Unified Approach to Software Reliability through Predictive Testing and Fault Tolerance Models

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A series of interesting collaborative research projects led by Assoc. Prof. Dr. Siti Hafizah Ab Hamid is making significant strides in improving software reliability. These PhD and Master research works address key challenges such as defect prediction, fault tolerance, and ambiguity detection, creating a unified approach to enhancing software quality throughout the development lifecycle. The research begins with a focus on Just-in-Time Software Defect Prediction, utilizing Deep Q-Networks (DQN) to improve the detection of defects during the code change process. This model prioritizes changes likely to contain defects, reducing unnecessary code reviews and ensuring that critical issues are addressed efficiently. As a result, resources are allocated more effectively, boosting overall development efficiency.

Building on this, another research effort addresses fault tolerance in the Hadoop MapReduce framework. By implementing a dynamic fault tolerance mechanism that detects and responds to node failures, this work ensures that data-intensive systems continue operating with minimal disruption. Together, these approaches form a continuous process where defects are predicted and resolved, while fault tolerance is maintained to keep large-scale systems robust and efficient. Further strengthening the research, a Master's project introduces a test case prioritization model for regression testing. This model focuses on prioritizing ambiguous test cases that are prone to defects, ensuring that testing resources are concentrated where they are most needed. By classifying ambiguities and leveraging defect detection, the model enhances the overall effectiveness of testing, reducing ambiguities and improving defect detection at earlier stages.

The collaborative research is tied together by a final project focused on ambiguity detection in Software Requirements Specifications (SRS). This work ensures that the foundation of software development is solid, detecting ambiguities early in the process

to prevent misinterpretations. A clear and unambiguous SRS improves the accuracy of defect prediction, test case prioritization, and fault tolerance throughout the entire workflow. Together, these research projects create a cohesive framework that enhances software reliability from specification to defect detection, testing, and fault tolerance. The collaboration led by Assoc. Prof. Dr. Siti Hafizah Ab Hamid ensures that software systems are more robust, efficient, and adaptable to the complexities of modern software environments, paving the way for more reliable and sustainable software development practices.

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Figure 11: Comparison of ADI and Fault-prone SRS Score for each SRS
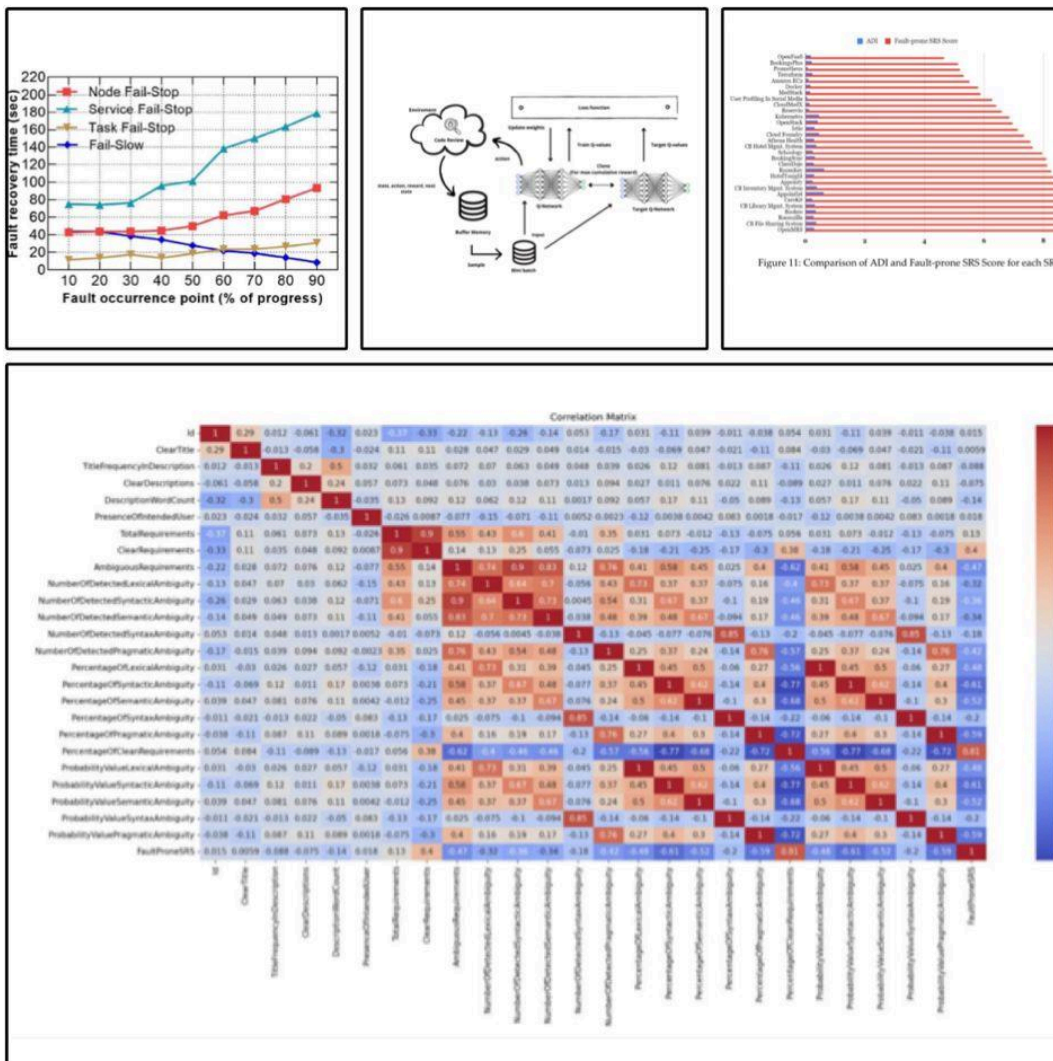
Fault tolerant in Hadoop
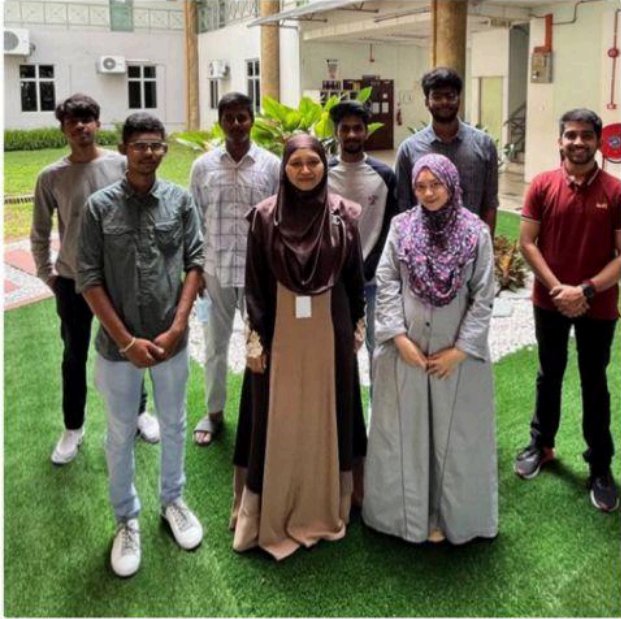
Research collaboration activities