



ӘЛ-ФАРАБИ АТЫНДАҒЫ ҚАЗАҚ ҰЛТТЫҚ УНИВЕРСИТЕТИ
КАЗАХСКИЙ НАЦИОНАЛЬНЫЙ УНИВЕРСИТЕТ ИМ. АЛЬ-ФАРАБИ
AL-FARABI KAZAKH NATIONAL UNIVERSITY

НЬЮКАСЛ УНИВЕРСИТЕТИ (ҰЛЫБРИТАНИЯ)
УНИВЕРСИТЕТ НЬЮКАСЛА (ВЕЛИКОБРИТАНИЯ)
NEWCASTLE UNIVERSITY (UK)

«ОҚЫТУДЫҢ БЕЛСЕНДІ ӘДІСТЕРІ»

халықаралық ғылыми-тәжірибелік
конференциясының
МАҚАЛАЛАР ЖИНАҒЫ

23–24 қараша, 2017 ж.

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SECTION 3: MODERN IT TECHNOLOGIES IN THE EDUCATIONAL PROCESS

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APPLICATION OF ARTIFICIAL INTELLIGENCE METHODS FOR CLUSTER LOAD
BALANCING

Abstract. Active learning is generally defined as any instructional method that engages students in the learning process. Active learning requires students to do meaningful learning activities and think about what they are doing. In this article, a new approach of load balancing in distributed systems has been explored. For this purpose, swarm intelligence algorithm and annealing simulation algorithm are considered. The result of the testing confirmed that due to the independent given number and complexity of the algorithm, the swarm intelligence algorithm is less efficient than the annealing simulation algorithm and the efficiency drop is proportional to the increase in the quantity of the variable.

Introduction. Active learning is generally defined as any instructional method that engages students in the learning process. In short, active learning requires students to do meaningful learning activities and think about what they are doing [1]. One of the imitation methods in education - case studies - begins in the twenties of the last century. In modern pedagogy, it can be called a method of analyzing specific situations. The essence of the method is quite simple: for the organization of training, descriptions of specific situations are used. Students are encouraged to comprehend the real life situation, the description of which simultaneously reflects not only any practical problem, but also updates a certain set of knowledge that must be learned when solving this problem [2]. The problem itself does not have unique solutions.

Currently, the development of computing technologies have reached a peak, when a simple increase in processor power, storage capacity, data bandwidth transmission networks has virtually exhausted their resources, and does not satisfy the growing needs of computing resources in science, education, and in solving complex applied tasks and of engineering calculations. The speed of network interaction becomes more comparable with the speed of processors, and, accordingly, the issue of "localization" of computing is gradually losing its urgency. It needs to have a conceptual leap in computing. In this regard, there is a tendency of shift towards distributed computing systems, which provide users access to geographically distribute computing resources, combined into a single powerful resource pool.

Methods. For the organization of computing processes in distributed environments requires the solution of several classes of tasks, including optimizing the use of available computing resources depending on their demand in terms of physical limitations. The problem of limited resources is particularly relevant for organizations with their own corporate information system. These types of institutions include education, medicine, banking sector, where the use of computing resources implies a significant number of users who simultaneously access the services of the computing environment. One of the main trends of development of information technologies is currently a massive introduction of high-performance cluster systems. At the moment, the problem of cluster load is one of the most urgent problems that are still being solved. In this case study, the situation will load balancing of cluster. Proceeding from the situation, the problem of the cluster load balancing was analyzed by the swarm intelligence method.

The distribution, or equalization of the loads pertaining to several nodes, it is possible to avoid such situations when the Web-packets transmitted over the network crash into one node, while others are idle. Suppliers have established the release of load balancing systems - software products that equalize the load, distributing it to several nodes. In addition, they increase fault tolerance: in case of failure, one machine sends data packets to another node. Thus, waiting time is reduced, and the number of unprocessed requests is minimized. Load balancing systems can be used when working with a variety of nodes (Figure 1).

The client does not suspect that it is addressing a whole group of servers: they are all presented to it in the form of a single unified virtual server [3]. In the process, the balancer uses a certain method of determining the system load and distributes the load [4]. For these purposes, the algorithm of the swarm intelligence is considered in this article.

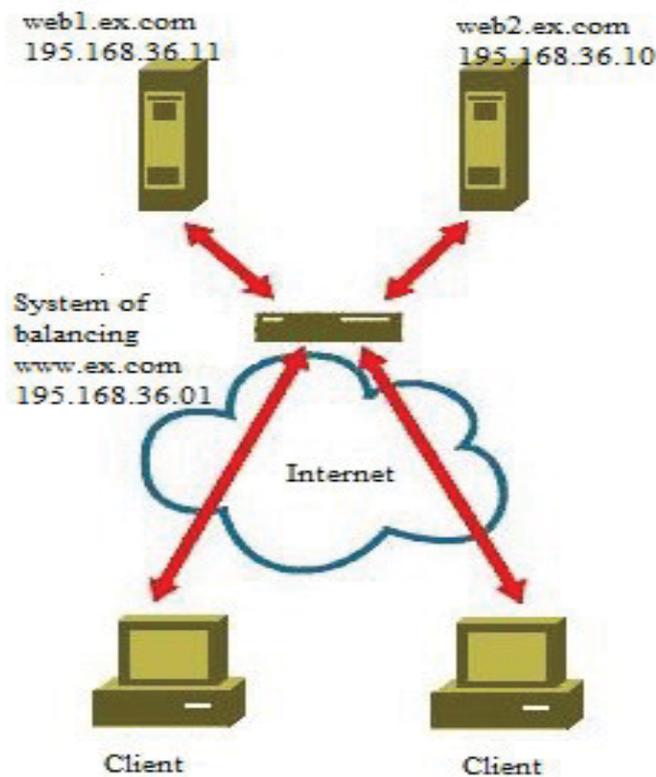


Figure 1. Balancing system

The swarm intelligence algorithm is one of the polynomial heuristic algorithms for solving optimization problems based on the imitation of the behavior of the colony of honey bees when collecting nectar in nature. The main purpose of the algorithm in nature is to explore the area around the hive in order to search for nectar and then collect it. To this end, the colony contains different types of bees.

- The main description of the algorithm will look like this:
- Initially, power sources are produced for all working bees;
- Repetition:
- Each bee (employed bee, EB) searches for a source, then estimates its amount of nectar and dances in a hive;
- Each Viewer (onlooker bee, OB) watches the dance of bees (EB) and selects one of their sources according to the dance, and then goes to that source. Then he estimates the amount of nectar;
- The abandoned power supplies will be identified and replaced with new power sources detected by scouts (scout bee, SB);
- The best food source found is stored in memory.
- While (requirement is true).

The swarm intelligence algorithm can be used to solve discrete (combinatorial) and continuous global optimization problems and has a sufficient degree of similarity with multi-start algorithms. Usually it includes the initial reconnaissance and subsequent work of the beehive bees. In the initialization (initial exploration), the exploration of the feature space is performed in order to determine K its most promising points with the best values of the objective function $f(X) = f(x_1, x_2, \dots, x_n)$ (in the simplest case using the random search method), which are stored in the hive. After that, local reconnaissance within the given reconnaissance radius R is made in the vicinity of the selected reconnaissance points in order to try to refine the solution (improve the record), while achieving an improvement in the hive, the updated value of the record f^* and the corresponding parameter vector of the objective function X^* are preserved. Combining the work of intelligence bees and worker bees for a given number of iterations C , the algorithm provides a gradual improvement of the remembered sample $R = [X_1, X_2, \dots, X_K]$ from K solutions. Upon completion of his work, the best solution is chosen from the set of solutions, which is the result of the algorithm's work [5].

Results. Since we considered the random number density, the density curve was first calculated and plotted (Figure 2).

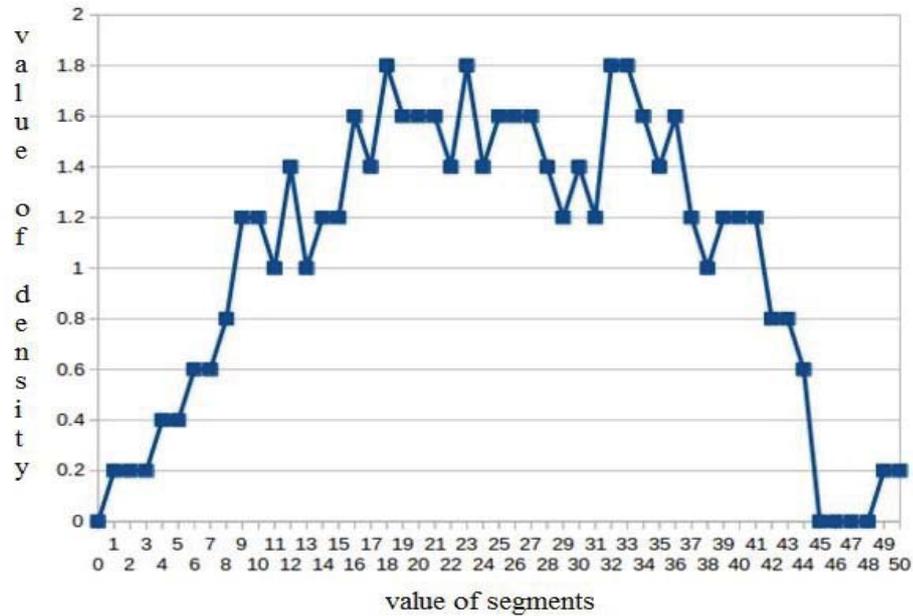


Figure 2. Density of the load value

The entire analysis process began with the analysis of the algorithm and smoothly passed to the realization of method, which consisted of two stages, and at the end switched to testing the results. Two stages of realization are sequential and parallel realizations. The result of the first stage of realization is shown in Figure 3.

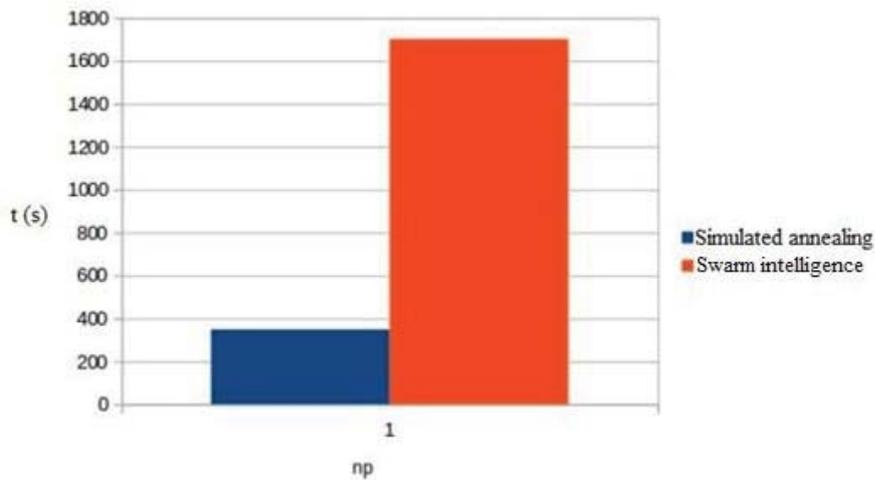


Figure 3. Execution time of the sequential realization (t – time in milliseconds and np – number of nodes) with Cycle number_of_SI = 10000

After a sequential stage, you can proceed to the parallel stage of coding and testing, respectively. The first step of realizing of results of the parallel implementation started with runtime testing.

Section 3

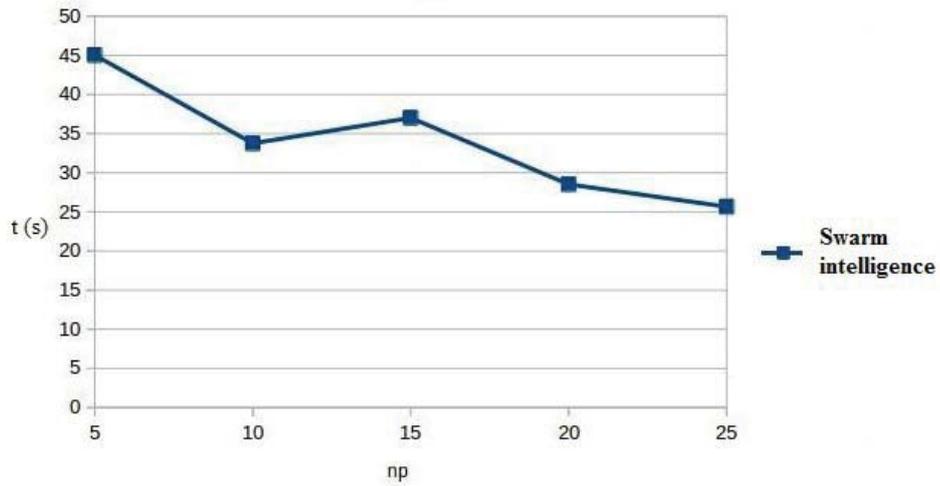


Figure 4. Execution time of the parallel realization of SI algorithm for Cycle_number_of_SI = 10000

The second step of the realizing of results was testing and determining parallel implementation's speedup.

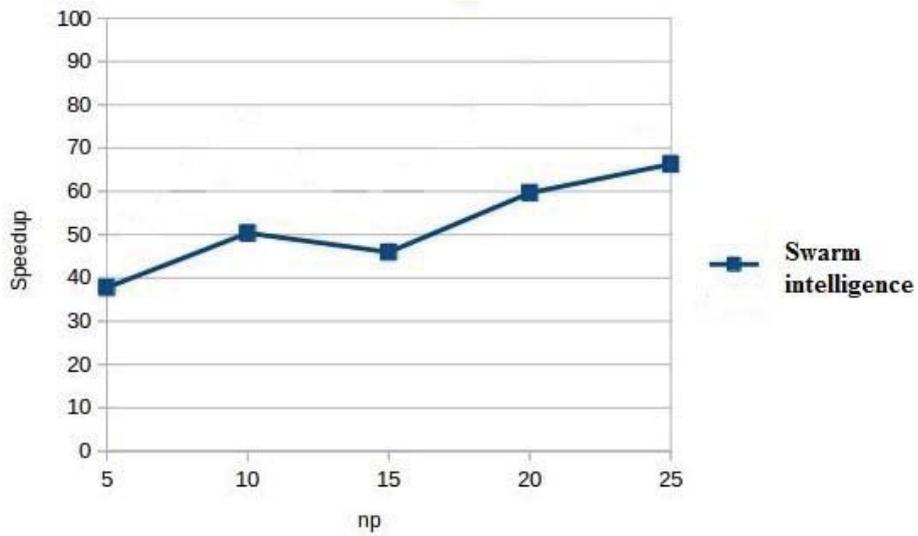


Figure 5. Speedup of the parallel algorithms with Cycle_number_of_SI = 10000

The last step of testing of methods was determining and calculating of efficiency of the parallel implementation.

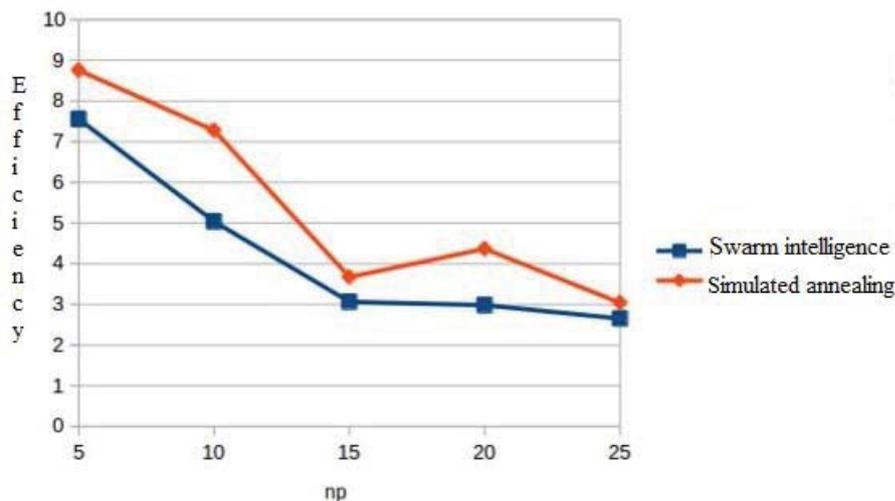


Figure 6. Efficiency of parallel algorithms with Cycle_number_of_SI = 10000

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ПРИМЕНЕНИЕ ТЕХНОЛОГИЙ РАЗРАБОТКИ МОБИЛЬНЫХ ПРИЛОЖЕНИЙ В УЧЕБНОМ ПРОЦЕССЕ

Abstract. *The article discusses the features of developing various types of applications for smartphones and their implementation in the learning process*

Современные мобильные телефоны, называемые смартфонами, - действительно "умные" устройства, предоставляющие их обладателям почти безграничные возможности: Интернет, почта, органайзер, аудио- и медиапроигрыватель, GPS, игры, общение и многое др. Основное отличие смартфона от обычного мобильного телефона – это наличие полноценной операционной системы (ОС), поэтому его считают мини-компьютером с функциями телефона. Установка дополнительных приложений, сотни тысяч которых предлагает Интернет, позволяет расширить функциональные возможности смартфонов.

Обучение студентов в данной сфере информационных технологий является перспективным направлением. На рынке труда прослеживается большая нехватка разработчиков приложений для мобильных устройств.

Наша цель - внедрение в учебный процесс основ создания приложений для мобильных устройств, дать студентам базовые знания и навыки в этой области. Конечно, в рамках одного курса невозможно охватить все технологии и приемы разработка приложений для мобильных устройств. Но дать