# Abstract

# 1 INTRODUCTION

Random testing[1] and partition testing[2,3,4] are two very famous methods of software testing. In traditional Random testing(RT), selecting and executing test cases from the test suit/input domain of the software under test(SUT) in accordance with a uniform or un-uniform probability distribution.

By combining random testing and partition testing, random partition testing(RPT) was proposed[11,12]. Suppose the input domain of SUT is partitioned into *m* subdomainsand the ith subdomain comprising distinct test cases. Firstly, RPT selects a subdomain according to a testing profile in which is the selection probability of subdomain . Then, a test case from the selected subdomain is randomly selected with probability. Moreover, the testing profile is invariant during the software testing.

In traditional random partition testing, the corresponding testing profile is constant during the software testing, which is not always a good choice. it is intuition that defects tend to clusters [5-7], which means the test cases in some subdomains may detect defects more easily than others. Following the intuition, Cai et al proposed the Dynamic Random Testing(DRT) [8] which is to improve the traditional random testing and random partition testing. The DRT includes software cybernetics that explores the interplay between software theory/engineer and control to solve software engineer problem [9]. The main advantage of the DRT technique is that the testing profile is dynamically updated in the period of software testing according to the result of executed test case. The paramount idea of DRT is to increase the probability of subdomains that have high defect detection rate.

There are some shortcomings in the original DRT.

1. In the experiment found that the value of the parameters have a great impact on the efficiency of DRT, but the value of the parameters are not unified. The best value may be different for different projects. Junpeng et al gave a range of epsilon / delta from the theoretical analysis [10]. But how to set values of the parameters in DRT, which still is a very difficult thing.
2. In general, the initial test profile is set by the test engineer, and then the parameters are very small, so that the partition with higher detection capability is difficult to stand up in a short time.
3. The testing profile is changed based on the execution result of each test case ,which is not rigorous.
4. The range of adjusting probability should be based on the current size of probability rather than consistent.

On the other hand, there are some external causes that affect the effect of the DRT algorithm.

1. The initial testing profile, in most cases, is the use of equal testing profile, but does not guarantee that the equivalent test profile is always a good choice.
2. In the black box test, the same partition strategy or different partition strategy of the same project, the number of partitions may also be different, different number of partitions led to the algorithm to detect the efficiency of change.

This paper, through five experiments summed up the DRT parameters of the universal range

of parameters. In this range, the detection efficiency of the DRT is relatively high. In order to compensate for the shortcoming of question 2, this paper proposes an algorithm based on rewards and punishment and named RDRT. According to the question 3 and 4, this paper proposes a dynamic random test based on Markov chain. According to the problem 5, the influence of the equal test profile and the unequal test profile (the number of test cases corresponding to the total number of test cases in the district) on the detection capability of the algorithm is compared by five experiments. According to question 6, this paper explores the impact of the number of partitions on the experiment through five experiments.

The rest of this paper is organized as follows:

# 2 RELATED STUDIES

In literature random testing and partition testing are two frequently mentioned strategies. Myers[13]once said, ”Probably the poorest methodology of all is random-input testing”. However, Duran[14]proposed that Random testing can be cost effective for many program and discover some relatively subtle errors without a great deal of effort。Weyuker[15] had shown analytically that partition testing can be an excellent testing strategy or a poor one. In particular, it depends largely on how the inputs that produce an incorrect output are concentrated within the subdomains defined by the partition. Hamlet[3] improved the negative results published about partition testing. Chen[4]thought that Partition testing performs better if the sampling rates are higher for partitions with higher failure rates. Tsoukalas et al.[16] held that PT is more Attractive than RT in terms of upper confidence bounds for the cost weighted performance, which represents worst-case situations. [Gutjahr](http://xueshu.baidu.com/s?wd=author%3A%28Gutjahr%2C%20W.J%29%20Dept.%20of%20Stat.%20Oper.%20Res.%20%26%20Comput.%20Sci.%2C%20Wien%20Univ.%2C%20Austria&tn=SE_baiduxueshu_c1gjeupa&ie=utf-8&sc_f_para=sc_hilight%3Dperson)[17] first proposed that under uncertainty, partition testing compares more favorably to random testing. [Boland](http://xueshu.baidu.com/s?wd=author%3A%28Philip%20J.%20Boland%29%20&tn=SE_baiduxueshu_c1gjeupa&ie=utf-8&sc_f_para=sc_hilight%3Dperson) et al.[18] investigated the relative effectiveness of partition testing versus random testing through the technique of majorization and the concepts of Schur.

# 3 MDRT、RDRT

# 4 EXPERIMENT SETUP

# 5 ANALYSIS AND DISCUSSION

# 6 CONCLUSION AND FUTURE WORKS