Mirror Adaptive Random Testing in TSTL

Hassan Lashari

Random testing has proved to be a simple yet effective approach for software testing. Based on this, an improved testing approach was proposed known as Adaptive Random Testing (ART) [3]. ART randomly generates tests cases and spreads them evenly. It relies on the fact that inputs that are close to each other will normally exhibit similar behavior when it comes to failures. It uses information regarding the location of a test that has been previously executed and whether or not it has produced a failure [4]. Therefore, if a previously executed test has not produced a failure, the chance of an input close to it that will produce a failure is also low. An even spread of tests will ensure that chance of detecting a failure is high. Compared to random testing, ART requires 50% fewer test cases to detect the first failure. This improvement from ART over random testing has motivated a need to investigate this approach.

Even though ART provides significant improvement over random testing, several approaches have been proposed that further improve ART. For my proposal, I plan to investigate an improvement of ART called Mirror Adaptive Random Testing (MART). MART reduces the overheads of ART that are caused in order to spread the test cases evenly [1]. The goal of this project would be to implement some form of MART using TSTL. In the Mirror Adaptive Random Testing algorithm, the input domain can be sectioned into equal-sized subdomains. A subdomain is selected and ART is used to generate a test case. Thereafter, a mapping function is used to generate an image of the generated test case in each of the subdomains. These subdomains are known as mirror domains. The test cases from these mirror domains are tested and the above process is repeated until a condition is met. For my implementation, the stopping condition will be when a fault is detected. The algorithm will be tested on the AVL tree and will be compared to the random tester from class. ART provides a better performance than random testing, but still suffers from overhead that is caused by spreading the test cases evenly. MART aims to reduce this complexity and that is why I decided to investigate this algorithm.
In addition to that, if time permits, I would also like to investigate how coverage information can be used to guide test case selection.

References:

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[4] Z. Q. Zhou, "Using Coverage Information to Guide Test Case Selection in Adaptive Random Testing," *Computer Software and Applications Conference Workshops (COMPSACW), 2010 IEEE 34th Annual*, Seoul, 2010, pp. 208-213.