Chapter 9
Efficient Software Cost Estimation Using Artificial Intelligence:
Incorporating Hybrid Fuzzy Modelling

Sonia Juneja
https://orcid.org/0000-0003-2472-4890
IMS Engineering College, India

ABSTRACT

Accurate cost estimation is desired for efficient budget planning and monitoring. Traditional approach for software cost estimation is based on algorithmic models expressing relationship among different project parameters using mathematical expressions. Algorithmic models are parameter-based models and produce the best accuracy when these parameters are well defined and predictable. The fundamental factor governing project cost within algorithmic models is the software size, quantifiable either in lines of code or function points. Analogy based estimation and expert judgment-based estimation falls under the category of non-algorithmic models. Both algorithmic and non-algorithmic models can estimate project cost and effort required but are unable to face challenges arising due to dynamic user requirements, latest technological trends, and impact of cost drivers on estimation process. Different machine learning based approaches like fuzzy modelling, regression models, optimization techniques, and ensemble methods can be used to predict an estimate nearest to the real cost of the project.

1. INTRODUCTION

Software cost estimation involves predicting the expenses associated with developing a software system, encompassing effort, time, and required resources. These estimates are vital for planning, design, coding, testing, and maintenance phases. Crucial for project planning and management, accurate estimations empower stakeholders to make informed decisions on budgeting, resource allocation, and scheduling,

DOI: 10.4018/979-8-3693-3502-4.ch009

thereby ensuring project success. While numerous software tools employing diverse algorithms and approaches exist to aid in cost estimation, challenges persist in the estimation process.Top of Form

There are numerous factors contributing the complexity of software cost estimation as listed below:

1. **Uncertain and imprecise parameters**: Few parameters defining software projects are inherently uncertain. Ambiguous project requirements, wide scope, and changing technology throughout the project makes it difficult to estimate costs accurately.
2. **Enhanced Complexity**: Software projects are generally involves multiple technologies, dependencies, and stakeholders. In depth understanding of the complexities involved can contribute to better estimation process.
3. **Missing Related Data**: Unavailability of sufficient historical data for related projects makes it challenging to accurately estimate costs based on past experiences.
4. **Dynamicity of Requirements**: As the project progresses, stakeholder's understanding about the need enhances which may result in changing requirements. Estimating costs for projects with evolving requirements can be challenging.
5. **External Cost drivers**: There are various external factors, also known as cost drivers, such as experience of personnel involved, technological advancements, system requirements etc. which impact cost estimation for software projects.
6. **Availability of different Estimation Techniques**: Different estimation techniques have different strengths and weaknesses, and selecting the right technique is crucial for accurate estimation.
7. **Communication**: Effective communication with stakeholders is essential for accurate cost estimation. Misunderstandings or lack of communication may lead to incorrect assumptions and inaccurate estimates.

In order to meet these challenges, researchers are working on incorporating Artificial Intelligence (AI) techniques to meet the offered challenges as stated above and enhance the accuracy and performance of estimation models.AI and ML offers multiple benefits to software development and estimation. AI has the capability to automate the process of code generation and assist bug detection resulting in optimized performance of software development process. For instance, a McKinsey study revealed that integrating AI into development processes can yield significant reductions in both software development costs and time. Additionally, AI can facilitate Predictive Analytics and Data-Driven Development, entailing the analysis of extensive datasets from software development, including code repositories, version control systems, and project management tools. By offering insights and predictions, these analytical approaches enable developers to make informed, data-driven decisions and enhance their development practices for improved results.

2. LITERATURE REVIEW

Software Cost Estimation (SCE) aims at foreseeing the resources required to build up a software product. SCE may be observed like a sub-area of software engineering, which incorporates the prediction of multiple costs to be incurred during development process. The prediction of manpower required and incurred cost is done prior to the actual development of the software so as to generate effective planning for the process. Since 1980s, numerous techniques have been devised to predict the development