

RELIABILITY PAPER

Dynamic testing resource allocation modeling for multi-release software using optimal control theory and genetic algorithm

Testing
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Abstract

Purpose – The use of software is overpowering our modern society. Advancement in technology is directly proportional to an increase in user demand which further leads to an increase in the burden on software firms to develop high-quality and reliable software. To meet the demands, software firms need to upgrade existing versions. The upgrade process of software may lead to additional faults in successive versions of the software. The faults that remain undetected in the previous version are passed on to the new release. As this process is complicated and time-consuming, it is important for firms to allocate resources optimally during the testing phase of software development life cycle (SDLC). Resource allocation task becomes more challenging when the testing is carried out in a dynamic nature.

Design/methodology/approach – The model presented in this paper explains the methodology to estimate the testing efforts in a dynamic environment with the assumption that debugging cost corresponding to each release follows learning curve phenomenon. We have used optimal control theoretic approach to find the optimal policies and genetic algorithm to estimate the testing effort. Further, numerical illustration has been given to validate the applicability of the proposed model using a real-life software failure data set.

Findings – The paper yields several substantive insights for software managers. The study shows that estimated testing efforts as well as the faults detected for both the releases are closer to the real data set.

Originality/value – We have proposed a dynamic resource allocation model for multirelease of software with the objective to minimize the total testing cost using the flexible software reliability growth model (SRGM).

Keywords Testing phase, Resource allocation, Multirelease, Optimal control theory, Genetic algorithm

Paper type Research paper

1. Introduction

Globalization has shown a strong impact on software industry in the technology-driven era. Ever-changing trends and technological advancements in software systems have proven to be a blessing for the customers in daily life. Customers rely on the functionality and accuracy of the software and demand highly reliable and good-quality software which in turn increases the tremendous pressure/burden on the software developers. To survive in this competitive market scenario, software developers need to be customer centric. Thus, in order to achieve this goal, software developers are always in search for new roads to fulfill the growing user demands with proper planning and effort. The job of developing bug-free software is extremely challenging for the firms. During software testing process, important decisions such as allocation of resources, maintenance strategy, release time of the software, etc., have to be taken by the software developers. Software testing plays the most crucial role in software development process as it involves the utilization of resources such as CPU hours and manpower which are both limited and precious. Testing also helps in removing latent faults



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