International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 12 261 – 264

A Review on GPU Based Parallel Computing for NP Problems

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Abstract- Now a days there are different number of optimization problems are present. Which are NP problems to solve this problems parallel metaheuristic algorithm are required. Graph theories are most commonly studied combinational problems. In this paper providing the new move towards solve this combinational problem with GPU based parallel computing using CUDA architecture. Comparing those problem with relevant to the transfer rate, effective memory utilization and speedup etc. to acquire the paramount possible solution. By applying the different algorithms on the optimization problem to catch the efficient memory exploitation, synchronized execution, saving time and increasing speedup of execution. Due to this the speedup factor is enhance and get the best optimal solution.

Keywords – *Graph Theory, CUDA, GPU, parallel metaheuristic.*

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I. INTRODUCTION

In today's era there is a huge amount of interest into the field of the Parallel Computing and it's analysis which had lead many research challenges related to confide applications. The term "Parallel computing" is the synchronized use of various compute resources to resolve the computational problems. That means the problem is divided into number of distinct elements that can be solved concurrently. Every part is further divided into the chain of instructions. The instructions from every parts are executed at once on different processors. An overall power or synchronization mechanism is employed [1,2,3].

The operations performs parallel, data analysis is very difficult and challenging task rather than several other applications on statistics like locating, identifying or citing data, complex problem needs vast computational control as well as time to solve[4]. GPUs provide the platform for attractive performance to energy consumption and the cost of acquisition proportion, and allow to performing many types of complex computations more rapidly whereas maintaining the equal cost in relation to the CPUs with the faster transferring rate. Alternatively, because of significant differences as of the CPU structural design, employ of GPUs often requires major changes in the algorithm. GPUs comprise the enormous quantity of comparatively simple computing units (processing elements), and thus taking full advantage of their performance requires an appropriate division of calculations into subtasks. All together, the vast amount of high latency operations must be minimized, particularly involving universal memory access [5,6].

Complex problem such as TSP(Travelling Salesman Problem) & All Pair Shortest Path needs huge computational power as well as time for the solving. That takes lots of time for sole computer to resolve such large problems. Parallel computing is the new approach to crack such a variety of problems via General Purpose Graphical Processing Unit (GPU). GPUs are to be accomplish graphical processing such as straightforward arithmetic operations also on graphics in the form of matrices. So we can exploit GPUs processor to answer our problem to speed up the execution time.GPU consists of great number of processors embedded together in chip to carry out a precise kind of operations.

There are number of metaheuristic algorithms allow to find estimated solutions of good quality to many difficult optimization problems in a comparatively little period of era. Superior examples of competent heuristic algorithms are including the Ant Colony System (ACS) [1].Similarly to other metaheuristic algorithms, ant colony algorithms are computationally demanding, therefore much research effort was put into rising capable parallel versions for multi-processor computers [7,8,9]. There are important differences which make efficient simultaneous implementation of the algorithm more composite. In the modern days, optimization problems are utilized in a variety of areas such as interview scheduling, vehicle transportation and courier system by providing the reliable solution.

The rest of the paper is ordered as follows. Related work is explained in section II. Section III contains our system overview and Conclusion in section IV.

II. RELATED WORK

Rafał Skinderowicz proposed, the GPU-based Parallel Ant Colony System. Paper presents the three narrative comparable versions of the ACS for the graphics processing

units (GPUs). Towards the finest of our understanding, the ACS which shares several key essentials of the ACO and the MMAS, except differences in the process of construct the solutions and updating the pheromone trails make obtaining an proficient similar adaptation for the GPUs a complicated job. [1]

Laurence Dawson & Iain Stewart proposed, An improving Ant Colony Optimization performance on the GPU using CUDA. This paper implement together the tour creation along with pheromone informs stages of Ant Colony Optimization (ACO) on the GPU using a data correspondent approach. This drastically reduces the organization instant of tour construction. [2]

Akihiro Uchida, Yasuaki Ito & Koji Nakano proposed, An Efficient GPU Implementation of Ant Colony Optimization for the Traveling Salesman Problem. This Introduced the Ant Colony Optimization (ACO) approach as a environment enthused heuristics to discover excellent solutions of the Traveling Salesman Problem (TSP). In ACO approaches, a number of ants go across the cities of the TSP to locate recovered solutions of the TSP.[3]

Jose M. Cecilia, Jose M. Garcia, Manuel Ujaldon, Andy Nisbet & Martyn Amos proposed the, Parallelization strategies for Ant Colony Optimization on GPUs. That discuss quite a lot of parallelization tactic for together stages of the ACO algorithm scheduled the GPU. Alternative data-based parallelism proposal for Tour construction, which fits better on the GPU design. [4]

Hongtao Bai, Dantong OuYang, Ximing Li, Lili He & Haihong Yu proposed the, MAX-MIN Ant System on GPU with CUDA. In this the Multi ant colonies through individual constraint settings are entire offloaded to the GPU in analogous. Implemented this on GPU based with compute unified device architecture (CUDA). [5]

Ling Chen,Hai-Ying Sun & Shu Wang proposed the, Parallel Implementation Of Ant Colony Optimization on MPP. In this the algorithm, propose a plan intended for information swap among the processors which make each processor choose its associate to communicate and keep informed the pheromone adaptively. Also recommend a technique of adjusting the moment distance of information exchange adaptively accordance with the range of the solutions subsequently like in the direction of boosts the ability of search and avoid early convergence. [6]

Marco Dorigo & Luca Maria Gambardella proposed the, Ant Colony System : A Cooperative Learning Approach to the Traveling Salesman Problem. In the ACS, a set of collaborating agents called ants assist to discover the fine solutions to TSP's. Ants help using an indirect form of communication umpired by a pheromone they situate on the boundaries of the TSP graph while building solutions. [7]

Marco Dorigo, Vittorio Maniezzo, & Alberto Colorni proposed, Ant System: Optimization by a Colony of Cooperating Agents. The main distinctiveness of this mold is optimistic feedback, spread calculation, and the compose use of a realistic covetous heuristic. optimistic feedback accounts for speedy uncovering of good solutions, extend computation avoids premature convergence, and the greedy heuristic helps find acceptable solutions in the untimely phases of the search process.[8]

Ugur Cekmez, Mustafa Ozsiginan, & Ozgur Koray Sahingoz proposed, A Uav Path Planning With Parallel Aco Algorithm On Cuda Platform. The path is assembled for broadcasted keys and collecting data from a Wireless Sensor Network. Due to its ease and usefulness. [9]

Ying Tan & Ke Ding proposed the, A Survey on GPU-Based Implementation of Swarm Intelligence Algorithms. This follows the widespread appraisal of GPU-based equivalent SIAs in agreement with a recently proposed catalog. Serious concerns for the capable parallel completion of SIAs are also described in detail. [10]

Rafał Skinderowicz proposed, Ant Colony System with Selective Pheromone Memory for TSP. Includes, all trails are accumulated in a pheromone memory, which in the case of the Travelling Salesman Problem requires O(n2) memory storage, where n is the extent of the problem instance. [11]

Rafał Skinderowicz proposed, Ant Colony System with Selective Pheromone Memory for SOP. This paper extend the previous work on a original discriminating pheromone remembrance reproduction for the ACS in which pheromone standards are store up barely for the chosen subset of trails.[12]

Pavel Kromer, Jan Platos, Vaclav Snasel & Ajith Abraham proposed, A Comparison of Many-threaded Differential Evolution and Genetic Algorithms on CUDA. In this paper, compare discrepancy development and inherent algorithms implemented on CUDA while solving the independent tasks scheduling problem.[13]

Byunghyun Jang, Dana, Perhaad Mistry & David Kaeli proposed the, Exploiting Memory Access Patterns to Improve Memory Performance in Data-Parallel Architectures. The paper enclose techniques for enhancing the memory competence of appliances, based on the scrutiny and tagging of memory admittance samples in round bodies, mark vectorization via records transformation to advantage of the vector-based buildings and algorithmic memory selection for scalar-based architectures.[14]

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Kai-Cheng Wei, Chao-Chin Wu & Chien-Ju Wu., proposed Using CUDA GPU to Accelerate the Ant Colony Optimization Algorithm. This paper following a new parallel method, which is called the Transition Condition Method. The tentative outcome have proved that the quality of solutions does not be sacrificed in the cause of speed-up.[15]

III. SYSTEM OVERVIEW

3.1 Problem Statement –

Design a parallel environment framework which will be useful for resolve the optimization troubles very easily and effectively. Optimization problems those are NP problems can be solved by using the different heuristic algorithms. Appropriate to this the solution for a difficulty is gained quickly. At the equivalent time high postponent operations should be minimized, particularly involving comprehensive memory access. Use of various heuristic algorithms that will be useful for implementation of system. Getting the approximate key to the different optimization problem within little quantity of instance with effective memory utilization and increase the speedup of the operations.[13]

3.2 Proposed System –

Proposed system includes following components they are Data Preprocessing, CPU & GPU memory allocation, Data transfer, execution stage and Data transfer from GPU to CPU.

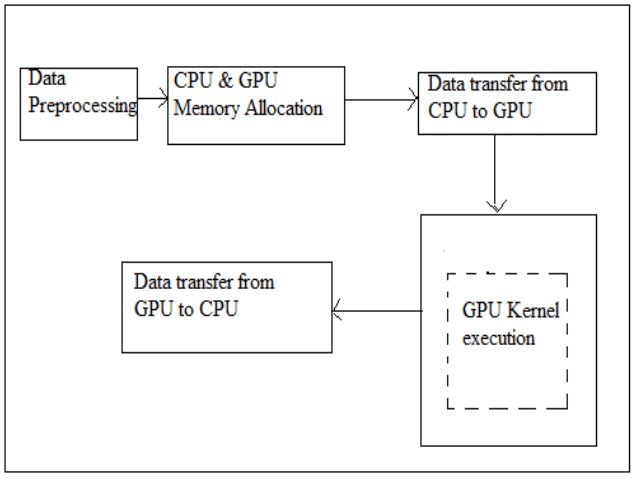

Figure. 1 Proposed System Architecture

Figure 1 indicates the flow of proposed system. In the Data preprocessing which performs the processing on the provided input data. After that CPU and GPU memory allocation is performed using the necessary techniques required for the allocation . Firstly data is located on CPU then that data is transfer from CPU in the direction of GPU. GPU side kernel performs completing of the various threads simultaneously that means checks the data transfer time. By performing the different heuristic algorithms[13,14].Finally resulted data is transfer from GPU to CPU.

3.2 Memory organization flow for GPU Architecture

Simplified Memory Organization flow for GPU structure design is described in the figure 2.

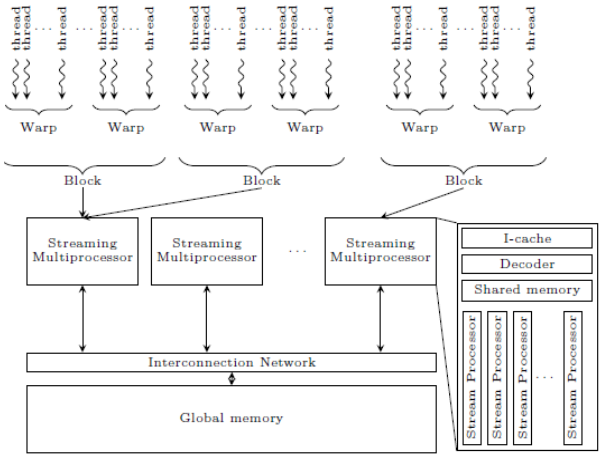

Figure. 2 Memory Organization flow for GPU Architecture.

Generally the GPU contains a vast number of stream processors, each belonging to one of numerous streaming multiprocessors(SM). At any specified moment a solitary core achieved calculations for a particular thread. Threads are assembled into the blocks, with each chunk assigned to a individual SM. Cores belongs to the same SM share, with others, the records , limited memory, data fetch and decoding, and load or store units[15]. By allocating various auxiliary units, more computing cores can be packed into a lone SM at the expense of some grade of flexibility of calculations of entity cores. Which is time-consuming, frequently at an order of multiple cycles, in accessing the overall memory are one of the main obstruction to proficient analogous computations on GPUs. The GPU memory bus is wider than the memory bus of the CPU and has a relatively huge bandwidth, but it is often still not adequate to provide data for every of the central part of the GPU. For this reason, the GPU programming model assumes the utilize of a bulky number of threads[1].

IV. CONCLUSION

The proposed system can provide scalable and capable memory utilization using GPU based parallel computing approach. The system will be accomplished for giving accurate results analysis and to build the best possible optimal solution for good quality. Which encompass a series of properties such as precision, strength, scalability, and so forth. It will be convenient than traditional analysis systems.

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