Enhancing Software Testing Accuracy Through a Generative AI-Powered Framework

G K Munasinghe

(Reg. No.: MS23050730)

A THESIS

SUBMITTED TO

SRI LANKA INSTITUTE OF INFORMATION TECHNOLOGY

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF SCIENCE IN INFORMATION TECHNOLOGY

December 2024

I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

Dr. Prasanna S. Haddela

_____

Approved for MSc. Research Project:

MSc. Programme Co-ordinator, SLIIT

Approved for MSc:

_____

Head of Graduate Studies, FoC, SLIIT

DECLARATION

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to the Sri Lanka Institute of Information Technology or to any other institution for assessment for any other purpose.

Sign: 

G. K. Munasinghe

Date: …13/01/2025……

ABSTRACT

Enhancing Software Testing Accuracy Through a Generative AI-Powered Framework

Geethma Munasinghe

MSc. in Information Technology

Supervisor: Dr. Prasanna S. Haddela

December 2024

Software testing is an essential part of the software development lifecycle that ensures the dependability and quality of software systems. However, traditional testing methods typically fail to detect flaws, resulting in potential software breakdowns and increased rectification costs. In response, this research aims to a revolutionary approach to improving software testing accuracy by generating test cases based on a Generative AI-Powered Framework. Using the power of generative artificial intelligence, this framework attempts to intelligently construct diverse and complex test cases, discovering hidden flaws that standard testing approaches may miss. This system employs strong machine learning algorithms to assess code structures and historical testing data, enabling the construction of custom test scenarios based on the program's specific properties. In addition, this incorporates feedback mechanisms for continuously refining and enhancing the testing process, resulting in improved overall testing accuracy and efficiency. This study demonstrates the utility and superiority of the proposed framework in enhancing software testing accuracy, hence raising the bar for software quality assurance operations. This system has the potential to result in better safer and reliable software solutions by boosting test coverage and maybe reducing the number of undetected problems. This study increases AI-powered software testing, paving the way for further usage of Artificial Intelligence technology in the software development process.

ACKNOWLEDGEMENT

While at SLIIT, I have been fortunate to receive guidance from remarkable advisors who have each contributed uniquely to my work. First and foremost, I would like to thank my supervisor, Dr. Parasana Haddala. His guidance has been very useful during this process. He continually gave me intelligent counsel, constructive critique, and encouragement, which helped develop my thoughts and improve my writing. Dr. Haddala's dedication to my development and to my research extended far beyond academic supervision; he also introduced me to a large network of experts, several tools and research websites which considerably enriched my research experience.

I would also want to express my deepest gratitude to the whole SLIIT faculty for their unfailing support. Their knowledge and enthusiasm for teaching have been an inspiration, and their advice has substantially aided my academic progress. I am very grateful to my committee members for their helpful ideas and criticism, which have helped me improve my thesis.

Thank you, friends, work colleagues, senior students and the lecturers of SLIIT for the companionship and endless hours of shared ideas, brainstorming, and moral support. Finally, I am deeply grateful to my family for their unwavering love and support. Their confidence in my ability has been a continual source of strength, helping me to overcome any challenge. This thesis could not have been completed without their patience, understanding, and support.

My deepest gratitude goes to the library staff, whose aid in locating research materials and resources has been essential. Your commitment to promoting academic achievement has really improved my job. I am very grateful to my mentors, panel members and my lecturers, whose support and guidance have helped define my academic career. Your words of wisdom and conviction in my abilities have served as a guiding light throughout this journey.

Thank you to everyone who has taken part in this fantastic research project. This accomplishment would not have been possible without your help, for which I am eternally thankful.

TABLE OF CONTENTS

List of Figures

List of Tables