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Software Fault Prediction

A Road Map

Springer

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ISSN 2191-5768 ISSN 2191-5776 (electronic)
SpringerBriefs in Computer Science
ISBN 978-981-10-8714-1 ISBN 978-981-10-8715-8 (eBook)
https://doi.org/10.1007/978-981-10-8715-8

Library of Congress Control Number: 2018942190

Printed on acid-free paper

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
part of Springer Nature
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Preface

Software quality assurance (SQA) is a vital and foremost important task to build robust software and to ensure that the developed software meets the standardized quality specifications. There are many parameters/measurements used to measure the quality of the software system. One such measure is the fault-proneness information of the software modules. The presence of faults not only reduces the quality of the software but also increases the development cost of the system. Thus, ensuring lower faults in software system ensures a higher quality of the software. Software fault prediction (SFP) is one such activity, which is used to predict the fault-proneness of the software system prior to the testing process. A large number of software fault prediction models can be found in the literature. Most of these models have used the historical software data, the previously revealed software faults, and metric information to predict the fault-proneness of the software modules. In general, the developed fault prediction model is used to predict that whether a software module is faulty or non-faulty. This book is focused on exploring the use of software fault prediction in building reliable and robust software systems. First, we introduce the basic concepts related to software fault prediction process and discuss its generalized architecture. We also discuss different types of fault prediction models presented in the literature. Subsequently, we discuss different works presented earlier for predicting software modules being faulty or non-faulty. At last, we present an evaluation of different techniques for the software fault prediction and discuss their results. This book also covers the details of the software fault datasets and discusses their different issues with respect to software fault prediction. In addition to various important works reported in this area, some of reported works in this domain are also summarized. The book has been organized as follows. Chapter 1 introduces the basic concepts of software fault prediction and various terminologies. Chapter 2 explains the generalized architecture of software fault prediction process and discusses its different components. Chapter 3 provides the details of types of fault prediction models and discusses the state-of-the-art literature of each model. Chapter 4 describes the software fault datasets and different issues of fault datasets when building fault prediction models. Chapter 5 presents an empirical study to evaluate various fault prediction techniques with reference to

binary class prediction. Chapter 6 presents another study evaluating the techniques for the prediction of number of faults in the software modules. The book concludes with Chap. 7, which provides the summary of the discussed works. The primary contribution of the book lies in presenting a single source of information for software engineers and researchers for learning about the area of software fault prediction. The book can also work as an initial source of information for starting research in this domain. In addition, the book can be useful to the experienced researchers in getting summary of latest work reported in this area. We are hopeful that the book will not only provide a good introductory reference but will also give the readers a breadth and depth of this topic.

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Acknowledgements

First, I would like to extend my sincere gratitude to the Almighty God. I also express my thanks to the many people who provided their support in writing this book, either directly or indirectly. I thank Dr. Sandeep Kumar, for the impetus to write this book. I want to acknowledge my sisters and parents for their blessing and persistent backing. I thank all my friends and colleagues for being a source of inspiration and love throughout my journey. I want to thank the anonymous reviewers for proofreading the chapters and the publishing team.

—Santosh Singh Rathore

I would like to express my sincere thanks to my institute, Indian Institute of Technology Roorkee, India, for providing me a healthy and conducive working environment. I am also thankful to the faculty members of the Department of Computer Science and Engineering, Indian Institute of Technology Roorkee, India, for their constant support and encouragement. I am especially thankful to some of my colleagues, who are more like friends and give me constant support. I am also thankful to Prof. R. B. Mishra of the Indian Institute of Technology, Banaras Hindu University, India, for his guidance. I am grateful to the editor and the publication team of the Springer for their constant cooperation in writing the book. I am really thankful to my wife, sisters, brother, parents-in-law, and my lovely daughter Aastha, who is my life, for their love and blessings. I have no words to mention the support, patience, and sacrifice of my parents. I dedicate this book to God and to my family.

—Sandeep Kumar

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Sandeep Kumar (SMIEEE'17) is currently working as an assistant professor in the Department of Computer Science and Engineering, Indian Institute of Technology (IIT) Roorkee, India. He has supervised 3 Ph.D. theses, about 30 master dissertations, about 15 undergraduate projects, and is currently supervising 4 Ph.D. students. He has published more than 45 research papers in international/national journals and conferences and has also written book/chapters with Springer, USA, and IGI Publications, USA. He has also filed two patents for his work done along with his students. He is the member of board of examiners and board of studies of various universities and institutions. He has collaborations in industry and academia. He is currently handling multiple national and international research/consultancy projects. He has received Young Faculty Research Fellowship Award from MeitY (Government of India), NSF/TCPP Early Adopter Award 2014 and 2015, ITS Travel Award 2011 and 2013, and others. He is the member of ACM and senior member of IEEE. His name has also been enlisted in major directories such as Marquis Who's Who and IBC. His areas of interest include semantic Web, Web services, and software engineering. Email: sandeepkumargarg@gmail.com, sgargfec@iitr.ac.in

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