A Suitable Initialization Procedure for Speeding a Neural Network Job-Shop Scheduling

Rukhsana G. Sache
Department of Computer Science and Engineering
SVERI's College of Engineering, Pandharpur, Maharashtra, India

Yoginath R. Kalshetty
Department of Computer Science and Engineering
SVERI's College of Engineering, Pandharpur, Maharashtra, India

Abstract- Artificial neural network models have been successfully applied to solve a job-shop scheduling problem (JSSP) known as a Nonpolynomial (NP-complete) constraint satisfaction problem. Our main contribution is an improvement of the algorithm proposed in the literature. It consists in using a procedure optimizing the initial value of the starting time. The aim is to speed a Hopfield Neural Network (HNN) and therefore reduce the number of searching cycles. This new heuristic provides several advantages; mainly to improve the searching speed of an optimal or near optimal solution of a deterministic JSSP using HNN and reduce the make span. Simulation results of the proposed method have been performed on various benchmarks and for the simulation results the proposed heuristic method is used , and this method is efficient with respect to the resolution speed, quality of the solution, and the reduction of the computation time.

Keywords – Artificial Neural Network, Job-shop scheduling, Hopfield network, Optimization methods, Constraint satisfaction.

I. INTRODUCTION

The job-shop scheduling problem (JSSP) aims at a resource allocation problem with respect to allocation and sequence constraints. It is one of the most complicated and complex issues. It has gained increasing interest over the last three decades.

There exist three common well-known approaches to solve JSSP: priority rules, combinatorial optimization, and constraints analysis Käschel et al has given detail comparison of these methods. JSSP has a great impact on manufacturing systems nowadays. In the modeling and design of manufacturing systems, the quality of service (QoS) In order to evaluate the efficacy of the framework Zude [3] has developed a prototype Model effectively satisfy the various performance requirements for manufacturing systems , the design, and verification of distributed networks Hirsch et al , table-based scheduling method is one of the approach adapted to the distribute DSM is introduced by Handa et al. which are directly affected by applying JSSP new and efficient algorithms.

The most important standard optimization methods from the research in the literature is dedicated to the following methods such as heuristic methods Yahyaoui et al., genetic algorithms Morandin et al. [4], intelligent methods Zaied et al., Ferrolho et al[4], neural networks Foo et al., Satake et al. and Yang et al. [5], particle swarm optimization (PSO) Huynh et al., Liao et al., Electron et al. local search Ma et al., hybrid methods Moghaddam et al., and taboo search Yong et al. to mention but a few. References [6] provide excellent review papers on JSSP. Recently, the neural network approach for JSSP has been one of the hotspots in the production–scheduling field for a comprehensive classification and a review of production scheduling with neural network. First Foo et al. presented a novel approach using an original Hopfield Neural Network (HNN) for solving the JSSP. Then, they introduced integer linear programming networks as an extension of the original Hopfield network . Their objective is the minimization of the sum of all the starting times last operation (makespan) for each job. So far, HNN have been successfully applied to solve JSSP . All the works mentioned here used nonadaptive networks. Willems et al. [1]–[2], proposed a recent HNN structure used for solving a JSSP. They described the method and applied it on a simple example of five machines and five jobs.

In this paper, we propose a modification of the heuristic proposed by Williams et al. [1]–[2] Job-shop scheduling problem is one of the most complicated and typical issues. It belongs to the large class of nondeterministic polynomial time complete (NP-complete) problems. In general, an NP-complete problem is one which for some input of size N takes a time proportional to at least 2N. Even the JSSP is not only NP-hard, it is one of the worst

members in the class. An indication of this is given by the fact that one 10×10 (10 jobs/10 machines) problem formulated by Muthand Thompson remained unsolved for over 20 years. The traditional job-shop scheduling problem is defined as follows : there are n jobs to be processed through m machines in a described order under certain restrictive assumptions; each job must pass through each machine exactly one time. The job processing on a machine is called an operation and requires a duration known as the processing time. Minimizing the makespan Cmax will be considered as the optimization criterion in this paper, in other words, to minimize the floating time of jobs. The proposed modification consists in a suitable choice of the HNN initialization starting time of the JSSP. This optimal choice draws a fast training of the neural network and near-optimal solution. This new heuristic has been tested and compared with other existing methods on many benchmarks.
The rest of the paper is organized as follows. Proposed Heuristic method are explained in section II. Experimental results are presented in section III. Concluding remarks are given in section IV.

II. PROPOSED ALGORITHM

A. Proposed Heuristic method –

It refers to experience-based techniques for problem solving, learning, and discovery that give a solution which is not guaranteed to be optimal. Where the exhaustive search is impractical, heuristic methods are used to speed up the process of finding a satisfactory solution. Heuristic is an adjective for experience-based techniques that help in problem solving, learning and discovery. A heuristic method is used to rapidly come to a solution that is hoped to be close to the best possible answer, or 'optimal solution'. Heuristics are "rules of thumb", educated guesses, intuitive judgments or simply common sense. A heuristic is a general way of solving a problem. Heuristics as a noun is another name for heuristic methods.

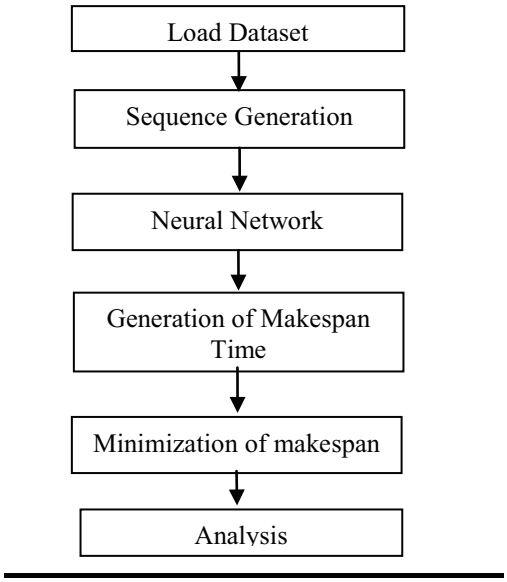


Figure1. Flow chart for generating performance chart from input dataset.

In more precise terms, heuristics stand for strategies using readily accessible, though loosely applicable, information to control problem solving in human beings and machines.While an algorithm is a method containing finite set of instructions used to solving a problem. The method has been proven mathematically or scientifically to work for the problem. There are formal methods and proofs.

How to process this algorithm or method is shown in Figure 1. In this first we load the data which contain the Number of machines and corresponding time for the machines. And The sequence of the jobs are swapped in order to identify the make span time and SPT by the use of HNN (Hopfield Neural Network).After Swapping we check the Sequence is optimized or not by HNN.Then we compute the Makespan time for the each Sequence by (Heuristic Method).From the identified Make span time we find the SPT(Shortest Processing time).

III. Experiment and Result

The test set for this evaluation experiment for job shop scheduling using neural network the input dataset is given as like matrix format and in this the number of jobs and machines are mentioned and also processing time that is how much time that job is process on that machine. Matlab 7.0 software platform is use to perform the experiment. The PC for experiment is equipped with an Intel P4 2.2GHz Personal laptop and 2GB memory.

The proposed heuristic method and HNN is used for generating the optimized result and minimum makespan time. From the simulation of the experiment results, we can draw to the conclusion that this method is robust for optimized result.

Figure2. For input data and sequence generation.

In this module we will load the benchmark job and machines dataset .*and again the* Sequence generation is a strategy for protecting confidentiality in released micro data records. In the simplest case of its use, values of a single attribute (or variable) are formulated between randomly selected pairs of records.

And after clicking on the Neural Network (Hopfield Neural Network) the performance chart and confusion matrix is generated as.

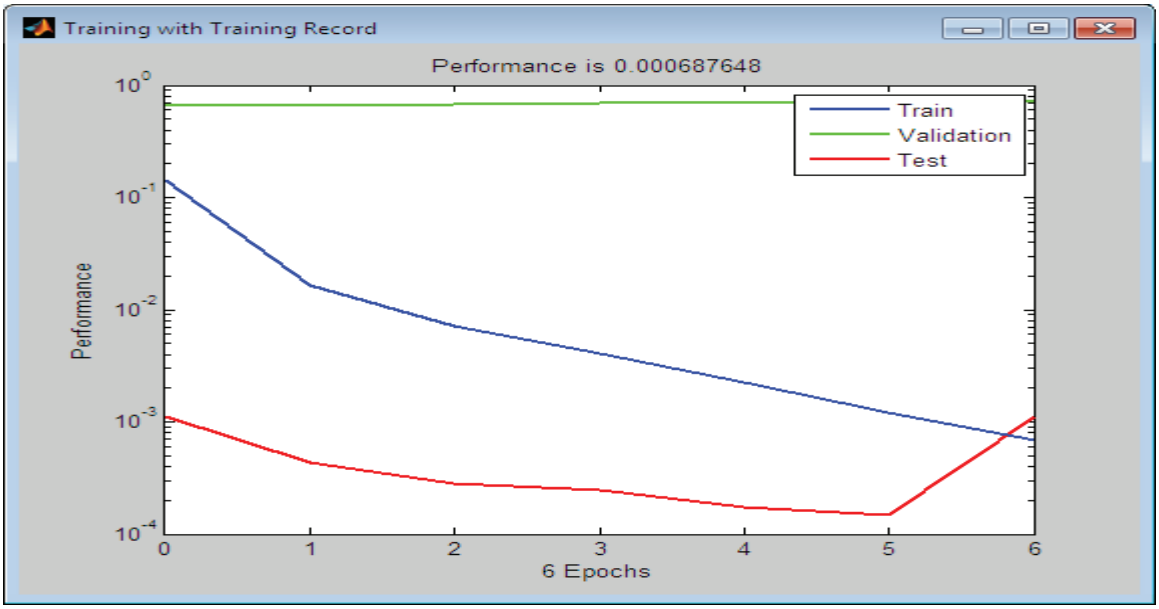


Figure 3. Performance chart

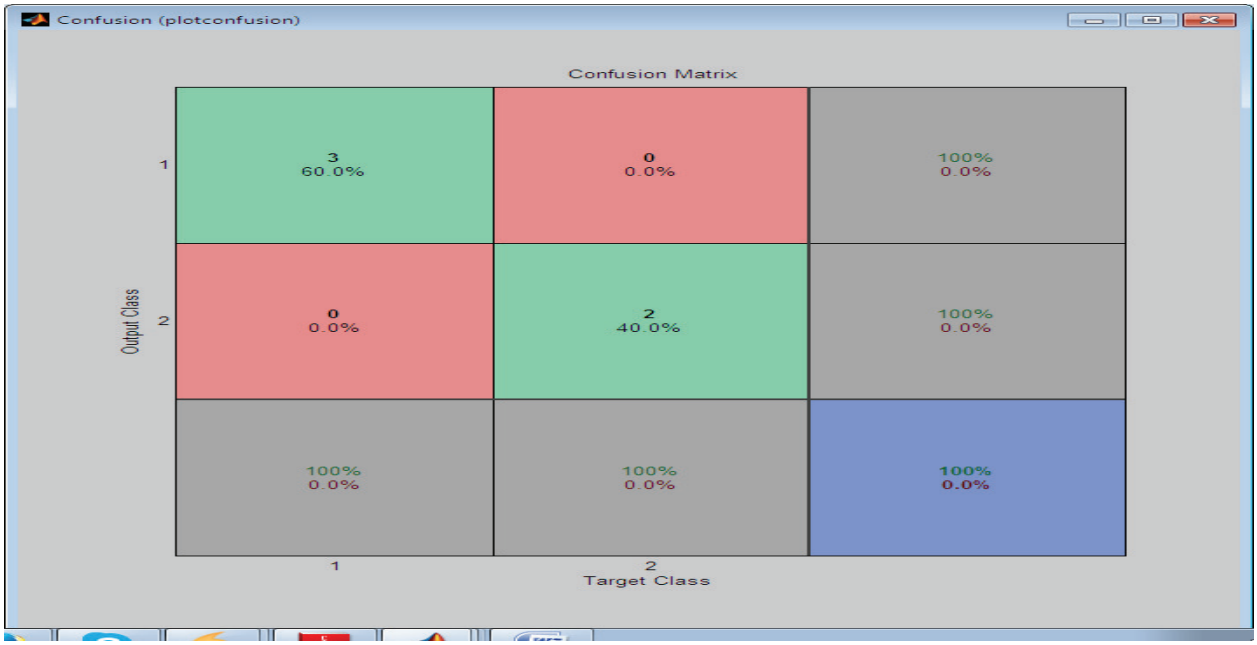


Figure 4 Show how much level of optimized sequence is generated.

A Neural Network is a system with an input, an output and at least one hidden intermediate layer which is formed by simple computational units interlinked called neurons. After a training process the neutrons establish synapses (weights) between them and the network should have the ability to respond to newer situations.
And after clicking on Makespan time for all possible sequences makespan time is generated and after that according to the sequence which generate the minimum makespan is consider.

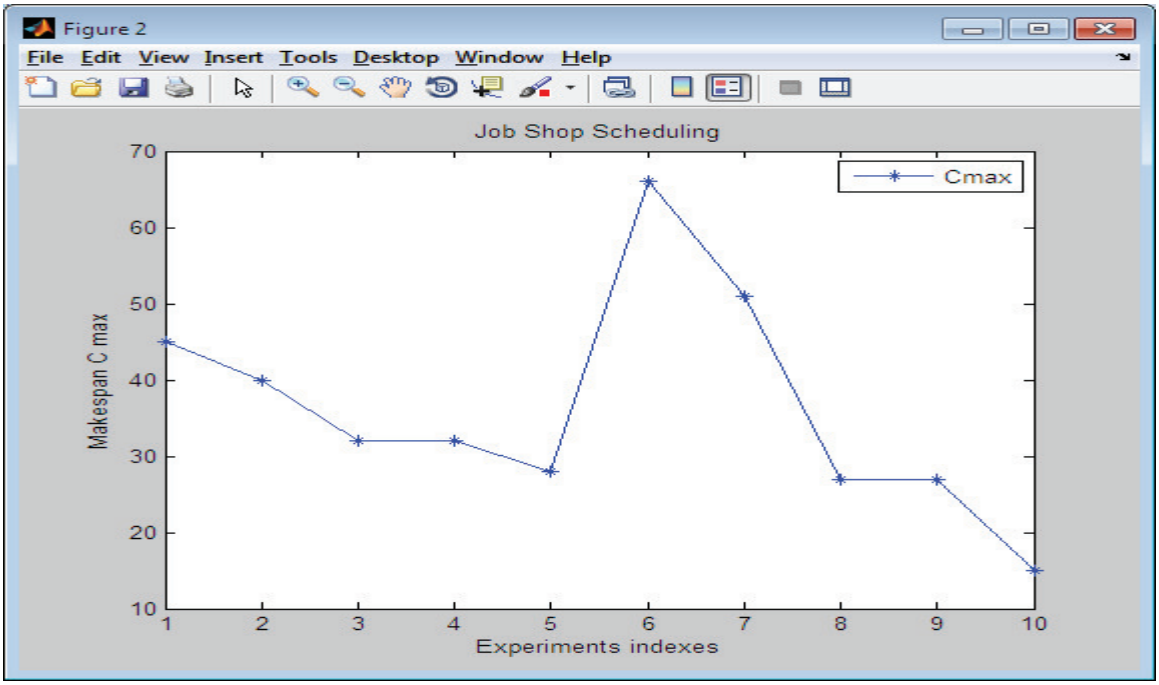
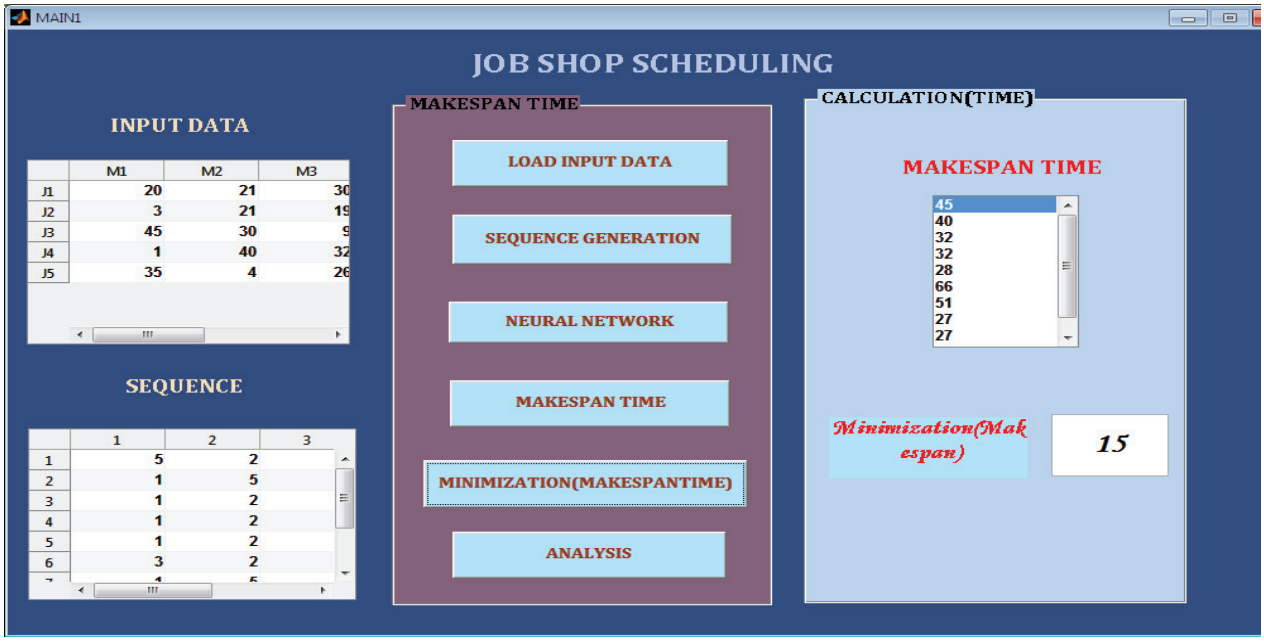
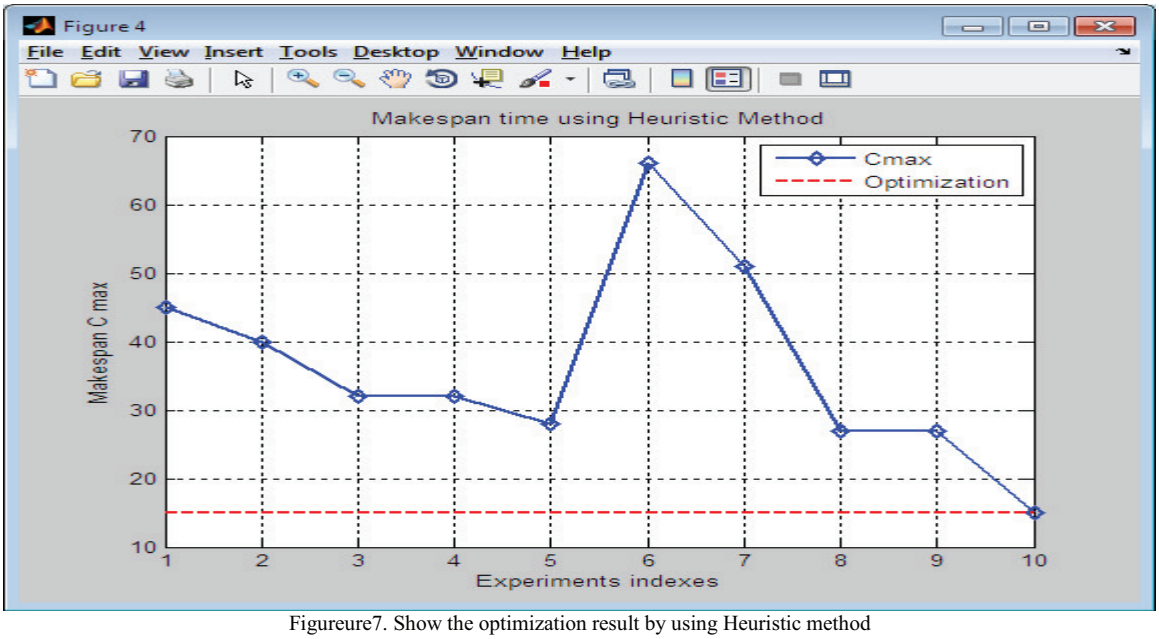


Figure 5. Shows the makespan time(Cmax)



Figureure 6. Shows the makespan time for all sequences and also minimum makespan time.



Figureure7. Show the optimization result by using Heuristic method

IV.CONCLUSION

In this paper, a new heuristic initialization procedure of the algorithm is used for solving the JSSP. It has several advantages in terms of reducing the number of cycles related to the total completion time of all the jobs that is makespan time. In this paper, 10x10 dataset problems are solved and hence proposed heuristic algorithm is suitable for solving small-sized as well as big-sized problems. Also it gives the better performance and optimization level of those sequences which give the minimum makespan.

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