A Neuro-Fuzzy Tool for Software Estimation

X. Huang, *D.Ho*[1], J. Ren and L.F. Capretz
University of Western Ontario, N6G 1H1, Canada
[1]Toronto Design Center, Motorola Canada Ltd., L6G 1B3, Canada

Abstract

Accurate software estimation such as cost estimation, quality estimation and risk analysis is a major issue in software project management. In this paper, we present a soft computing framework to tackle this challenging problem. We first use a preprocessing neuro-fuzzy inference system to handle the dependencies among contributing factors and decouple the effects of the contributing factors into individuals. Then we use a neuro-fuzzy bank to calibrate the parameters of contributing factors. In order to extend our framework into fields that lack of an appropriate algorithmic model of their own, we propose a default algorithmic model that can be replaced when a better model is available. Validation using industry project data shows that the framework produces good results when used to predict software cost.

1 Introduction

As software development has become an essential investment for many organizations, software estimation is gaining an ever-increasing importance in effective software project management. In practice, software estimation includes cost estimation, quality estimation, risk analysis, etc. Accurate software estimation can provide powerful assistance for software management decisions[1]. The principal challenges are 1) the relationships between software output metrics and contributing factors exhibit strong complex nonlinear characteristics; 2) measurements of software metrics are often imprecise and uncertain; 3) difficulty in utilizing both expert knowledge and numerical project data in one model. To solve software estimation problems, we propose a soft computing framework based on the "divide and conquer" approach[2, 3].

2 Soft Computing Framework

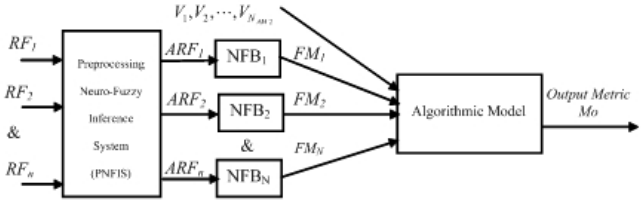

Figure 1: Soft-Computing Framework

3 Case Study Using the COCOMO Model

In this case study, there is a total of 69 project data available, including 6 project data from industry and 63 project data from the original COCOMO'81 database.

$$M_o = A_k \times (Size)^{B_k} \times \prod_{i=1}^{15} EM_i \qquad (1)$$

Table 1: Cost Estimation For 69 Project Data

PRED	COCOMO81		Framework		Improve
	#Projects	Accuracy	#Projects	Accuracy	
20%	49	71%	62	89%	18%
30%	56	81%	64	92%	11%
50%	65	94%	67	97%	3%
100%	69	100%	69	100%	0%

4 Conclusion

This paper has presented a general framework for software estimation. The framework concentrates on the preprocessing neuro-fuzzy inference system, the neuro-fuzzy bank and the algorithmic model. We consider as the rating value of contributing factor as input and produce software metric as output. This framework has been validated with project data from the industry. The main benefit of this approach is its good interpretability, that is, by using the fuzzy rules, the approach tries to simulate the software engineers' line of thought when they are doing software estimation process of software engineers software estimation. Another great advantage of this research is that we could put together expert knowledge (fuzzy rules), project data and the traditional algorithmic model into one general framework that can have a wide range of applicability in software cost estimation, quality estimation and risk analysis.

References

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