AN EXPERIMENT OF ANT ALGORITHMS: CASE STUDY OF KOTA KINABALU CENTRAL TOWN

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ABSTRAK

Masalah pencarian laluan yang terpendek adalah salah satu masalah optimisasi yang amat sukar diselesaikan. Terdapat pelbagai algoritma yang boleh digunakan bagi menyelesaikan masalah ini. Dalam kajian ini, *Ant Algorithm* digunakan bagi penyelesaian masalah ini mengunakan data sebenar. Bandaraya Kota Kinabalu (BKK) digunakan sebagai data sebenar. BKK ini dijadikan graf eksperimen, dimana bangunan diwakili sebagai nod, jalan raya yang menyambungkan bangunan-bangunan diwakili sebagai lengkung. Manakala jarak antara bangunan diwakilkan sebagai pemberat kepada garis penyambung nod tersebut. Objektif kajian ini adalah untuk meneroka dan menilai *Ant System* dan *Ant Colony System* dalam menyelesaikan masalah pencarian laluan yang terpendek. Perbezaan algoritma ini juga turut dibincangkan. Proses simulasi digunakan sebagai kaedah kajian ini. Terdapat beberapa eksperimen yang dijalankan bagi melihat kesesuaian algoritma tersebut. Ini berpandukan manipulasi beberapa parameter. Pada akhir kajian, didapati AS tidak sesuai bagi menyelesaikan masalah untuk data BKK kerana tiada wujud *Hamiltonian cycle*. Walau bagaimanapun ACS adalah algoritma yang sesuai malah memberi jawapan yang optima.

ABSTRACT

Shortest path is one of the optimization problems that are difficult to solve. There are many algorithms that used to solve this problem. In this study, ant algorithms are used to find the shortest path using a real data. Kota Kinabalu Central Town (KKCT) is been used as the real data, where the nodes represent as buildings, the arc represent as roads and weight on the arc represent as distance. The objectives of this study are to explore and evaluate the Ant System (AS) algorithm and Ant Colony System (ACS) algorithm in finding shortest paths. Both algorithms are compared. Simulation is used as a method in this study. This is because a simulator is been designed. There are several experiment carry out using the simulator. The experiments involved manipulating several parameters. As a result, the AS was found to be not suitable for the real data used because KKCT is a graph without Hamiltonian cycle. ACS was found to be suitable for KKCT real data and produced an optimal solution.

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LIST OF ABBREVIATIONS

Acronym	Meaning
AS	Ant System
ACS	Ant Colony System
EC	Evolutionary Computation
FPGA	Field Programmable Gate Arrays
KKCT	Kota Kinabalu Central Town
PSO	Particle Swarm Optimization
SI	Swarm Intelligence
TSP	Travelling Salesman Problem

CHAPTER 1

INTRODUCTION

The nature is an importance source of inspiration for academicals research. In artificial intelligence simulation methods that nature uses, form several different areas. Important techniques for problem solving are genetic algorithms, neural networks, self-organizing systems and insect algorithms. The problem solving capabilities of all these paradigms are known in different names such as collective intelligence, natural computing, emergent problem solving, bio inspired solution or autocatalytic optimizing. The optimization or problem solving strength of algorithms that was inspired on processes can be put to work in different areas: travelling salesman (TSP), scheduling, routing, graph partitioning and ordering problems. Those problems are popularly used to proof that a new technique is able to compete with other techniques.

Recently, scientists turn to insects for ideas that can be used for heuristics (Tarasewich & McMullen, 2002). Many aspects of the collective activities of social insects, such as ants are self-organizing. It means that complex group behaviour emerges from the interactions of individuals who exhibit simple behaviours by themselves. This idea is also known as Swarm Intelligence (SI). Swarm intelligence had a diversity of meaning. Bonabeau *et al.* (2003) said that Swarm Intelligence is the property of a system whereby the collective behaviours of (unsophisticated) agents interacting locally with their environment cause coherent functional global patterns to emerge.

The contents of the thesis is for internal user only

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