

# Application of Parallel Genetic Algorithm in Daily Life

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**Abstract**—Genetic algorithm was used to find the solution to problems by Darwinian Evolution and the same applies to Parallel Genetic Algorithm (PGA) which was created by John Holland. Genetic algorithms are the best search methods that rely on the principles of natural selection and genetics. The objective of this paper is to show where the Parallel Genetic Algorithm had been applied in our life. A model is used to optimize bus route headway which aims to locate an adequate harmony between passenger and operator costs and it is called as the optimal of service quality and the minimization of operational costs. The combination of Graphics Processing Unit with Parallel Genetic Algorithm to generate daily activity plans is the solution for the problem. A methodology is proposed in terms of yard crane scheduling as well as a dynamic Hierarchical Parallel Genetic Algorithm using Grid Computing. Today, Parallel Genetic Algorithm has been used widely due to the powerful search it provides and it is also the hard programs that control many parameters.

**Keywords:** Parallel Genetic Algorithm, GPU

## I. INTRODUCTION

Genetic algorithm was used to find the solution to problems by Darwinian Evolution [2]. Parallel Genetic Algorithm (PGA) was created by John Holland [3]. From current research on parallel genetic algorithm, it can be divided into three categories: *global*, *island* and *cellular genetic algorithm* [4]. In addition, there are so many successful experiments that suggest that GA is not limited to unimodal functions [5].

Genetic algorithms [2] are the best search methods that rely on the principles of natural selection and genetics [6]. Nowadays, it has been connected effectively to discover worthy answer for issues in business, engineering and science. Generally, GA is able to discover great arrangements in sensible measures of time, yet as they are connected to harder and more concern issues there is expansion in the time required to discover a suitable solution.

The objective of this paper is to show where is Parallel Genetic Algorithm had been applied in our life. Moreover, PGA is used in certain problem to maximize or optimize solution. For example, PGA used in bus route headway [7], generate daily activity [8], comparison between swarm

optimization and UAV path planning [9] and yard crane scheduling [10].

## II. APPLICATIONS OF PGA IN DAILY LIFE

1. Parallel genetic algorithm in bus route headway optimization [7].

In this paper, a model is used to optimize bus route headway which aims to locate an adequate harmony between passenger and operator costs and it is called as the optimal of service quality and the minimization of operational costs [7]. So, PGA was used to increase the quality of genetic algorithm to answer the headway optimize model. Below is Figure 1 showing a flowchart after PGA is implemented to maximize the result of bus route headway.

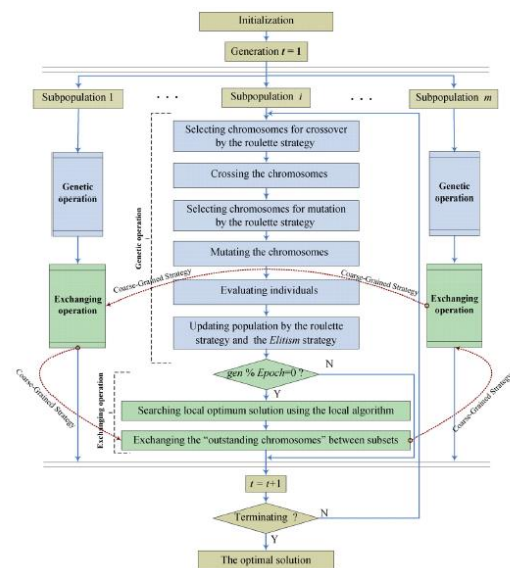


Figure 1. PGA implement for bus route headway

2. A GPU-Based Parallel Genetic Algorithm for Generating Daily Activity Plans [8].

The combination of Graphics Processing Unit [8] with Parallel Genetic Algorithm to generate daily activity plans is the solution for this problems [8]. They also state that, previous paper only generates daily activity for individual only, but after they improve GPU adapted with PGA, they can generate daily activity for multiple people.

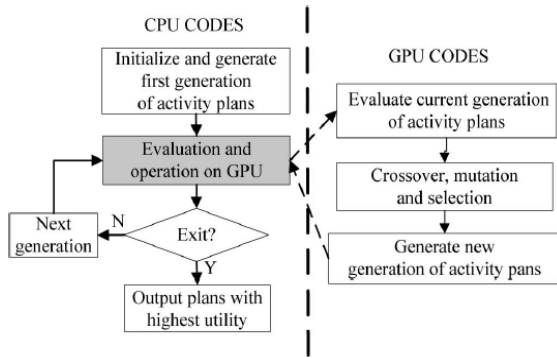


Figure 2. PGA using GPU-Based implementation

As for the result in this paper, they also state that they improve their previous work using GA to generate the daily activity plans. But after using GPU-based implementation to generate daily activity, they have increased the value of generating the daily from 300 to 1000 individual and house agents compared with CPU-only implementation.

### 3. A hybrid parallel genetic algorithm for yard crane scheduling [10].

In this paper, they had proposed a methodology in terms of yard crane scheduling [10]. Furthermore, an effective model using programming for this paper is originally created that based on rolling horizon approach. The flowchart of the algorithm is displayed below in Figure 3.

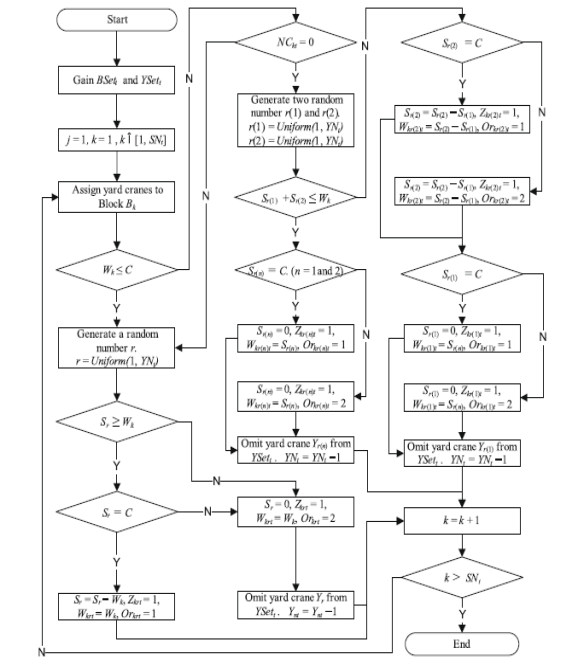


Figure 3. Hybrid PGA for yard crane

### 4. Efficient Hierarchical Parallel Genetic Algorithms using Grid computing [11].

For this paper, they had proposed an dynamic Hierarchical Parallel Genetic Algorithm using Grid Computing. In

addition, the framework is created using the technologies of Grid computing. And to approach the framework, they proposed a theory [11]. As stated below, they created a flowchart to present how the PGA using Grid computing. Figure 4 shows the flow of the PGA using Grid computing.

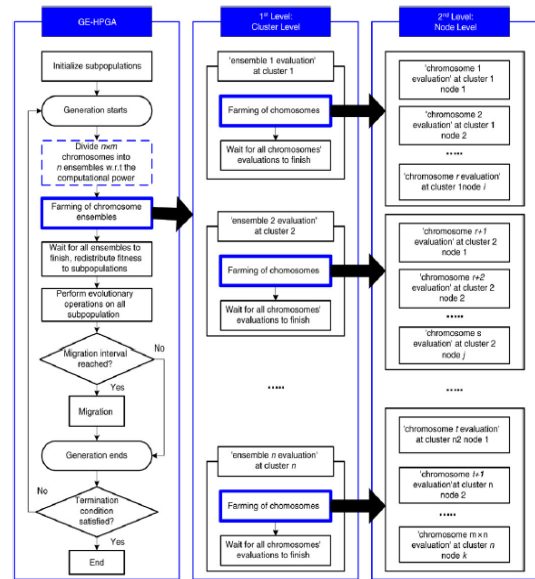


Figure 4. PGA using Grid computing

### 5. Comparison of Parallel Genetic Algorithm and Particle Swarm Optimization for Real-Time UAV Path Planning [9].

In this paper, they stated they used PGA and particle swarm optimization to adapt between the complexity of problem and quasi-optimal trajectories [9]. Furthermore, they had compared the results between PGA and particle swarm optimization in UAV path planning.

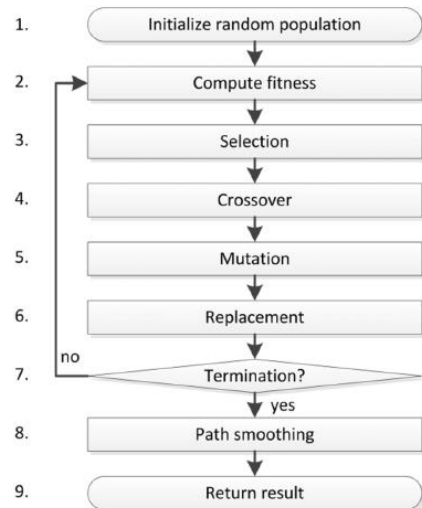


Figure 5. Flowchart of PGA

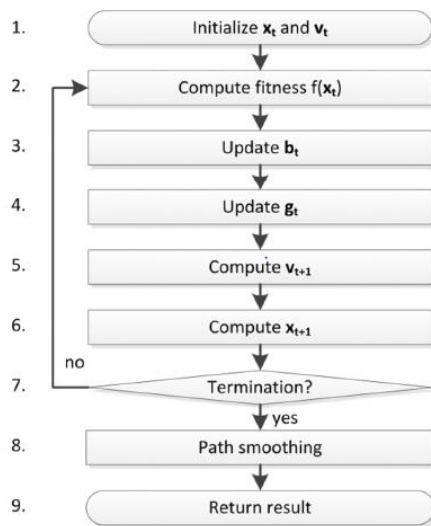


Figure 6. Flowchart of UAV using particle swarm optimization

### III. CONCLUSION

Genetic algorithm and Parallel Genetic Algorithm had been used to find the solution to problems that require the best search methods that rely on the principles of natural selection and genetics. The PGA had been applied in our life with various applications of different models, such as bus route headway optimization and yard crane scheduling. Today, PGA has been and will be used widely due to the powerful search it provides as well as the hard programs being applied to control many problem parameters.

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