A Case for Decision Support Systems on Project Management

Sinem Besir, Kökten Ulas Birant

Dokuz Eylül University, Computer Engineering Department, Buca,Izmir, Turkey
sinembesir@gmail.com, ulas@cs.deu.edu.tr

Abstract. Companies use project management systems in order to manage and plan their processes. The use of these systems provide functionalities such as generation of time charts, definition of milestones, adaption of time charts relative to risk analysis and more. The data used in these systems is entered by the system user. The validity and accuracy of this data entered is relative to the experience, knowledge and prediction skills of the person who entered the data. Because of this, results can be erroneous. To avoid this problem, an automatic calculation for input values could be used resulting in a more valid and accurate planning. Using the system developed, companies can perform project planning and management functions easier and through the parameters and statistical data used and more accurate time charts can be generated.

Keywords: Decision Support Systems, Data Mining, Project Management

1 Introduction

Development of software-based computerized solutions requires creativity, time, money and labor effort which are used in the various phases of development. One of the most important factors that should be taken into consideration in the process of development is planning and management of the resources available. Resource management is the efficient and effective deployment for an organization's resources when they are needed. Such resources may include financial resources, inventory, human skills, production resources or information technology. Project management systems are used for this purpose.

Project management is the planning, organizing, directing, and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives. Furthermore, project management utilizes the systems approach to management by having functional personnel assigned to a specific project. Classical project management includes a number of elements: initiation, planning or development, production or execution, monitoring and controlling, closing. So, the initiation phase contains too many estimations and assumptions. For this phase, the amount of the real and proven information is the most important data for a good estimation and therefore for a successful project. A

decision support system may be a supporter for the experts with a synthesis of the information.

2 A Simple Decision Support System

Project management systems which are currently in use operate by relying on the data gathered through the user. Projects are planned and managed according to the start and end dates provided by the user as it is decided by the project manager. The defined start and end dates may not be the optimal dates depending on the experience level of the project manager. In order to avoid the use of experience-based data, a standardized system which provides ease in data gathering and calculating can be developed. By generating a project archive with the parameters effective in the management process and applying data mining techniques to this archive, the effective weights of parameters can be found and used in order to obtain a standardized system.

2.1 Motivation

Project management systems which are currently in use operate by relying on the data gathered through the user. Projects are planned and managed according to the start and end dates provided by the user as it is decided by the project manager. The defined start and end dates may not be the optimal dates depending on the experience level of the project manager. In order to avoid the use of experience-based data, a standardized system which provides ease in data gathering and calculating can be developed. By generating a project archive with the parameters effective in the management process and applying data mining techniques to this archive, the effective weights of parameters can be found and used in order to obtain a standardized system.

2.2 Application

The standardized system would have the following roles in its structure:

- Projects, which are made up of tasks
- Tasks, which are performed by employees
- Employees, who are assigned to tasks

Considering the system as a whole, it is possible to group the parameters which would be used in the system in three groups: project-based parameters, employeebased parameters, task based parameters. In order to be able to determine the weights of the effective parameters, a sample data set must be prepared to train the system and determine the weight values.

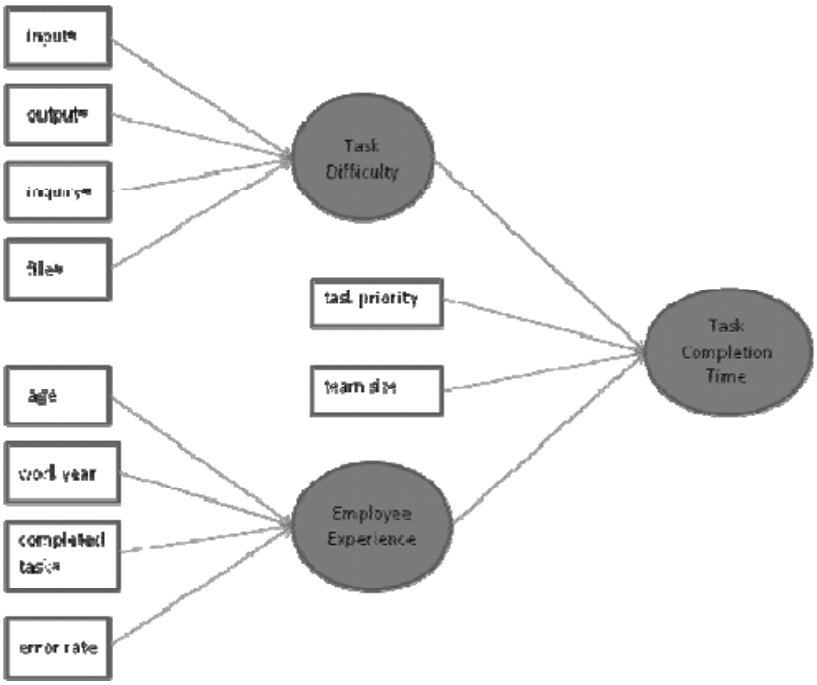

Fig. 1. Calculation of parameter weights and generation of the results

In the process of preparing the sample data set, the first step is determining the parameters that would be effective in training the system. Effective parameters are defined by considering the variability of the parameters. If a change in a parameter's value affect the result that is demanded to be calculated, that parameter must also be used in the process of finding the weights. The second step is to define the range of possible values that the parameter can have. The minimum and maximum range values would be defined by considering the worst and best cases for a parameter. The third and last step is determining the range intervals for the range found in the previous step.

Fixed k-interval discretization method would be appropriate to determine the range intervals. Fixed k-interval discretization method divides the sorted values of a numeric attribute into k intervals, where each interval contains (n/k) possibly duplicated adjacent values, where n is the number of observed values. "k" is determined without reference to the properties of the sample data set. The method originally ignores relationships among different attributes. In order to provide a relationship among the parameters determined at the first step, the intervals determined for all parameters needs to be combined in a form that there exists a value for each possible interval combination.

In order to calculate the parameter weight values which are used to calculate task completion time, employee experience and task difficulty, neural network algorithm is used by using the tables which contain sample datasets for the relative calculations. Neural network works by processing the sample dataset by recalculating weights

while processing each record in the table. When the error value becomes stable, it is possible to stop the processing. As the dataset size is quite large and at least one sample record is provided for all possible combinations of parameter range values, the processing is stopped after processing all records in the sample dataset twice.
The algorithm used for the neural network application in the thesis is as follows:
1. Initialize weight values (symbolized with w), learning rate (symbolized with lr) and threshold (symbolized with t)
2. Load the sample dataset into the memory
3. For each record in the dataset:
    a. Gather parameter values (symbolized with x) and result value (symbolized with z) and assign the values gathered into relative variables
    b. Calculate the output product (x * w) for all parameters and their corresponding weights (symbolized with c)
    c. Calculate the sum of all outputs (symbolized with s)
    d. If (s > t) then value assigned for network is 1, otherwise 0 (symbolized with n)
    e. Calculate the error value with the subtraction (z - n) (symbolized with e)
    f. Calculate the correction value with the production (lr x e) (symbolized with r)
    g. Calculate new weight values by the formula (w + (r * x))

2.3 Risks

The developed system is run on the sample dataset that is generated by producing random values according to predefined criteria. This would affect the reliability of the results as the dataset is not consisted of actual test data.

Relatively to this risk, the parameters are not sufficient; they are defined according to basic requirements. More efficient results would be gathered by using a more extensive list of parameters.

3 Further Work

When this system is expanded and worked on in the future, two possible upgrades can be possible. One of the improvements is providing a web-based system rather than a standalone system. By converting the current system into a web-based system, the system would be available to anyone from anywhere without an installation.

Developing a better formula can be achieved by having a more reliable dataset which consists of actual task results instead of a randomly generated dataset. The system can be expanded and run with a new dataset by adapting the parameters relatively to the new dataset. This would provide better parameter weight values. Additionally, a deeper inspection with real data would reveal other parameters that would be effective in the weight calculation.

4 Conclusion

Statistical Timeline Development System is designed to provide efficient and reliable results that are used for project management purposes with the usage of neural network algorithm and the formulas generated. The system is extendable for new parameters and new dataset formats. With self-learning logic, the system is capable of perfecting the weights used in the formulas which are used in generating the results. The purpose of the system is generating the most accurate results.

References

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