## Week 7 Journal

Rodger Byrd

## I. OVERVIEW

For my area I'm looking at Anti-Patterns in code, these are also known as code smells. I've also seen them referred to as Atoms of Confusion and nano patterns.

## II. JOURNAL ENTRY

This week I continued working on the draft paper, I was so focused on that that I actually forgot to complete this journal entry, so I apoligzie for the late entry. I feel like I'm on track to finish a good draft this weekend. The only negative I'm encountering is that I think I might be trashing too many papers. I have 75 I'm using. On the plus side, I was only looking at very recent papers, 2018-2019. If I go to 2016-2017 I'm sure I'll find a lot of relelvant ones.

The files for this latex document are in the github repository located at https://github.com/rodger79/CS6000

Relevan papers are referenced in the bibliography below.

## REFERENCES

- M. Mantyla, J. Vanhanen, and C. Lassenius, "A taxonomy and an initial empirical study of bad smells in code," in *International Conference on Software Maintenance*, 2003. ICSM 2003. Proceedings., Sep. 2003, pp. 381–384.
- [2] R. Arcoverde, A. Garcia, and E. Figueiredo, "Understanding the Longevity of Code Smells: Preliminary Results of an Explanatory Survey," in *Proceedings of the 4th Workshop on Refactoring Tools*, ser. WRT '11. New York, NY, USA: ACM, 2011, pp. 33– 36, event-place: Waikiki, Honolulu, HI, USA. [Online]. Available: http://doi.acm.org/10.1145/1984732.1984740
- [3] A. Yamashita and L. Moonen, "Do developers care about code smells? An exploratory survey," Oct., pp. 242–251.
- [4] V. Garousi and B. Kk, "Smells in software test code: A survey of knowledge in industry and academia," *Journal of Systems* and Software, vol. 138, pp. 52 – 81, 2018. [Online]. Available: http://www.sciencedirect.com/science/article/pii/S0164121217303060
- [5] N. Yoshioka, H. Washizaki, and K. Maruyama, "A survey on security patterns," *Progress in Informatics*, no. 5, p. 35, Mar. 2008. [Online]. Available: http://www.nii.ac.jp/pi/n5/5\_35.html
- [6] T. Sharma and D. Spinellis, "A survey on software smells," *Journal of Systems and Software*, vol. 138, pp. 158 173, 2018. [Online]. Available: http://www.sciencedirect.com/science/article/pii/S0164121217303114
- [7] D. Gopstein, J. Iannacone, Y. Yan, L. DeLong, Y. Zhuang, M. K.-C. Yeh, and J. Cappos, "Understanding Misunderstandings in Source Code," in *Proceedings of the 2017 11th Joint Meeting on Foundations of Software Engineering*, ser. ESEC/FSE 2017. New York, NY, USA: ACM, 2017, pp. 129–139, event-place: Paderborn, Germany. [Online]. Available: http://doi.acm.org/10.1145/3106237.3106264
- [8] S. Singh and S. Kaur, "A systematic literature review: Refactoring for disclosing code smells in object oriented software," Ain Shams Engineering Journal, vol. 9, no. 4, pp. 2129 – 2151, 2018. [Online]. Available: http://www.sciencedirect.com/science/article/ pii/S2090447917300412
- [9] Z. Li, T.-H. P. Chen, J. Yang, and W. Shang, "Dlfinder: Characterizing and Detecting Duplicate Logging Code Smells," in *Proceedings of* the 41st International Conference on Software Engineering, ser. ICSE '19. Piscataway, NJ, USA: IEEE Press, 2019, pp. 152– 163, event-place: Montreal, Quebec, Canada. [Online]. Available: https://doi.org/10.1109/ICSE.2019.00032
- [10] M. S. Haque, J. Carver, and T. Atkison, "Causes, Impacts, and Detection Approaches of Code Smell: A Survey," in *Proceedings of the ACMSE 2018 Conference*, ser. ACMSE '18. New York, NY, USA: ACM, 2018, pp. 25:1–25:8, event-place: Richmond, Kentucky. [Online]. Available: http://doi.acm.org/10.1145/3190645.3190697
- [11] F. A. Fontana, V. Lenarduzzi, R. Roveda, and D. Taibi, "Are architectural smells independent from code smells? An empirical study," *Journal of Systems and Software*, vol. 154, pp. 139 – 156, 2019. [Online]. Available: http://www.sciencedirect.com/science/article/pii/S0164121219301013
- [12] B. Walter, F. A. Fontana, and V. Ferme, "Code smells and their collocations: A large-scale experiment on open-source systems," *Journal of Systems and Software*, vol. 144, pp. 1 21, 2018. [Online]. Available: http://www.sciencedirect.com/science/article/pii/S0164121218301109
- [13] S. S. Afjehei, T.-H. P. Chen, and N. Tsantalis, "iPerfDetector: Characterizing and detecting performance anti-patterns in iOS applications," *Empirical Software Engineering*, Apr. 2019. [Online]. Available: https://doi.org/10.1007/s10664-019-09703-y
- [14] F. Tian, P. Liang, and M. A. Babar, "How Developers Discuss Architecture Smells? An Exploratory Study on Stack Overflow," in 2019 IEEE International Conference on Software Architecture (ICSA), Mar. 2019, pp. 91–100.
- [15] C. Vassallo, S. Proksch, H. C. Gall, and M. Di Penta, "Automated Reporting of Anti-patterns and Decay in Continuous Integration," in *Proceedings of the 41st International Conference on Software Engineering*, ser. ICSE '19. Piscataway, NJ, USA: IEEE Press, 2019, pp. 105–115, event-place: Montreal, Quebec, Canada. [Online]. Available: https://doi.org/10.1109/ICSE.2019.00028
- [16] D. Taibi, V. Lenarduzzi, and C. Pahl, Microservices Anti Patterns: A Taxonomy, 2019.
- [17] A. Tahir, A. Yamashita, S. Licorish, J. Dietrich, and S. Counsell, "Can You Tell Me if It Smells?: A Study on How Developers Discuss Code Smells and Anti-patterns in Stack Overflow," in *Proceedings of* the 22Nd International Conference on Evaluation and Assessment in

- Software Engineering 2018, ser. EASE'18. New York, NY, USA: ACM, 2018, pp. 68–78, event-place: Christchurch, New Zealand. [Online]. Available: http://doi.acm.org/10.1145/3210459.3210466
- [18] R. Ibrahim, M. Ahmed, R. Nayak, and S. Jamel, "Reducing redundancy of test cases generation using code smell detection and refactoring," *Journal of King Saud University - Computer and Information Sciences*, 2018. [Online]. Available: http://www.sciencedirect.com/science/article/ pii/S1319157818300296
- [19] H. Brabra, A. Mtibaa, F. Petrillo, P. Merle, L. Sliman, N. Moha, W. Gaaloul, Y.-G. Guhneuc, B. Benatallah, and F. Gargouri, "On semantic detection of cloud API (anti)patterns," *Information and Software Technology*, vol. 107, pp. 65 82, 2019. [Online]. Available: http://www.sciencedirect.com/science/article/pii/S095058491830226X
- [20] S. Hussain, J. Keung, M. K. Sohail, A. A. Khan, G. Ahmad, M. R. Mufti, and H. A. Khatak, "Methodology for the quantification of the effect of patterns and anti-patterns association on the software quality," *IET Software*, vol. 13, no. 5, pp. 414–422, 2019.
- [21] Y. Lyu, D. Li, and W. G. J. Halfond, "Remove RATs from Your Code: Automated Optimization of Resource Inefficient Database Writes for Mobile Applications," in *Proceedings of the 27th* ACM SIGSOFT International Symposium on Software Testing and Analysis, ser. ISSTA 2018. New York, NY, USA: ACM, 2018, pp. 310–321, event-place: Amsterdam, Netherlands. [Online]. Available: http://doi.acm.org/10.1145/3213846.3213865
- [22] A. Abadi, M. Abadi, and I. Ben-Harrush, "Fixing anti-patterns in javascript," US Patent US9 983 975B2, May, 2018. [Online]. Available: https://patents.google.com/patent/US9983975B2/en
- [23] M. Kessentini, R. Mahaouachi, and K. Ghedira, "What you like in design use to correct bad-smells," *Software Quality Journal*, vol. 21, no. 4, pp. 551–571, Dec. 2013. [Online]. Available: https://doi.org/10.1007/s11219-012-9187-6
- [24] A. Kaur, K. Kaur, and S. Jain, "Predicting software change-proneness with code smells and class imbalance learning," in 2016 International Conference on Advances in Computing, Communications and Informatics (ICACCI), Sep. 2016, pp. 746–754.
- [25] N. Pritam, M. Khari, L. H. Son, R. Kumar, S. Jha, I. Priyadarshini, M. Abdel-Basset, and H. V. Long, "Assessment of Code Smell for Predicting Class Change Proneness Using Machine Learning," *IEEE Access*, vol. 7, pp. 37414–37425, 2019.
- [26] A. Kaur, S. Jain, and S. Goel, "SP-J48: a novel optimization and machine-learning-based approach for solving complex problems: special application in software engineering for detecting code smells," Neural Computing and Applications, Apr. 2019. [Online]. Available: https://doi.org/10.1007/s00521-019-04175-z
- [27] A. Maiga, N. Ali, N. Bhattacharya, A. Saban, Y. Guhneuc, and E. Aimeur, "SMURF: A SVM-based Incremental Anti-pattern Detection Approach," in 2012 19th Working Conference on Reverse Engineering, Oct. 2012, pp. 466–475.
- [28] L. Kumar and A. Sureka, "An Empirical Analysis on Web Service Anti-pattern Detection Using a Machine Learning Framework," in 2018 IEEE 42nd Annual Computer Software and Applications Conference (COMPSAC), vol. 01, Jul. 2018, pp. 2–11.
- [29] D. D. Nucci, F. Palomba, D. A. Tamburri, A. Serebrenik, and A. D. Lucia, "Detecting code smells using machine learning techniques: Are we there yet?" in 2018 IEEE 25th International Conference on Software Analysis, Evolution and Reengineering (SANER), Mar. 2018, pp. 612–621.
- [30] R. Malhotra, "A systematic review of machine learning techniques for software fault prediction," *Applied Soft Computing*, vol. 27, pp. 504 – 518, 2015. [Online]. Available: http://www.sciencedirect.com/science/ article/pii/S1568494614005857
- [31] F. A. Fontana and M. Zanoni, "Code smell severity classification using machine learning techniques," *Knowledge-Based Systems*, vol. 128, pp. 43 – 58, 2017. [Online]. Available: http://www.sciencedirect.com/ science/article/pii/S0950705117301880
- [32] F. Arcelli Fontana, M. V. Mntyl, M. Zanoni, and A. Marino, "Comparing and experimenting machine learning techniques for code smell detection," *Empirical Software Engineering*, vol. 21, no. 3, pp. 1143–1191, Jun. 2016. [Online]. Available: https: //doi.org/10.1007/s10664-015-9378-4
- [33] Findings from FUMEC University Provides New Data on Machine Learning (Machine Learning Techniques for Code Smells Detection: a Systematic Mapping Study), 2019.

- [34] U. Azadi, F. A. Fontana, and M. Zanoni, "Poster: machine learning based code smell detection through WekaNose," in 2018 IEEE/ACM 40th International Conference on Software Engineering: Companion Proceedings (ICSE-Companion). IEEE, 2018, pp. 288–289.
- [35] M. Kessentini, "Understanding the Correlation between Code Smells And Software Bugs," 2019.
- [36] A. Barbez, F. Khomh, and Y.-G. Guhneuc, "A Machine-learning Based Ensemble Method For Anti-patterns Detection," *CoRR*, vol. abs/1903.01899, 2019. [Online]. Available: http://arxiv.org/abs/1903. 01899
- [37] S. Saluja and U. Batra, "Assessing Quality by Anti-pattern Detection in Web Services," Social Science Research Network, Rochester, NY, SSRN Scholarly Paper ID 3350876, Mar. 2019. [Online]. Available: https://papers.ssrn.com/abstract=3350876
- [38] W. Song, C. Zhang, and H. Jacobsen, "An Empirical Study on Data Flow Bugs in Business Processes," *IEEE Transactions on Cloud Computing*, pp. 1–1, 2018.
- [39] M. I. Azeem, F. Palomba, L. Shi, and Q. Wang, "Machine learning techniques for code smell detection: A systematic literature review and meta-analysis," *Information and Software Technology*, vol. 108, pp. 115 – 138, 2019. [Online]. Available: http://www.sciencedirect.com/science/ article/pii/S0950584918302623
- [40] V. Garousi, B. Kucuk, and M. Felderer, "What We Know About Smells in Software Test Code," *IEEE Software*, vol. 36, no. 3, pp. 61–73, May 2019.
- [41] D. Arcelli, V. Cortellessa, and D. D. Pompeo, "Performance-driven software model refactoring," *Information and Software Technology*, vol. 95, pp. 366 – 397, 2018. [Online]. Available: http://www. sciencedirect.com/science/article/pii/S0950584917301787
- [42] S. Fakhoury, V. Arnaoudova, C. Noiseux, F. Khomh, and G. Antoniol, "Keep it simple: Is deep learning good for linguistic smell detection?" in 2018 IEEE 25th International Conference on Software Analysis, Evolution and Reengineering (SANER), Mar. 2018, pp. 602–611.
- [43] Z. Li, X.-Y. Jing, and X. Zhu, "Progress on approaches to software defect prediction," *IET Software*, vol. 12, no. 3, pp. 161–175(14), Jun. 2018. [Online]. Available: https://digital-library.theiet.org/content/ journals/10.1049/iet-sen.2017.0148
- [44] J. Carver, B. Penzenstadler, and A. Serebrenik, "Software Analysis, Evolution, and Reengineering, and ICT Sustainability," *IEEE Software*, vol. 35, no. 4, pp. 78–80, Jul. 2018.
- [45] M. A. Zaidi and R. Colomo-Palacios, "Code Smells Enabled by Artificial Intelligence: A Systematic Mapping," in *Computational Science and Its Applications ICCSA 2019*, S. Misra, O. Gervasi, B. Murgante, E. Stankova, V. Korkhov, C. Torre, A. M. A. Rocha, D. Taniar, B. O. Apduhan, and E. Tarantino, Eds. Cham: Springer International Publishing, 2019, pp. 418–427.
- [46] G. M. Ubayawardana and D. D. Karunaratna, "Bug Prediction Model using Code Smells," in 2018 18th International Conference on Advances in ICT for Emerging Regions (ICTer), Sep. 2018, pp. 70–77.
- [47] X. Ban, S. Liu, C. Chen, and C. Chua, "A performance evaluation of deep-learnt features for software vulnerability detection," *Concurrency* and *Computation: Practice and Experience*, vol. 31, no. 19, p. e5103, 2019. [Online]. Available: https://onlinelibrary.wiley.com/doi/ abs/10.1002/cpe.5103
- [48] L. Pellegrini and V. Lenarduzzi, "Are Code Smells the Root Cause of Faults?: A Continuous Experimentation Approach," in *Proceedings* of the 19th International Conference on Agile Software Development: Companion, ser. XP '18. New York, NY, USA: ACM, 2018, pp. 28:1–28:3, event-place: Porto, Portugal. [Online]. Available: http://doi.acm.org/10.1145/3234152.3234153
- [49] T. Sharma, "Detecting and Managing Code Smells: Research and Practice," in Proceedings of the 40th International Conference on Software Engineering: Companion Proceedings, ser. ICSE '18. New York, NY, USA: ACM, 2018, pp. 546–547, event-place: Gothenburg, Sweden. [Online]. Available: http://doi.acm.org/10.1145/ 3183440 3183460
- [50] V. K. Kulamala, A. S. C. Teja, A. Maru, Y. Singla, and D. P. Mohapatra, "Predicting Software Reliability using Computational Intelligence Techniques: A Review," in 2018 International Conference on Information Technology (ICIT), Dec. 2018, pp. 114–119.
- [51] N. Tsuda, H. Washizaki, Y. Fukazawa, Y. Yasuda, and S. Sugimura, "Machine Learning to Evaluate Evolvability Defects: Code Metrics Thresholds for a Given Context," in 2018 IEEE International Conference

- on Software Quality, Reliability and Security (QRS), Jul. 2018, pp. 83-94.
- [52] K. Karauzovi-Hadiabdi and R. Spahi, "Comparison of Machine Learning Methods for Code Smell Detection Using Reduced Features," in 2018 3rd International Conference on Computer Science and Engineering (UBMK), Sep. 2018, pp. 670–672.
- [53] J. A. Reshi and S. Singh, "Investigating the Role of Code Smells in Preventive Maintenance," *Journal of Information Technology Management*, vol. 10, no. 4, pp. 41–63, 2019.
- [54] H. Liu, Z. Xu, and Y. Zou, "Deep Learning Based Feature Envy Detection," in Proceedings of the 33rd ACM/IEEE International Conference on Automated Software Engineering, ser. ASE 2018. New York, NY, USA: ACM, 2018, pp. 385–396, event-place: Montpellier, France. [Online]. Available: http://doi.acm.org/10.1145/3238147.3238166
- [55] B. Grodniyomchai, K. Chalapat, K. Jitkajornwanich, and S. Jaiyen, "A Deep Learning Model for Odor Classification Using Deep Neural Network," in 2019 5th International Conference on Engineering, Applied Sciences and Technology (ICEAST), Jul. 2019, pp. 1–4.
- [56] H. Liu, J. Jin, Z. Xu, Y. Bu, Y. Zou, and L. Zhang, "Deep Learning Based Code Smell Detection," *IEEE Transactions on Software Engineering*, pp. 1–1, 2019.
- [57] P. Kokol, M. Zorman, G. Zlahtic, and B. Zlahtic, Code smells, 2018.
- [58] K. Alkharabsheh, J. A. Taboada, Y. Crespo, and T. Alzu'bi, "Improving Design Smell Detection for Adoption in Industry," in 2018 8th International Conference on Computer Science and Information Technology (CSIT), Jul. 2018, pp. 213–218.
- [59] N. Kamaraj and A. Ramani, "Search-Based Software Engineering Approach for Detecting Code-Smells with Development of Unified Model for Test Prioritization Strategies," *International Journal of Applied Engineering Research*, vol. 14, no. 7, pp. 1599–1603, 2019.
- [60] A. Gupta, B. Suri, V. Kumar, S. Misra, T. Blaauskas, and R. Damaeviius, "Software code smell prediction model using Shannon, Rnyi and Tsallis entropies," *Entropy*, vol. 20, no. 5, p. 372, 2018.
- [61] M. Lafi, J. W. Botros, H. Kafaween, A. B. Al-Dasoqi, and A. Al-Tamimi, "Code Smells Analysis Mechanisms, Detection Issues, and Effect on Software Maintainability," in 2019 IEEE Jordan International Joint Conference on Electrical Engineering and Information Technology (JEEIT), Apr. 2019, pp. 663–666.
- [62] R. Spahi and K. Kara\djuzovi-Hadiabdi, "Class Level Code Smell Detection using Machine Learning Methods," book of, p. 74, 2018.
- [63] F. Ferreira, L. L. Silva, and M. T. Valente, Software Engineering Meets Deep Learning: A Literature Review, 2019.
- [64] H. Foidl and M. Felderer, "Risk-based Data Validation in Machine Learning-based Software Systems," in *Proceedings of the 3rd ACM SIGSOFT International Workshop on Machine Learning Techniques for Software Quality Evaluation*, ser. MaLTeSQuE 2019. New York, NY, USA: ACM, 2019, pp. 13–18, event-place: Tallinn, Estonia. [Online]. Available: http://doi.acm.org/10.1145/3340482.3342743
- [65] J. A. Reshi and S. Singh, Predicting Software Defects through SVM: An Empirical Approach, 2018.
- [66] Y. Wang, S. Hu, L. Yin, and X. Zhou, "Using Code Evolution Information to Improve the Quality of Labels in Code Smell Datasets," in 2018 IEEE 42nd Annual Computer Software and Applications Conference (COMPSAC), vol. 01, Jul. 2018, pp. 48–53.
- [67] T. Sharma, V. Efstathiou, P. Louridas, and D. Spinellis, On the Feasibility of Transfer-learning Code Smells using Deep Learning, 2019.
- [68] J. Rubin, A. N. Henniche, N. Moha, M. Bouguessa, and N. Bousbia, "Sniffing Android Code Smells: An Association Rules Mining-Based Approach," in 2019 IEEE/ACM 6th International Conference on Mobile Software Engineering and Systems (MOBILESoft), May 2019, pp. 123– 127.
- [69] A. Kaur and S. Singh, "International Journal of Applied Engineering Research." [Online]. Available: https://www.ripublication.com/ijaer18/ ijaerv13n11\_176.pdf
- [70] F. Pecorelli, F. Palomba, D. Di Nucci, and A. De Lucia, "Comparing Heuristic and Machine Learning Approaches for Metric-based Code Smell Detection," in *Proceedings of the 27th International Conference* on *Program Comprehension*, ser. ICPC '19. Piscataway, NJ, USA: IEEE Press, 2019, pp. 93–104, event-place: Montreal, Quebec, Canada. [Online]. Available: https://doi.org/10.1109/ICPC.2019.00023
- [71] P. Kriens and T. Verbelen, Software Engineering Practices for Machine Learning, 2019.

- [72] B. Chernis and R. Verma, "Machine Learning Methods for Software Vulnerability Detection," in *Proceedings of the Fourth ACM International Workshop on Security and Privacy Analytics*, ser. IWSPA '18. New York, NY, USA: ACM, 2018, pp. 31–39, event-place: Tempe, AZ, USA. [Online]. Available: http://doi.acm.org/10.1145/3180445.3180453
- [73] Y. Xiong, B. Wang, G. Fu, and L. Zang, "Learning to Synthesize," in Proceedings of the 4th International Workshop on Genetic Improvement Workshop, ser. GI '18. New York, NY, USA: ACM, 2018, pp. 37–44, event-place: Gothenburg, Sweden. [Online]. Available: http://doi.acm.org/10.1145/3194810.3194816
- [74] M. Hirsch, A. Rodriguez, J. M. Rodriguez, C. Mateos, and A. Zunino, "Spotting and Removing WSDL Anti-pattern Root Causes in Code-first Web Services Using NLP Techniques: A Thorough Validation of Impact on Service Discoverability," Computer Standards & Interfaces, vol. 56, pp. 116 – 133, 2018. [Online]. Available: http://www.sciencedirect.com/science/article/pii/S0920548917300892
- [75] M. Fowler, Refactoring: improving the design of existing code. Addison-Wesley Professional, 2018.
- [76] A. Koenig, "Patterns and antipatterns," *The patterns handbook: techniques, strategies, and applications*, vol. 13, p. 383, 1998.
- [77] C. M. Bishop, Pattern recognition and machine learning. springer 2006.
- [78] A. L. Samuel, "Some studies in machine learning using the game of checkers. IIrecent progress," in *Computer Games I*. Springer, 1988, pp. 366–400.
- pp. 366–400. [79] "How a Self-Driving Uber Killed a Pedestrian in Arizona - The New York Times." [Online]. Available: https://www.nytimes.com/interactive/2018/03/20/us/self-driving-uber-pedestrian-killed.html