References

[1] D. Tomassi, "Bugs in the wild: examining the effectiveness of static analyzers at finding real-world bugs," *Proceedings of the 2018 26th ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineerin,* 2018.

[2] A. Rio and B. A. Fernando, "Detecting Sudden Variations in Web Apps Code Smells' Density: A Longitudinal Study," *Quality of Information and Communications Technology,* pp. 82-96, 2021.

[3] Fard, Amin M, Mesbah A., "JSNOSE: Detecting JavaScript Code Smells," *2013 IEEE 13th International Working Conference on Source Code Analysis and Manipulation (SCAM,* pp. 116-125, 2013.

[4] T. V. D. W. S. J. E. Roehm, "Evaluating Maintainability Prejudices with a Large-Scale Study of Open-Source Projects," *Springer International Publishing,* pp. 151--171, 2018.

[5] Elder V., Andrea D., Marcelo M., "A Systematic Literature Review on Bad Smells–5 W's: Which, When, What, Who, Where," *IEEE Transactions on Software Engineering,* vol. 47, no. 1, pp. 17-66, 2021.

[6] T. Amanatidis, A. Chatzigeorgiou, "Studying the Evolution of PHP Web Applications," *Butterworth-Heinemann,* vol. 72, no. 20, p. 48–67, 2016.

[7] Z. Gao, C. Bird and E. Barr, "To Type or Not to Type: Quantifying Detectable Bugs in JavaScript," *2017 IEEE/ACM 39th International Conference on Software Engineering (ICSE),* 2017.

[8] D. Flanagan, JavaScript - The Definitive Guide, Sebastopol: O'Reilly Media, 2002.

[9] B. Pierce, Types and Programming Languages, Massachusetts: The MIT Press, 2002.

[10] Meijer, Erik, Drayton, "Static Typing Where Possible, Dynamic Typing When Needed: The End of the Cold War Between Programming Languages," *OOPSLA'04 Workshop on Revival of Dynamic Languages,* 2004.

[11] "How Codebase Health Impacts Hiring and Retention 2021 Report," Stepsize, 2022. [Online]. Available: https://www.stepsize.com/how-codebase-health-impacts-hiring-and-retention-2021-report. [Accessed 03 02 2022].

[12] B. Couriol, "Airbnb Releases Tool to Convert Large Codebases to Typescript," InfoQ, 2022. [Online]. Available: https://www.infoq.com/news/2020/08/airbnb-Typescript-migration/. [Accessed 03 02 2022].

[13] "TypeScript at Google," Youtube.com, 2018. [Online]. Available: https://www.youtube.com/watch?v=sjov1k5jexA. [Accessed 03 02 2022].

[14] "TypeScript at Slack - Slack Engineering," Slack Engineering, 2017. [Online]. Available: https://slack.engineering/Typescript-at-slack/. [Accessed 04 02 2022].

[15] "Stack Overflow Developer Survey 2021," Stack Overflow, 2022. [Online]. Available: https://insights.stackoverflow.com/survey/2021. [Accessed 2 02 2022].

[16] D. Spinellis, "Choosing a programming language," *IEEE Software,* vol. 23, no. 4, pp. 62-63, 2006.

[17] "flow-bin | npm trends," Npmtrends.com, 2022. [Online]. Available: https://www.npmtrends.com/flow-bin-vs-Typescript. [Accessed 2 02 2022].

[18] "New Node.js Foundation Survey Reports New "Full Stack" In Demand Among Enterprise Developers | Node.js," Node.js, 2022. [Online]. Available: https://nodejs.org/uk/blog/announcements/nodejs-foundation-survey/. [Accessed 04 02 2022].

[19] Q. Hanam, F. Brito and A. Mesbah, "Discovering bug patterns in JavaScript," *Proceedings of the 2016 24th ACM SIGSOFT International Symposium on Foundations of Software Engineering,* no. 156, p. 144, 2016.

[20] G. Catolino, F. Palomba, A. Zaidman and F. Ferrucci,, "Not all bugs are the same: Understanding, characterizing, and classifying bug types," *Journal of Systems and Software,* no. 181, p. 165, 2019.

[21] P. Gyimesi et al., "BUGSJS: a benchmark and taxonomy of JavaScript bugs," *Software Testing, Verification and Reliability,* vol. 31, 2021.

[22] Dalton J., Patricia M., Wilkerson A., "Investigating Test Smells in JavaScript Test Code," *Brazilian Symposium on Systematic and Automated Software Testing,* vol. 2, no. 10, p. 36–45, 2021.

[23] Y. Jia and M. Harman, "An Analysis and Survey of the Development of Mutation Testing," *IEEE Transactions on Software Engineering,* vol. 37, no. 5, pp. 649-678, 2011.

[24] M. Kintis, M. Papadakis, A. Papadopoulos, E. Valvis and N. Malevris,, "Analysing and Comparing the Effectiveness of Mutation Testing Tools: A Manual Stud," *2016 IEEE 16th International Working Conference on Source Code Analysis and Manipulation (SCAM),* 2006.

[25] C. Seaman, "Qualitative methods in empirical studies of software engineering," *IEEE Transactions on Software Engineering,* vol. 25, no. 4, pp. 557-572, 1999.

[26] A. Feldthaus, M. Schafer, M. Sridharan, J. Dolby and F. Tip, "Efficient construction of approximate call graphs for JavaScript IDE services," *2013 35th International Conference on Software Engineering (ICSE),* pp. 752-761, 2013.

[27] "Find Bugs in Java Programs," findbugs.sourceforge.net, 02 06 2015. [Online]. Available: http://findbugs.sourceforge.net/. [Accessed 20 03 2022].

[28] Bogner, Justus & Merkel, Manuel, "To Type or Not to Type? A Systematic Comparison of the Software Quality of JavaScript and TypeScript Applications on GitHub," *022 IEEE/ACM 19th International Conference on Mining Software Repositories (MSR),*, pp. 658-669, 2022.

[29] N. Pingclasai, H. Hata and K. Matsumoto, "Classifying Bug Reports to Bugs and Other Requests Using Topic Modeling," *2013 20th Asia-Pacific Software Engineering Conference (APSEC),* vol. 2, pp. 13-18, 2013.

[30] F. Ocariza, K. Pattabiraman and A. Mesbah, "Detecting unknown inconsistencies in web applications," *2017 32nd IEEE/ACM International Conference on Automated Software Engineering (ASE)*, 2017.

[31] C. Le Goues, M. Dewey-Vogt, S. Forrest and W. Weimer, "A systematic study of automated program repair: Fixing 55 out of 105 bugs for $8 each"," *2012 34th International Conference on Software Engineering (ICSE)*, 2012.

[32] J. Wang et al., "A comprehensive study on real world concurrency bugs in Node.js," in *2017 32nd IEEE/ACM International Conference on Automated Software Engineering (ASE)*, 2017.

[33] T. Leesatapornwongsa, J. Lukman, S. Lu and H. Gunawi, "TaxDC," in *Proceedings of the Twenty-First International Conference on Architectural Support for Programming Languages and Operating Systems*, 2016.

[34] M. Kumari, A. Misra, S. Misra, L. Fernandez Sanz, R. Damasevicius and V. Singh, "Quantitative Quality Evaluation of Software Products by Considering Summary and Comments Entropy of a Reported Bug," *Entropy*, vol. 21, no. 1, p. 91, 2019.

[35] "Code Quality and Code Security," SonarSource SA, 2022. [Online]. Available: https://www.sonarqube.org/. [Accessed 02 04 2022].

[36] G. Pinto, F. Casto and W. Torres, "A study on the most popular questions about concurrent programming | Proceedings of the 6th Workshop on Evaluation and Usability of Programming Languages and Tools," in *ACM Conferences*, 2022.

[37] K. Herzig, S. Just and A. Zeller, "Herzig, Kim and Just, Sascha and Zeller, Andreas," *2013 35th International Conference on Software Engineering (ICSE)*, pp. 392-401, 2013.

[38] D. D., "lib.es5.d.ts," microsoft, [Online]. Available: https://github.com/microsoft/TypeScript/blob/main/lib/lib.es5.d.ts#L1066. [Accessed 02 02 2022].

[39] A. Bachmann, C. Bird, F. Rahman, P. Devanbu and A. Bernstein,, "The missing links," *Proceedings of the eighteenth ACM SIGSOFT international symposium on Foundations of software engineering - FSE*, 2010.

[40] S. Lu, S. Park, E. Seo, and Y. Zhou, "Learning from Mistakes: A Comprehensive Study on Real World Concurrency Bug Characteristics," *Association for Computing Machinery*, vol. 42, no. 2, p. 329–339, 2008.

[41] S. Hanenberg,, "An experiment about static and dynamic type systems," *ACM SIGPLAN Notice*, vol. 45, no. 10, pp. 22-35, 2010.

[42] "GitHub - mozilla/rhino: Rhino is an open-source implementation of JavaScript written entirely in Java," github.com, 2020. [Online]. Available: https://github.com/mozilla/rhino. [Accessed 05 03 2022].

[43] Falleri, F. Morandat, X. Blanc, M. Martinez and M. Monperrus, "Fine-grained and accurate source code differencing," *Proceedings of the 29th ACM/IEEE international conference on Automated software engineering*, no. 12, p. 313–324, 2014.

[44] "Weka 3 - Data Mining with Open Source Machine Learning Software in Java," waikato, 2022. [Online]. Available: https://www.cs.waikato.ac.nz/ml/weka/. [Accessed 24 03 2022].

[45] "Sample Size Calculator: Understanding Sample Sizes | SurveyMonkey," surveymonkey, 2022. [Online]. Available: https://www.surveymonkey.com/mp/sample-size-calculator/. [Accessed 01 05 2022].

[46] A. Saboury, P. Musavi, F. Khomh and G. Antoniol, "An empirical study of code smells in JavaScript projects," *2017 IEEE 24th International Conference on Software Analysis, Evolution and Reengineering (SANER)*, pp. 294-305, 2017.