkats groom each other regularly to increase the bond between each other. One or more meerkats will act as a guard to look for the predators when the other meerkats are hunting for food [1]. When there is a predator, the guard meerkat will give a warning bark to inform the other meerkats to hide into the holes. The guard will be the first one to come out from the holes to ensure whether the predator had left or not and if the predator had left the guard meerkat will stop the warning bark and the other meerkats can continue their routine.

Agent-based modelling (ABM) is a method for simulating the interactions between each individual agent which can be simulated using NetLogo. ABM is to simulate a complex dynamic model. "Dynamics" is defined as continuously changing or developing and always involve in many complex elements. ABM makes the problems easily to solve and that would be very difficult to solve using

traditional dynamical methods [7]. Several examples of Agent Based Modelling application for swarm intelligence are ant colony optimization (ACO), bee colony optimization (BCO) and so on.

In this work the meerkat swarm dynamics behavior is simulated by using agent-based modelling (ABM) method. The parameters such as number of groups, chances to go for the best food, range of perception and number of foods are designed, and the simulation result of different input values of parameter is studied. This document contains the guidelines extended abstract preparation.

2.0 RELATED WORKS

In year 2018, the work done by Al-Obaidi *et al.*, studied the Meerkat Clan Algorithm. They are described by a decentralized manner of working in which it imitates the performance of swarms of social insects, flocks of birds, or schools of fish. The benefit of optimization practices of swarm intelligence over old-fashioned methods is their strength and flexibility [21].

The research which focused on meerkats' foraging behavior had been done by Azmilumur, Meerkats are social-living mongoose which can be found in boundless areas of southern Africa. They colonized in social groups that consist of dominant pair and between 3 to 25 members that co-operate in vigilance, territorial defense and co-operative breeding [22].

3.0 BEHAVIOUR MODELLING

First the number of agents will be generate based on the input from the user and then the agents inside the arena will start to form a group. After forming a group, the agents will start foraging for food. If agents found the food, then sum of probability of agents same with its quality of food is compared to the chances to go to the best food. If the sum of probability of agents same with its quality of food is less than the chances to go to the best food then agent will move toward the other agents with its favorite quality of food if and only if the agents that found its favorite quality of food in the range of perception. If there are no any agents that found its favorite quality of food in the range of perception, it will come out from its current food source and go to search for the best food.

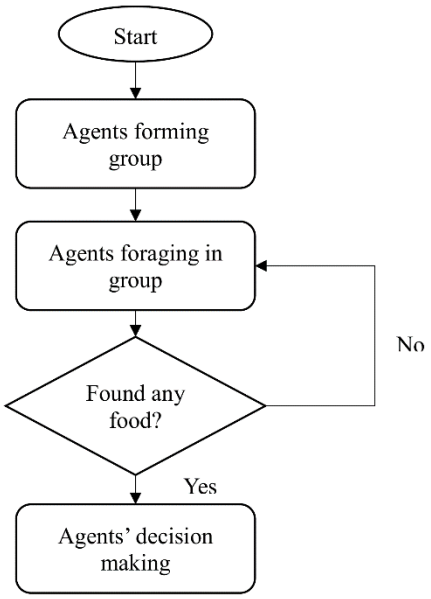

Figure 1. Flow chart of the agent foraging behavior models

However, if the sum of probability of agents same with its quality of food is larger than the chances to go to the best food, it will start counting the number of agents same with its quality of food. If the number of agents same with its quality of food is smaller than the number of agents at other food

source, it will start search for the bigger group. If the big group is in the range of perception and sum of probability of agents same with its quality of food is less than 70% of the sum of the total quality of number of agents with same quality of food, it will move toward the big group or else it will stay at its food source.

4.0 RESULTS

51 samples are chosen from a total 2000 number of ticks for each simulation of different number of groups is recorded and studied. In this simulation, the number of agents is set to 20, range of perception is set to 35 patches and chances to leave the current food source and go to the best food is set to 50%. In these simulations, the total quality found by agents is refer to summation of food quality of all the agents that found the food and, in this case, the maximum quality of number of agents with best food is 80. Based on the Figure 4.4, 3 groups, 4 groups and 5 groups are trapped in local maxima. In term of the number of ticks to reach the highest mean quality, 4 number of groups is the fastest to reach its maximum quality follow by 5 number of groups and 3 number of groups. However, the simulation of 3 number of groups has the smallest difference with the global maximum compare to the other two.

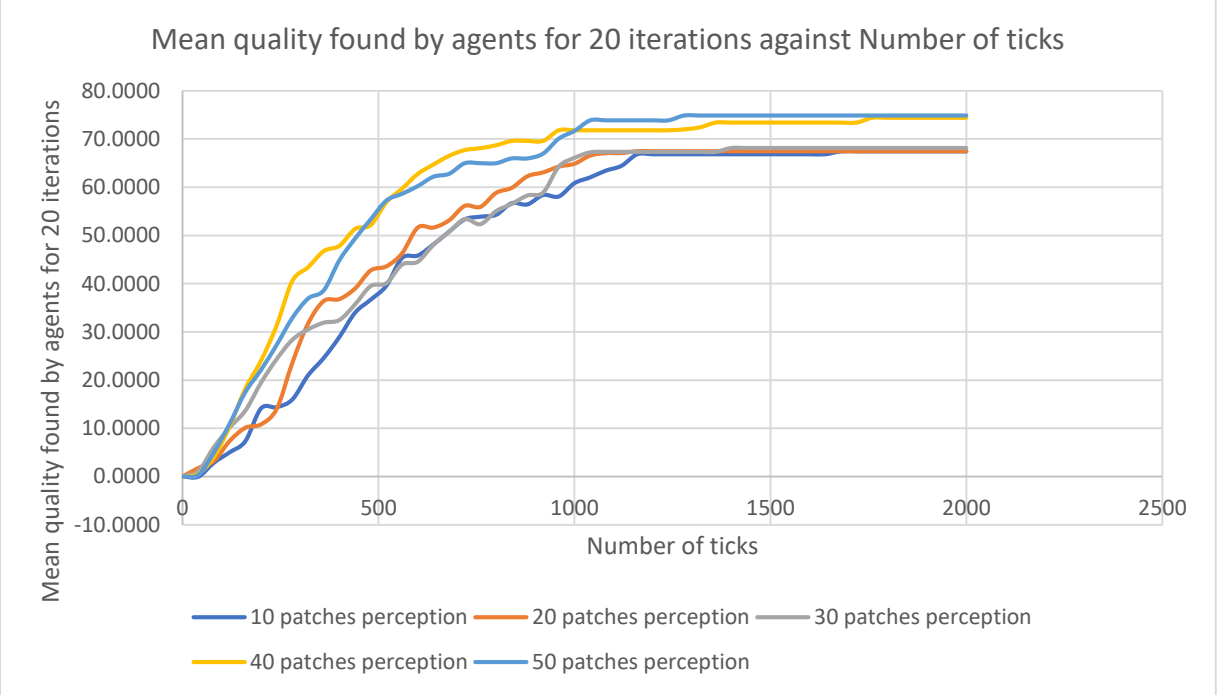

Figure 2. Comparison between 10 patches perception, 20 patches perception, 30 patches perception, 40 patches perception and 50 patches perception

5.0 CONCLUSION

The Meerkats behavior had been studied and parameters which are number of groups, chances to go to the best food, range of perception and number of foods were designed for simulation of the foraging behavior of meerkats. The number of groups will determine how many groups will be formed in the arena. The chances to go to the best food parameter is to determine the percentage that agent will come out from its current food and search for the best food. The range of perception parameter is to determine how far is the vision of the agent. The number of food parameter determines how many food sources present in the arena.

6.0 ACKNOWLEDGEMENT
All authors have disclosed no conflicts of interest, and authors would like to thank the Ministry of Education Malaysia and Universiti Sains Malaysia for supported the work by Fundamental Research Grant Scheme (Grant number: USM/PELECT/6071239).

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