

## EVALUATION AND USE OF SOFTWARE DEFECT PREDICTION PROCESSES IN THE GLOBAL SCENARIO

### *AValiação e Utilização de Processos de Previsão de Defeitos de Software no Cenário Global*

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#### **Resumo**

Este trabalho consiste em uma revisão acadêmica e crítica do artigo científico: "A necessidade de uma previsão de defeitos mais informativa: uma revisão sistemática da literatura", publicado em inglês em 2024 no prestigiado periódico Information and Software Technology, indexado na base de dados científica Scopus. A publicação de resenhas permite aos leitores decidir, de forma ágil e analítica, se devem consumir determinado conteúdo mais extenso e, em alguns casos, conteúdo caro, conteúdo em língua estrangeira ou conteúdo de difícil acesso. O trabalho transita, em sua fundamentação teórica, entre os temas de Previsão de Defeitos de Software e Inteligência Artificial. O objetivo do trabalho original foi analisar os modelos de software atuais e apontar uma direção para a causa de sua previsão de defeitos. Cento e trinta e dois artigos foram analisados em uma revisão sistemática da literatura. A principal descoberta foi que 68% dos modelos não utilizavam nenhuma técnica para explicar o fenômeno. E apenas 7% o faziam de forma satisfatória. Como contribuição prática da revisão, a apresentação, a sugestão de monitoramento e o consumo de artigos científicos e editoriais da revista Information and Software Technology podem auxiliar, de forma teórica e prática, estudantes de graduação, pós-graduação e profissionais do mercado na área de Ciências Exatas e suas interfaces com as Ciências Sociais Aplicadas.

Palavras-chave: Previsão de defeitos de software. Inteligência artificial. Explicabilidade.

## Abstract

*This work is an academic and critical review of the scientific article: The need for more informative defect prediction: A systematic literature review published in English, in 2024, in the prestigious journal Information and Software Technology, indexed in the Scopus scientific database. Publishing reviews allows readers to decide in an agile and analytical way, whether certain longer content should be consumed, and in some cases, expensive content, content in a foreign language or content that is difficult to access. The work moves, in its theoretical foundation, between the themes Software Defect Prediction and Artificial intelligence. The objective of the original work was to analyze current software models and show a direction for the cause of their defect prediction. 132 articles were analyzed in a systematic literature review. The main finding was that 68% of the models did not use any technique to explain the phenomenon. And only 7% did so satisfactorily. As a practical contribution of the review, the presentation, suggestion of monitoring and consumption of the scientific articles and editorials from the journal Information and Software Technology may help, in a theoretical and practical way, undergraduate students, postgraduate and market professionals in the Exact Sciences area and it interfaces with Applied Social Sciences.*

**Keywords:** Software Defect Prediction. Artificial Intelligence. Explainability.

## INTRODUCTION

### REVIEW OF THE WORK:

GRATTAN, N.; DA COSTA, D.; STANGER, N. The need for more informative defect prediction: A systematic literature review. Information and Software Technology, v. 171, n. 107456, 2024. <https://doi.org/10.1016/j.infsof.2024.107456>

**Keywords:** Systematic literature review. Software quality. Software defect prediction. Explainable Artificial Intelligence. Machine learning

In this work, it was decided to carry out an and critical review of a scientific article from an academic journal of high relevance in the academic environment: Information and Software Technology. The publication of the reviews allows readers to decide, in an agile and analytical way, whether they should consume certain longer content, which is sometimes expensive, ia a foreign language or difficult to access (Calvosa, 2022). Reviews allow for a critical view of a work, creating opportunities for debates, insights and academic discussions (Alves et al., 2025).

About the journal, it is indexed on the ScienceDirect platform of the scopus scientific database, one of the most comprehensive, reliable and disseminated in scientific and academic environments. And its metrics are the h5 indicator of 64 citations, while its h5 median is 94 citations. In comparison with a journal in the same area of research interest, the traditional Brazilian Journal Transinformação, from PUC Campinas, classified as A1 in the Qualis/Capes extract of the last quarterly evaluation, founded in 1989, has as metrics the h5 indicator of 13 citations, while its h5 median is 22 citations.

The original article, written in English, has three authors. The first, Natalie Grattan, is a PhD student in the subject of Automated Software Defect Prediction at the University of Otago (New Zealand). The second author, Daniel Alencar da Costa, has a post-doctorate in Software Reengineering from Queen's University (Canada), and works as an assistant professor at the University of Otago (New Zealand). Finally, Nigel Stanger, is a doctor in Information Science from the University of Otago (New Zealand), where he

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has also worked as an associate professor since 1994.

There are several software prediction and analysis models, with applications in different areas (Dias et al., 2025). The objective of these models is to achieve maximum effectiveness to avoid errors in their execution process. To ensure this objective, the concept of Software Defect Prediction (SPD) emerges, defined by Nassif et al (2023) as the process of identifying failures and/or bugs in software modules based on class or method level metrics. In this sense, the literature review carried out by the authors of the original work points out that there is a possible lack of transparency in the presentation of the results obtained from these explainable AI (Artificial Intelligence) models, the so-called Opaque Models. According to Guidotti et al (2018), models are considered opaque when they present a large combination of parameters and do not present the internal logic for arrival at the result. Because, without precise information about the execution of the process, mistaken decisions can be made when based solely on the final result, allowing for failure and error in prediction.

The original work is divided into eight sections. The “Introduction” section of the work contextualizes the use of SPD (in industries). The “Theoretical Foundation” section presents the concepts and relationships between explainable AI and the importance of transparency associated with the increased use of AI by organizations. The following section dealt with the method used: research questions defined, database selection, search strings, article selection, inclusion and exclusion criteria, data extraction, quality scoring. In the demographic summary field, the authors presented information on the articles used in the study between 2017 and 2023. The “Quality Metrics” section highlights the quality of the

articles used in the research. The considerations showed that most of the articles did not use explainable methods and SPD models. However, some have used a kind of classifier for prediction analysis. Finally, in the “Conclusion” section, the authors pointed out that there was no standardized way to assess the explainability of a model, since understanding depends on the reader, leaving the conclusion somewhat subjective, despite bringing a practical contribution, especially due to the descriptive statistics demonstrated.

The work has graphic elements that help the reader understand in which area the SPD is most used academically. For example, Table 1 stands out for providing a summary of previous systematic literature reviews on software defect prediction. Figure 1 presents a summary of the methodology adopted for the selection of papers. While figures 2 and 3, respectively, show the number of papers by year of acceptance and the number of the authors by country, showing the global frequency and the countries that use the SPD. Figure 4 shows the distribution of the quality scores by quality metrics, which helps to explain the review carried out by the authors. In total, the original work contains 25 graphic elements, including tables and figures, which provide comparisons between research carried out in different countries, type of outputs from software defect prediction models, as well as type of explanation and description. Together, these elements present information about explainability and its SPD evaluation techniques in a more agile and didactic way, as well as the main evaluation metrics used to measure software performance for readers.

The systematic presentation of the state of the art within the field of software defect prediction is very useful for academics working with models from an explainability perspective. In the original

work, the robustness of the data presented allows a broad view of the empirical studies carried out in recent years in this field of activity. Therefore, the work is relevant for professionals in the areas of TI, information Systems, Computing and those interested in learning more about the subject within competitive organizations (Ferreira et al., 2021) or public organizations (Ferreira et al., 2024) that are adopting new technologies, especially when using Explainable AI as an automated learning tool, in production or decision-making processes, in digital or in-person environments with a virtual perspective (Flores et al., 2024). For the professional environment, the work may contribute to greater notoriety in the use of technological and computational tools and models that are guided by reliable results produced by machine learning algorithms, which may affect the strategic planning of organizations (Calvosa, 2023). And this is a revolution not only technological but above cultural, if we think about the production and interpretation of data, automated and autonomous processes, human dependence to start processing information and the management of organizations just 5 years ago (Macedo et al., 2024; Lima et al., 2022; Santos Lopes et al., 2022).

From a critical perspective, the idea of predicting failures during the software execution process is not new. In 2017, Yang et al (2017) already pointed out the existence of the well-defined SDPs in the literature, such as the just-in-time SPD. However, the methodology used for study and the comparisons, assessments and metrics contained in the graphic elements enrich the study, justifying its importance as a reading. A highlight of the research was the extensive domain of studies coming from China. This shows how Chinese research is impacting the global software and artificial intelligence market, as can

be seen in the recent DeepSeek phenomenon. Will there be room for commercial or academic competitiveness in Brazil for this area of knowledge? (Batista et al., 2022). And in what ways can the use of these technologies and approaches enable greater academic success among university students? (Ribeiro et al., 2025; Predes Junior et al., 2025).

What is the impact of this research and its technologies on the academic environment (Fortunato et al., 2024). Would it be possible to replicate the methodology of this research in Brazil? Are there any national commercial initiatives; scientific study or research groups; Brazilian scientific articles published in prestigious media that deal with the topics of Software Defect Prediction, Explainable Artificial Intelligence or Opaque Models? What are the main production centers or companies of this type of technology in Brazil? Would it be possible to create a type of ordering or ranking to classify the main authors or works involving these themes (i) in Brazil, (ii) in Spanish and/or English, (iii) by database or (iv) by type or industry that best uses this technology? What is the relationship between the implementation of these technologies and possible cultural resistance on the part of members of the organization in not adopting them? What is the impact of adopting these technologies on decision-making, business leadership and the acceptance of the company's innovations? (Calvosa; Ferreira, 2023; Boas et al., 2023). These previous questions are suggested as issues for discussion and debate in the classroom, in the extension projects and in scientific initiation (Alvarenga et al., 2024; Ornelas et al., 2025). Furthermore, they can also be used to generate questions and research issues for the preparation of final coursework or master's dissertations (Mendonça de Souza et al., 2024; Melo Franco et al., 2023).

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Finally, it should be noted that the Information and Software Technology magazine focuses on research and sharing of experiences in the areas of information systems; computing development, modeling, design, engineering and management of software; and validation of computational processes. Therefore, as a practical contribution of this work, the presentation and suggestion of the monitoring and consumption of scientific articles and editorials of this journal for future readers may help in a theoretical way and practice undergraduate and graduate students and market professionals in the Exact Sciences area and its interfaces with Applied Social Sciences (Fortunato et al., 2024, Sampaio Martins et al., 2022).

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