

References

- [1] Prasad, Ramjee, and Vandana Rohokale. "Cyber Threats and Attack Overview." In *Cyber Security: The Lifeline of Information and Communication Technology*, pp. 15-31. Springer, Cham, 2020. ↑1
- [2] Lewis, J. A. (2002). *Assessing the risks of cyber terrorism, cyber war and other cyber threats* (p. 12). Washington, DC: Center for Strategic & International Studies. ↑1
- [3] Vyawahare, M., & Chatterjee, M. (2020). Survey on Detection and Prediction Techniques of Drive-by Download Attack in OSN. In *Advanced Computing Technologies and Applications* (pp. 453-463). Springer, Singapore. ↑2
- [4] Categories of Cyber Security. Available at: <https://www.kaspersky.com/resource-center/definitions/what-is-cyber-security>. ↑3
- [5] Sitelock Security Report. Available at: <https://www.sitelock.com/download/SiteLock-Website-Security-Insider-Q4-2017.pdf>. ↑4 ↑15
- [6] Microsoft Edge. Available at: <https://www.microsoft.com/en-us/edge>. ↑4
- [7] Mozilla Firefox. Available at: <https://www.mozilla.org/>. ↑4
- [8] Google Chrome. Available at: <https://www.google.com/chrome/>. ↑4
- [9] Denko, Blaž & Pecnik, Spela & Fister jr, Iztok. (2021). A Comprehensive Comparison of Hybrid Mobile Application Development Frameworks. *International Journal of Security and Privacy in Pervasive Computing*. 13. 78-90. 10.4018/IJSPPC.2021010105. ↑4
- [10] Article on 'App Development Decisions: Native, Web or Hybrid?' Available at: <https://medium.com/@Imaginnovation/app-development-decisions-native-web-or-hybrid-31c103f9b4e1>. ↑4 ↑5
- [11] Singhal, Mohit. "Analysis and Categorization of Drive-by Download Malware Using Sandboxing and Yara Ruleset." PhD diss., 2019. ↑4

-
- [12] Symantec Corporation, "Internet Security Threat Report 2020," Symantec, 2020. Available: <http://www.symantec.com>. ↑4 ↑16
- [13] Sihwail, Rami, Khairuddin Omar, and Khairul Akram Zainol Ariffin. "A survey on malware analysis techniques: Static, dynamic, hybrid and memory analysis." *International Journal on Advanced Science, Engineering and Information Technology* 8, no. 4-2 (2018): 1662. ↑4 ↑8
- [14] Tahir, Rabia. "A study on malware and malware detection techniques." *International Journal of Education and Management Engineering* 8, no. 2 (2018): 20. ↑4
- [15] Thanh, Cong Truong, and Ivan Zelinka. "A survey on artificial intelligence in malware as next-generation threats." In *Mendel*, vol. 25, no. 2, pp. 27-34. 2019. ↑4
- [16] Market Share of Mobile Platforms globally. Available at: <https://gs.statcounter.com/os-market-share/mobile/worldwide>. ↑5
- [17] Article on 'Android Devices Worldwide'. Available at: <https://www.gizchina.com/2021/05/19/there-are-over-3-billion-active-android-devices-worldwide/>. ↑5
- [18] Android Versions Market Share. Available at: <https://gs.statcounter.com/android-version-market-share/mobile-tablet/worldwide>. ↑5
- [19] Android WebView. Available at: <https://developer.android.com/guide/webapps/webview>. ↑5 ↑9 ↑49
- [20] Acemoglu, Daron, and Pascual Restrepo. 8. *Artificial Intelligence, Automation, and Work*. University of Chicago Press, 2019. ↑5
- [21] Haenlein, Michael, and Andreas Kaplan. "A brief history of artificial intelligence: On the past, present, and future of artificial intelligence." *California management review* 61, no. 4 (2019): 5-14. ↑5 ↑5
- [22] Bory, Paolo. "Deep new: The shifting narratives of artificial intelligence from Deep Blue to AlphaGo." *Convergence* 25, no. 4 (2019): 627-642. ↑5
- [23] Sabouret, Nicolas, and Lizete De Assis. "Understanding Artificial Intelligence." (2020). ↑6
- [24] Jackson, Philip C. *Introduction to artificial intelligence*. Courier Dover Publications, 2019. ↑7

-
- [25] Web Hacking Statistics 2021. Available at: <https://patchstack.com/website-hacking-statistics/>. ↑8
- [26] J.J. Rosen, 2014. The Internet that you can't Google!. Available at: <https://www.tennessean.com/story/money/tech/2014/05/02/jj-rosen-popular-search-engines-skim-surface/8636081/>. ↑8
- [27] Mirea, Mihnea, Victoria Wang, and Jeyong Jung. "The not so dark side of the darknet: a qualitative study." *Security Journal* 32, no. 2 (2019): 102-118. ↑8
- [28] Pure, Ivo. "An automated methodology for validating web related cyber threat intelligence by implementing a honeyclient." ↑8
- [29] B. Altay, T. Dokeroglu, and A. Cosar, "Context-sensitive and keyword density-based supervised machine learning techniques for malicious webpage detection," *Soft Computing*, pp. 1–15, 2018. ↑8
- [30] McMahan, Brendan, Eider Moore, Daniel Ramage, Seth Hampson, and Blaise Aguera y Arcas. "Communication-efficient learning of deep networks from decentralized data." In *Artificial Intelligence and Statistics*, pp. 1273-1282. PMLR, 2017. ↑9 ↑131 ↑137
- [31] Hard, Andrew, Kanishka Rao, Rajiv Mathews, Swaroop Ramaswamy, Françoise Beaufays, Sean Augenstein, Hubert Eichner, Chloé Kiddon, and Daniel Ramage. "Federated learning for mobile keyboard prediction." *arXiv preprint arXiv:1811.03604* (2018). ↑9 ↑133
- [32] Li, Wenqi, Fausto Milletari, Daguang Xu, Nicola Rieke, Jonny Hancox, Wentao Zhu, Maximilian Baust et al. "Privacy-preserving federated brain tumor segmentation." In *International Workshop on Machine Learning in Medical Imaging*, pp. 133-141. Springer, Cham, 2019. ↑9 ↑133 ↑135
- [33] Rieke, Nicola, Jonny Hancox, Wenqi Li, Fausto Milletari, Holger R. Roth, Shadi Albarqouni, Spyridon Bakas, et al. "The future of digital health with federated learning." *NPJ digital medicine* 3, no. 1 (2020): 1-7. ↑9
- [34] Long, Guodong, Yue Tan, Jing Jiang, and Chengqi Zhang. "Federated Learning for Open Banking." In *Federated Learning*, pp. 240-254. Springer, Cham, 2020. ↑9
- [35] Kohonen, Teuvo. "The self-organizing map." *Proceedings of the IEEE* 78, no. 9 (1990): 1464-1480. ↑10

-
- [36] B Wainakh, Aidmar, Alejandro Sanchez Guinea, Tim Grube, and Max Mühlhäuser. "Enhancing privacy via hierarchical federated learning." In 2020 IEEE European Symposium on Security and Privacy Workshops (EuroS&PW), pp. 344-347. IEEE, 2020. [↑11](#)
- [37] J.J. Rosen, 2014. The Internet that you can't Google'. Available at: <https://www.tennessean.com/story/money/tech/2014/05/02/jj-rosen-popular-search-engines-skim-surface/8636081/>. [↑15](#)
- [38] G. K. Jayasinghe, J. S. Culpepper, and P. Bertok, "Efficient and effective realtime prediction of drive-by download attacks," 2014. [↑16](#)
- [39] Y. Cao, X. Pan, Y. Chen, and J. Zhuge, "JShield: Towards Real-time and Vulnerability-based Detection of Polluted Drive-by Download Attacks," in Proceedings of the 30th Annual Computer Security Applications Conference., 2014, pp. 466–475. [↑16](#) [↑16](#)
- [40] S. Sarwade and P. D. D. Patil, "Document-based and URL-based Features for Automatic Classification of Cross-Site Scripting in Web Pages," vol. 3, pp. 1–10, 2013. [↑17](#) [↑18](#)
- [41] L. Invernizzi, S. Benvenuti, M. Cova, C. Kruegel, and G. Vigna, "EVILSEED : A Guided Approach to Finding Malicious Web Pages," in IEEE Symposium on Security & Privacy (SP), 2012, pp. 428–442. [↑18](#) [↑21](#) [↑23](#) [↑31](#)
- [42] D. Canali, M. Cova, G. Vigna, C. Kruegel, "Prophiler: a fast filter for the large-scale detection of malicious web pages," 2011. [↑19](#) [↑21](#) [↑75](#) [↑76](#)
- [43] P. S. Rohit, R. Krishnaveni, "Deep Malicious Website Detection," vol. 2, Issue 4, pg. 517-522, 2013. [↑19](#)
- [44] N. Provos, P. Mavrommatis, M. A. Rajab, and F. Monrose, "All Your iFrames Point to Us," in USENIX Security Symposium, 2008. [↑19](#)
- [45] Y.-T. Hou, Y. Chang, T. Chen, C.-S. Lai, and C.-M. Chen, "Malicious web content detection by machine learning," Expert Systems with Applications, vol. 37, no. 1, pp. 55–60, Jan. 2010. [↑21](#)
- [46] Pham, Kien, Aécio Santos, and Juliana Freire. "Understanding Website Behavior based on User Agent." Proceedings of the 39th International ACM SIGIR conference on Research and Development in Information Retrieval. ACM, 2016. [↑21](#)

-
- [47] P. Likarish and E. Jung, "A targeted web crawling for building malicious javascript collection," in Proceeding of the ACM DSMM, 2009, vol. 21, no. 4, pp. 23–26. [↑21](#)
- [48] H. Y. I Jo, E Jung, "Interactive Website Filter for Safe Web Browsing," Journal of Information Science, vol. 131, pp. 115–131, 2013. [↑21](#)
- [49] M. T. Qassrawi and H. Zhang, "Detecting Malicious Web Servers with Honeyclients," vol. 6, no. 1, pp. 145–152, 2011. [↑21](#)
- [50] T. H. and F. C. Ikin, Ali, "Monkey-Spider : Detecting Malicious Websites with Low-Interaction Honeyclients," vol. 8, 2008. [↑21](#) [↑75](#) [↑76](#)
- [51] Malware Domain List. Available at: <http://www.malwaredomainlist.com/>. [↑23](#)
- [52] JSoup- JSoup Java Library. Available: <http://www.jsoup.org>. [↑23](#) [↑28](#) [↑168](#)
- [53] "HTML Unit". Available: <http://htmlunit.sourceforge.net/>. [↑24](#) [↑24](#) [↑27](#) [↑28](#)
[↑59](#) [↑168](#)
- [54] "Rhino-Mozilla". Available:<https://developer.mozilla.org/docs/Mozilla/Projects/Rhino>. [↑24](#) [↑24](#) [↑26](#) [↑26](#) [↑28](#) [↑59](#) [↑169](#)
- [55] N. Z. Univeristy of Waikato, "WEKA.". Available: <http://ml/weka>. [↑24](#) [↑28](#) [↑60](#)
[↑66](#) [↑170](#)
- [56] Quinlan, J. R. C4.5: Programs for Machine Learning. Morgan Kaufmann Publishers, 1993. [↑24](#) [↑28](#) [↑58](#) [↑58](#)
- [57] F. Karbalaie, A. Sami, and M. Ahmadi, "Semantic Malware Detection by Deploying Graph Mining," vol. 9, no. 1, pp. 373–379, 2012. [↑25](#)
- [58] S. Kaplan, C. Siefert, B. Livshits, B. Zorn, and C. Curtsinger, NO FUS : Automatically Detecting Obfuscated JavaScript Code, 2011. [↑25](#) [↑26](#)
- [59] B. S. Pintol and R. Barnete, "A novel algorithm for obfuscated code analysis," in Information Forensics and Security (WIFS), 2011 IEEE International Workshop, 2011, pp. 1–5. [↑25](#)
- [60] MalCrawler Code Hosted Online on GitHub. Available at: <https://github.com/aksingh2411/MalCrawler>. [↑28](#)
- [61] Google Safe Browsing API. Available: <https://developers.google.com/safe-browsing>. [↑29](#) [↑34](#) [↑35](#) [↑51](#) [↑54](#) [↑63](#) [↑67](#) [↑99](#) [↑126](#) [↑127](#) [↑132](#) [↑132](#) [↑137](#)
[↑164](#) [↑168](#)

-
- [62] Dataset: "Android Malicious Dataset 2017 (CICAndMal2017)". Available: <https://www.unb.ca/cic/datasets/andmal2017.html>. ↑32 ↑50 ↑160 ↑166 ↑119
- [63] Dataset: "Android Application Dataset for Malware Detection". Available: <https://github.com/CSKAMIL/Android-Application-Dataset-for-Malware-Detection>. ↑32
- [64] Dataset: "Android Antimalware Dataset". Available: <https://github.com/VT-Magnum-Research/antimalware/tree/master/arff>. ↑32
- [65] Utility for Downloading APKs from Google Play: "APK Combo". Available: <https://apkcombo.com/en-in/>. ↑32 ↑50 ↑160 ↑120
- [66] JADX Disassembler for APKs. Available: <https://github.com/skylot/jadx>. ↑32 ↑119 ↑120 ↑168
- [67] Singh, A. K., and Navneet Goyal. "Malcrawler: A crawler for seeking and crawling malicious websites." In International Conference on Distributed Computing and Internet Technology, pp. 210-223. Springer, 2017. https://doi.org/10.1007/978-3-319-50472-8_17. ↑34 ↑35 ↑156 ↑59 ↑62 ↑63 ↑64 ↑98
- [68] Dataset, Visualization Code and Output, and Pre-processing Code are hosted on Mendeley Data. [Online] Available at: <http://dx.doi.org/10.17632/gdx3pkwp47.1>. ↑35 ↑45 ↑159
- [69] Code for Visualization of Dataset hosted on Kaggle. [Online] Available at: <https://www.kaggle.com/aksingh2411/visualisation-of-webpages-dataset>. ↑35 ↑45
- [70] Kohonen, Teuvo. "The self-organizing map." Proceedings of the IEEE 78, no. 9 (1990): 1464-1480. ↑46
- [71] Code and Results of SOM-based Analysis of Webpages Dataset hosted online on Kaggle. Available at: <https://www.kaggle.com/aksingh2411/som-model-of-webpages-dataset>. ↑48
- [72] A. K. Singh and N. Goyal, "A Comparison of Machine Learning Attributes for Detecting Malicious Websites," 11th International Conference on Communication Systems & Networks (COMSNETS 2019), Bengaluru, India, 2019, pp. 352-358. ↑156 ↑75 ↑76 ↑123 ↑125
- [73] GeoIP Database. [Online] Available at: <https://www.maxmind.com/en/geop2-databases>. ↑61 ↑63 ↑156 ↑167

-
- [74] JavaScript Auto De-Obfuscator (JSADO). [Online] Available at: <https://github.com/lucianogiuseppe/JS-Auto-DeObfuscator>. ↑98 ↑157 ↑168
- [75] Selenium for Python. [Online] Available at: <https://pypi.org/project/selenium>. ↑157
- [76] Code for De-obfuscation. [Online] Available at: <https://github.com/lucianogiuseppe/JS-Auto-DeObfuscator/blob/master/jsado.py>. ↑157
- [77] TLD Library. [Online] Available at: <https://pypi.org/project/tld>. ↑157
- [78] WHOIS API. [Online] Available at: <https://whois.whoisxmlapi.com>. ↑158 ↑170
- [79] Pre-processing code on Kaggle. [Online] Available at: <https://www.kaggle.com/aksingh2411/sample-preprocessing-of-web-content-dataset-prepa/>. ↑159
- [80] Dataset: "Android Application Dataset for Malware Detection". Available: <https://github.com/cskamil/Android-Application-Dataset-for-Malware-Detection>. ↑50 ↑160 ↑166
- [81] Dataset: "Android Antimalware Dataset". Available: <https://github.com/VT-Magnum-Research/antimalware/tree/master/arff>. ↑50 ↑160 ↑166
- [82] Dataset for "Machine Learning Analysis of Hybrid Apps". Available: www.kaggle.com/aksingh2411/hybrid-apps-security-analysis. ↑50 ↑56
- [83] Visualization of Hybrid Apps Dataset: Live Run on Kaggle. Available at: <https://www.kaggle.com/aksingh2411/visualization-of-hybrid-apps-dataset>. ↑50 ↑56
- [84] Disassembling code (in Java) using JADX disassembler: Available at: <https://gist.github.com/aksingh2411/2867548195159cf1c8be3de149ecd161>. ↑50 ↑160 ↑166
- [85] Pre-processing code (in Python) for Hybrid Apps Dataset. Available at: <https://gist.github.com/aksingh2411/b661ad5d65b2667fd365455aa99d0fae>. ↑50 ↑166
- [86] Google Chrome Custom Tabs. Available: <https://developer.chrome.com/multidevice/android/customtabs>. ↑51 ↑161 ↑126 ↑127
- [87] Song, Wei, Qingqing Huang, and Jeff Huang. "Understanding JavaScript Vulnerabilities in Large Real-World Android Applications." *IEEE Transactions on Dependable and Secure Computing* (2018). ↑52 ↑160 ↑160

-
- [88] Custom Tabs Builder. Available at: <https://developer.android.com/reference/androidx/browser/customtabs/CustomTabsIntent.Builder>. ↑161
- [89] JavaScript Settings in WebView. Available at: [https://developer.android.com/reference/android/webkit/WebSettings#setJavaScriptEnabled\(boolean\)](https://developer.android.com/reference/android/webkit/WebSettings#setJavaScriptEnabled(boolean)). ↑161
- [90] JavaScript Interface. Available at: <https://developer.android.com/reference/android/webkit/JavascriptInterface>. ↑161
- [91] Manifest Permission. Available at: <https://developer.android.com/reference/android/Manifest.permission>. ↑162
- [92] Blanc, G., Miyamoto, D., Akiyama, M., & Kadobayashi, Y. (2012, March). Characterizing obfuscated JavaScript using abstract syntax trees: Experimenting with malicious scripts. In 2012 26th International Conference on Advanced Information Networking and Applications Workshops (pp. 344-351). IEEE. ↑163
- [93] WebViewClient Settings. Available at: <https://developer.android.com/reference/android/webkit/WebViewClient>. ↑163
- [94] Loading URLs in Android WebView. Available at: [https://developer.android.com/reference/android/webkit/WebView#loadUrl\(java.lang.String,%20java.util.Map%3Cjava.lang.String,%20java.lang.String%3E\)](https://developer.android.com/reference/android/webkit/WebView#loadUrl(java.lang.String,%20java.util.Map%3Cjava.lang.String,%20java.lang.String%3E)). ↑164
- [95] Evaluate JavaScript Method of Android WebView. Available at: [https://developer.android.com/reference/android/webkit/WebView#evaluateJavaScript\(java.lang.String,%20android.webkit.ValueCallback%3Cjava.lang.String%3E\)](https://developer.android.com/reference/android/webkit/WebView#evaluateJavaScript(java.lang.String,%20android.webkit.ValueCallback%3Cjava.lang.String%3E)). ↑165
- [96] The shouldOverrideUrlLoading() Method of Android WebView. Available at: [https://developer.android.com/reference/android/webkit/WebViewClient#shouldOverrideUrlLoading\(android.webkit.WebView,%20android.webkit.WebResourceRequest\)](https://developer.android.com/reference/android/webkit/WebViewClient#shouldOverrideUrlLoading(android.webkit.WebView,%20android.webkit.WebResourceRequest)). ↑165
- [97] Cheeseman, Peter C., Matthew Self, James Kelly, Will Taylor, Don Freeman, and John C. Stutz. "Bayesian Classification." In AAI, vol. 88, pp. 607-611. 1988. ↑58
- [98] Quinlan, J. Ross. "Induction of decision trees." Machine learning 1, no. 1 (1986): 81-106. ↑58
- [99] Li, Bin, J. Friedman, R. A. Olshen, and C. J. Stone. "Classification and regression trees (CART)." Biometrics 40, no. 3 (1984): 358-361. ↑58

-
- [100] Ho, Tin Kam. "Random decision forests." In Proceedings of 3rd international conference on document analysis and recognition, vol. 1, pp. 278-282. IEEE, 1995. ↑58
- [101] Drucker, Harris, Chris JC Burges, Linda Kaufman, Alex Smola, and Vladimir Vapnik. "Support vector regression machines." *Advances in neural information processing systems* 9 (1997): 155-161. ↑58 ↑58
- [102] Ma J, Saul L.K., Savage S. and Voelker, 2009, June. Beyond blacklists: learning to detect malicious websites from suspicious URLs. In *Proceedings of the 15th ACM SIGKDD international conference on Knowledge discovery and data mining*(pp. 1245-1254). ACM. ↑60 ↑63
- [103] Wressnegger C., Yamaguchi F., Arp D. and Rieck K., 2015. Analyzing and Detecting Flash-based Malware using Lightweight Multi-Path Exploration. *University of Göttingen, Germany*. ↑60 ↑64 ↑65
- [104] Mavrommatis N.P.P. and Monroe, 2008. All your iframes point to us. ↑60 ↑64
- [105] Ganesh N., Di Troia F., Corrado V.A., Austin, T.H. and Stamp M., 2016, March. Static analysis of malicious Java applets. In *Proceedings of the 2016 ACM on International Workshop on Security And Privacy Analytics* (pp. 58-63). ACM. ↑60 ↑64 ↑65
- [106] Mao J., Tian W., Li P., Wei T. and Liang Z., 2017. Phishing-Alarm: Robust and Efficient Phishing Detection via Page Component Similarity. *IEEE Access*. ↑60
- [107] Marco Cova, Christopher Kruegel, and Giovanni Vigna. 2010. Detection and analysis of drive-by-download attacks and malicious JavaScript code. In *Proceedings of the 19th international conference on World wide web (WWW' 10)*. ACM, New York, NY, USA, 281-290. ↑60 ↑64 ↑75 ↑76
- [108] Gorji A. and Abadi M., 2014, March. Detecting obfuscated JavaScript malware using sequences of internal function calls. In *Proceedings of the 2014 ACM Southeast Regional Conference* (p. 64) ACM. ↑60 ↑65 ↑65
- [109] Hall M.A. and Holmes G., 2003. Benchmarking attribute selection techniques for discrete class data mining. *IEEE Transactions on Knowledge and Data engineering*, 15(6), pp.1437-1447. ↑60 ↑67
- [110] Malware Domain List: 2017. [online] Available at: <https://www.malwaredomainlist.com/>. Accessed: 2017- 10- 07. ↑62 ↑67

-
- [111] A. P. Felt, R. Barnes, A. King, C. Palmer, C. Bentzel, and P. Tabriz, "Measuring HTTPS adoption on the web," in 26th USENIX Security Symposium, 2017, pp. 1323–1338. [↑63](#)
- [112] K. A. Messabi, M. Aldwairi, A. A. Yousif, A. Thoban, and F. Belqasmi, "Malware detection using DNS records and domain name features," in Proceedings of the 2nd International Conference on Future Networks and Distributed Systems. ACM, 2018, p. 29. [↑63](#)
- [113] M. Klatt, B. W. Roberts, and T. C. Helming, "Domain reputation evaluation process and method," Apr. 6, 2017, US Patent App. 14/872,191. [↑63](#)
- [114] H. Mekky, R. Torres, Z.-L. Zhang, S. Saha, and A. Nucci, "Detecting malicious HTTP redirections using trees of user browsing activity," in INFOCOM, 2014 Proceedings IEEE. IEEE, 2014, pp. 1159–1167. [↑63](#) [↑65](#)
- [115] M. Hirotomo, Y. Nishio, M. Kamizono, Y. Fukuta, M. Mohri, and Y. Shiraishi, "Efficient method for analyzing malicious websites by using multi-environment analysis system," in 2017 12th Asia Joint Conference on Information Security (AsiaJCIS). IEEE, 2017, pp. 48–54. [↑64](#)
- [116] R. Wang, Y. Zhu, J. Tan, and B. Zhou, "Detection of malicious web pages based on hybrid analysis," Journal of Information Security and Applications, vol. 35, pp. 68–74, 2017. [↑64](#)
- [117] C. Wressnegger and K. Rieck, "Looking back on three years of flash-based malware," in Proceedings of the 10th European Workshop on Systems Security. ACM, 2017, p. 6. [↑64](#) [↑65](#)
- [118] B. Altay, T. Dokeroglu, and A. Cosar, "Context-sensitive and keyword density-based supervised machine learning techniques for malicious webpage detection," Soft Computing, pp. 1–15, 2018. [↑64](#) [↑64](#) [↑64](#)
- [119] N. Jagpal, E. Dingle, J.-P. Gravel, P. Mavrommatis, N. Provos, M. A. Rajab, and K. Thomas, "Trends and lessons from three years fighting malicious extensions." in USENIX Security Symposium, 2015, pp. 579- 593. [↑65](#) [↑65](#)
- [120] S. Morishige, S. Haruta, H. Asahina, and I. Sasase, "Obfuscated malicious javascript detection scheme using the feature based on divided URL," in Communications (APCC), 2017 23rd Asia-Pacific Conference on. IEEE, 2017, pp. 1-6. [↑65](#) [↑66](#) [↑66](#)

-
- [121] O. Sivan and Y. Lavi, "Web page and web browser protection against malicious injections," Jul. 18, 2017. [↑66](#)
- [122] H. Kikuchi, D. Yu, A Chander - US Patent 9, 686, and U. 2017, "Method and apparatus for constructing security policies for web content instrumentation against browser-based attacks," 2017. [Online]. Available: <https://patents.google.com/patent/US9686288B2/en>. [↑66](#) [↑66](#)
- [123] A. K. Singh, "Dataset for Comparison of ML Attributes for Detecting Malicious Websites," 2018. [Online]. Available: <http://dx.doi.org/10.17632/stctg82wsf.1>. [↑67](#)
- [124] Chawla, Nitesh V., Kevin W. Bowyer, Lawrence O. Hall, and W. Philip Kegelmeyer. "SMOTE: synthetic minority over-sampling technique." *Journal of artificial intelligence research* 16 (2002): 321-357. [↑67](#)
- [125] Google Transparency Report. [Online] Available at: <https://transparencyreport.google.com/>. [↑75](#)
- [126] Kapravelos, Alexandros, Chris Grier, Neha Chachra, Christopher Kruegel, Giovanni Vigna, and Vern Paxson. "Hulk: Eliciting malicious behavior in browser extensions." In *23rd {USENIX} Security Symposium ({USENIX} Security 14)*, pp. 641-654. 2014. [↑75](#)
- [127] Eshete, Birhanu, Adolfo Villafiorita, and Komminist Weldemariam. "Binspect: Holistic analysis and detection of malicious web pages." In *International Conference on Security and Privacy in Communication Systems*, pp. 149-166. Springer, Berlin, Heidelberg, 2012. [↑75](#) [↑76](#)
- [128] Akiyama, Mitsuaki, Makoto Iwamura, Yuhei Kawakoya, Kazufumi Aoki, and Mitsutaka Itoh. "Design and implementation of high interaction client honeypot for drive-by-download attacks." *IEICE transactions on communications* 93, no. 5 (2010): 1131-1139. [↑76](#)
- [129] Yoo, Suyeon, Sehun Kim, Anil Choudhary, O. P. Roy, and T. Tuithung. "Two-phase malicious web page detection scheme using misuse and anomaly detection." *International Journal of Reliable Information and Assurance* 2, no. 1 (2014): 1-9. [↑76](#)
- [130] Wang, Rong, Yan Zhu, Jiefan Tan, and Binbin Zhou. "Detection of malicious web pages based on hybrid analysis." *Journal of Information Security and Applications* 35 (2017): 68-74. [↑76](#) [↑90](#)

-
- [131] David, Eli, Nadav Maman, and Guy Caspi. "Methods and systems for detecting malicious webpages." US Patent Application 15/641,851, filed January 10, 2019. ↑77
- [132] Shrivastava, Vishal, Shashank Satish Damodaran, and Megha Kamble. "Adalward: a deep-learning framework for multi-class malicious webpage detection." *Journal of Cyber Security Technology* (2020): 1-43. ↑77
- [133] Vinayakumar, R., K. P. Soman, and Prabaharan Poornachandran. "Evaluating deep learning approaches to characterize and classify malicious URL's." *Journal of Intelligent & Fuzzy Systems* 34, no. 3 (2018): 1333-1343. ↑77 ↑90
- [134] Wang, Huan-huan, Long Yu, Sheng-wei Tian, Yong-fang Peng, and Xin-jun Pei. "Bidirectional LSTM Malicious webpages detection algorithm based on convolutional neural network and independent recurrent neural network." *Applied Intelligence* 49, no. 8 (2019): 3016-3026. ↑77
- [135] Zhang, Qingchen, Laurence T. Yang, Zhikui Chen, and Peng Li. "A survey on deep learning for big data." *Information Fusion* 42 (2018): 146-157. ↑77
- [136] Schmidhuber, Jürgen. "Deep learning in neural networks: An overview." *Neural networks* 61 (2015): 85-117. ↑78
- [137] Le Roux, Nicolas, and Yoshua Bengio. "Deep belief networks are compact universal approximators." *Neural computation* 22, no. 8 (2010): 2192-2207. ↑78
- [138] Profanity Check Computation. [Online] Available at: <https://pypi.org/project/profanity-check>. ↑37
- [139] Singh, AK; Goyal, Navneet (2020), "Dataset of Malicious and Benign Webpages", MendeleyData, v1. [Online] Available at: <http://dx.doi.org/10.17632/gdx3pkwp47>. ↑144
- [140] Srivastava, Nitish, Geoffrey Hinton, Alex Krizhevsky, Ilya Sutskever, and Ruslan Salakhutdinov. "Dropout: a simple way to prevent neural networks from overfitting." *The journal of machine learning research* 15, no. 1 (2014): 1929-1958. ↑80 ↑99
- [141] Kingma, Diederik P., and Jimmy Ba. "Adam: A method for stochastic optimization." *arXiv preprint arXiv:1412.6980* (2014). ↑81
- [142] Nielsen, Michael A. *Neural networks and deep learning*. Vol. 2018. San Francisco, CA, USA: Determination press, 2015. ↑81

-
- [143] Johnson, Justin M., and Taghi M. Khoshgoftaar. "Survey on deep learning with class imbalance." *Journal of Big Data* 6, no. 1 (2019): 27. [↑85](#)
- [144] Amin, Adnan, Sajid Anwar, Awais Adnan, Muhammad Nawaz, Newton Howard, Junaid Qadir, Ahmad Hawalah, and Amir Hussain. "Comparing oversampling techniques to handle the class imbalance problem: A customer churn prediction case study." *IEEE Access* 4 (2016): 7940-7957. [↑85](#) [↑120](#)
- [145] Qiu, Qiang, and Zichen Song. "A nonuniform weighted loss function for imbalanced image classification." In *Proceedings of the 2018 international conference on image and graphics processing*, pp. 78-82. 2018. [↑86](#)
- [146] A Recipe for Training Neural Networks. [Online] Available at: <http://karpathy.github.io/2019/04/25/recipe/#2-set-up-the-end-to-end-training-evaluation-skeleton--get-dumb-baselines>. [↑86](#)
- [147] TensorFlow. [Online] Available at: <https://www.tensorflow.org>. [↑87](#) [↑104](#) [↑145](#) [↑170](#)
- [148] Keras. [Online] Available at: <https://keras.io>. [↑87](#) [↑104](#) [↑145](#) [↑169](#)
- [149] Software Code published on Kaggle. [Online] Available at: <https://www.kaggle.com/aksingh2411/malicious-webpage-detection-with-unstructured-data>. [↑87](#)
- [150] TensorFlow.js. [Online] Available at: <https://www.tensorflow.org/js>. [↑91](#) [↑109](#) [↑154](#)
- [151] Live Internet Statistics. Available at: <https://www.internetlivestats.com/total-number-of-websites>. [↑92](#)
- [152] Fang, Yong, Yang Li, Liang Liu, and Cheng Huang. "DeepXSS: Cross site scripting detection based on deep learning." In *Proceedings of the 2018 International Conference on Computing and Artificial Intelligence*, pp. 47-51. 2018. [↑77](#)
- [153] Vinayakumar, R., K. P. Soman, and P Poornachandran. "Evaluating deep learning approaches to characterize and classify malicious URLs." *Journal of Intelligent & Fuzzy Systems* 34, (2018). [↑94](#)
- [154] Wang, H Huan, L Yu, S Tian, Y Peng, and Pei. "Bidirectional LSTM Malicious webpages detection algorithm based on convolutional neural network and independent recurrent neural network." *Applied Intelligence* 49, no. 8 (2019): 3016-3026. [↑94](#)

-
- [155] Shrivastava, Vishal, S Damodaran, and M Kamble. "Adalward: a deep-learning framework for multi-class malicious webpage detection." *Journal of Cyber Security Technology* (2020): 1-43. [↑94](#)
- [156] Peters, Matthew, M Neumann, M Iyyer, M Gardner, K Lee, and L Zettlemoyer. "Deep contextualized word representations." *arXiv preprint*. [↑95](#)
- [157] Vaswani, Ashish, N Shazeer, N Parmar, J Uszkoreit, L Jones, Aidan N. Gomez, Kaiser, and I Polosukhin. "Attention is all you need." In *Advances in neural information processing systems*, 2017. [↑95](#) [↑109](#)
- [158] Devlin, Jacob, M Chang, and K Toutanova. "Bert: Pre-training of deep bidirectional transformers for language understanding." *arXiv preprint*. [↑95](#) [↑108](#) [↑109](#)
- [159] Cer, Daniel, Y Yang, S Kong, N Hua, N Limtiaco, R St John, N Constant, et al. "Universal sentence encoder." *arXiv preprint* (2018). [↑95](#)
- [160] TensorFlow Hub. Available at: <https://tfhub.dev>. [↑96](#)
- [161] Dataset of Random Web Content and JavaScript. Available at: <https://www.kaggle.com/aksingh2411/webjavascripttext-size50>. [↑97](#)
- [162] Code for De-obfuscation. Available at: <https://github.com/aksingh2411/JSADO>. [↑98](#)
- [163] Singh, A. K., and Navneet Goyal. (2020). "Dataset of Malicious and Benign Webpages". *Elsevier Data in Brief*. [↑144](#)
- [164] Kingma, Diederik P., and Jimmy Ba. "Adam: A method for stochastic optimization." *arXiv preprint arXiv:1412.6980* (2014). [↑99](#)
- [165] Nielsen, Michael A. *Neural networks and deep learning*. Vol. 2018. San Francisco, CA, USA: Determination press, 2015. [↑101](#)
- [166] A Recipe for Training Neural Networks. Available at: <http://karpathy.github.io/2019/04/25/recipe/#2-set-up-the-end-to-end-trainingevaluation-skeleton--get-dumb-baselines>. [↑104](#)
- [167] Bergstra, James, and Yoshua Bengio. "Random search for hyper-parameter optimization." *Journal of machine learning research* , (2012). [↑104](#)
- [168] Skikit-learn. Available at: <https://scikit-learn.org>. [↑105](#) [↑119](#) [↑121](#) [↑123](#) [↑170](#)

-
- [169] Jouppi, Norman P., C Young, et al. "In-datacenter performance analysis of a tensor processing unit." In *Proceedings of the 44th Annual International Symposium on Computer Architecture*, pp. 1-12. 2017. [↑105](#)
- [170] Code for Stage-I: Pre-training Autoencoders. Available at: <https://www.kaggle.com/aksingh2411/unsupervised-learning-web-content-javascript>. [↑105](#)
- [171] Code for Stage-II: DNN Classifier. Available at: <https://www.kaggle.com/aksingh2411/stage-ii-dnn-model-for-webcontent-classification>. [↑105](#)
- [172] Code for Grid Search of Hyperparameters. Available at: <https://www.kaggle.com/aksingh2411/grid-search-tuning-of-hyper-parameters>. [↑105](#)
- [173] Details of Number of Android Devices and Versions Active. Available: <https://www.androidpolice.com/2019/05/07/android-distribution-numbers-finally-back-for-may-2019-after-6-months/>. [↑113](#)
- [174] Hybrid Apps Beats Native Apps in Survey. Available: <https://adtmag.com/articles/2017/07/28/hybrid-beats-native.aspx>. [↑114](#)
- [175] Chin, Erika, and David Wagner. "Bifocals: Analyzing WebView vulnerabilities in android applications." In *International Workshop on Information Security Applications*, pp. 138-159. Springer, Cham, 2013. [↑115](#)
- [176] Bao, Wenying, Wenbin Yao, Ming Zong, and Dongbin Wang. "Cross-site Scripting attacks on Android hybrid applications." In *Proceedings of the 2017 International Conference on Cryptography, Security and Privacy*, pp. 56-61. ACM, 2017. [↑115](#)
- [177] Wei, Fengguo, Yuping Li, Sankardas Roy, Xinming Ou, and Wu Zhou. "Deep ground truth analysis of current android malware." In *International Conference on Detection of Intrusions and Malware, and Vulnerability Assessment*, pp. 252-276. Springer, Cham, 2017. [↑115](#)
- [178] Rizzo, Claudio, Lorenzo Cavallaro, and Johannes Kinder. "BabelView: Evaluating the Impact of Code Injection Attacks in Mobile Webviews." In *International Symposium on Research in Attacks, Intrusions, and Defenses*, pp. 25-46. Springer, Cham, 2018. [↑115](#)
- [179] Hu, Jiajun, Lili Wei, Yepang Liu, Shing-Chi Cheung, and Huaxun Huang. "A tale of two cities: How WebView induces bugs to Android applications." In *Proceedings of the 33rd ACM/IEEE International Conference on Automated Software Engineering*, pp. 702-713. ACM, 2018. [↑115](#)

-
- [180] Song, Wei, Qingqing Huang, and Jeff Huang. "Understanding JavaScript Vulnerabilities in Large Real-World Android Applications." *IEEE Transactions on Dependable and Secure Computing* (2018). [↑115](#)
- [181] Sexton, Julian, Andrey Chudnov, and David A. Naumann. "Spartan Jester: end-to-end information flow control for hybrid Android applications." In *2017 IEEE Security and Privacy Workshops (SPW)*, pp. 157-162. IEEE, 2017. [↑115](#)
- [182] Li, Tongxin, Xueqiang Wang, Mingming Zha, Kai Chen, XiaoFeng Wang, Luyi Xing, Xiaolong Bai, Nan Zhang, and Xinhui Han. "Unleashing the walking dead: Understanding cross-app remote infections on mobile WebViews." In *Proceedings of the 2017 ACM SIGSAC Conference on Computer and Communications Security*, pp. 829-844. ACM, 2017. [↑115](#)
- [183] Mohsen, Fadi, and Mohamed Shehab. "Proposing and Testing New Security Cue Designs for OAuth-WebView-Embedded Mobile Applications." In *2017 IEEE 3rd International Conference on Collaboration and Internet Computing (CIC)*, pp. 443-448. IEEE, 2017. [↑116](#)
- [184] Imamura, Yuta, Hiroyuki Uekawa, Yasuhiro Ishihara, Masaya Sato, and Toshihiro Yamauchi. "Web access monitoring mechanism for Android WebView." In *Proceedings of the Australasian Computer Science Week Multiconference*, p. 1. ACM, 2018. [↑116](#)
- [185] The Webkit project. Available at: <https://www.webkit.org>. [↑116](#)
- [186] The Chromium Project. Available at: <https://www.chromium.org>. [↑117](#)
- [187] WebView & Chrome Similarity & Interoperability. Available: <https://developer.chrome.com/multidevice/webview/overview>. [↑117](#)
- [188] Working with Android WebView. Available: <https://androidride.com/android-webview-example-tutorial-kotlin-java-download-source-code/>. [↑117](#)
- [189] WebView Developer Resource. Available: <https://developer.android.com/guide/webapps/webview#java>. [↑117](#)
- [190] Google Play Store Download of "WebView Tools". Available: <https://play.google.com>. [↑119](#)
- [191] Source Code of "WebView Tool". Available: <https://github.com/aksingh2411/WebViewTool>. [↑119](#) [↑153](#)

-
- [192] Dataset: "Android Application Dataset for Malware Detection". Available: <https://github.com/cskamil/Android-Application-Dataset-for-Malware-Detection>. ↑119
- [193] Dataset: "Android Antimalware Dataset". Available: <https://github.com/VT-Magnum-Research/antimalware/tree/master/arff>. ↑119
- [194] Hall, Mark A., and Geoffrey Holmes. "Benchmarking attribute selection techniques for discrete class data mining." *IEEE Transactions on Knowledge and Data engineering* 15, no. 6 (2003): 1437-1447. ↑123
- [195] Source Code of "WebView Monitor" Android App. Available: <https://github.com/aksingh2411/Web-View-Monitor>. ↑128 ↑153
- [196] UIWebView Component. Available at: <https://developer.apple.com/documentation/uikit/uiwebview>. ↑128 ↑155
- [197] Konečný, Jakub, H. Brendan McMahan, Felix X. Yu, Peter Richtárik, Ananda Theertha Suresh, and Dave Bacon. "Federated learning: Strategies for improving communication efficiency." *arXiv preprint arXiv:1610.05492* (2016). ↑129
- [198] Statistics of Smart Phones globally. Available at: <https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide>. ↑130
- [199] Lindell, Yehida. "Secure multiparty computation for privacy preserving data mining." In *Encyclopedia of Data Warehousing and Mining*, pp. 1005-1009. IGI global, 2005. ↑131 ↑134
- [200] Gentry, Craig. "Fully homomorphic encryption using ideal lattices." In *Proceedings of the forty-first annual ACM symposium on Theory of computing*, pp. 169-178. 2009. ↑131 ↑131 ↑134
- [201] Dwork, Cynthia, and Adam Smith. "Differential privacy for statistics: What we know and what we want to learn." *Journal of Privacy and Confidentiality* 1, no. 2 (2010). ↑131 ↑134
- [202] Dwork, Cynthia, Frank McSherry, Kobbi Nissim, and Adam Smith. "Calibrating noise to sensitivity in private data analysis." *Journal of Privacy and Confidentiality* 7, no. 3 (2016): 17-51. ↑131 ↑131 ↑134
- [203] Bonawitz, Keith, Hubert Eichner, Wolfgang Grieskamp, Dzmitry Huba, Alex Ingerman, Vladimir Ivanov, Chloe Kiddon et al. "Towards federated learning at scale: System design." *arXiv preprint arXiv:1902.01046* (2019). ↑131 ↑133 ↑135

-
- [204] Differential Privacy Team. Learning with privacy at scale. *Apple Machine Learning Journal*, 1(8), 2017. [Online] Available at: <https://machinelearning.apple.com/2017/12/06/learning-with-privacy-at-scale.html>. ↑131 ↑133
- [205] Liu, Lumin, Jun Zhang, S. H. Song, and Khaled B. Letaief. "Client-edge-cloud hierarchical federated learning." In *ICC 2020-2020 IEEE International Conference on Communications (ICC)*, pp. 1-6. IEEE, 2020. ↑131 ↑133 ↑133 ↑142 ↑142
- [206] Chakraborty, Anirban, Manaar Alam, Vishal Dey, Anupam Chattopadhyay, and Debdeep Mukhopadhyay. "A survey on adversarial attacks and defences." *CAAI Transactions on Intelligence Technology* (2021). ↑132
- [207] Hard, Andrew, Kanishka Rao, Rajiv Mathews, Swaroop Ramaswamy, Françoise Beaufays, Sean Augenstein, Hubert Eichner, Chloé Kiddon, and Daniel Ramage. "Federated learning for mobile keyboard prediction." *arXiv preprint arXiv:1811.03604* (2018). ↑132 ↑133
- [208] Virus Total API. [Online] Available at: <https://developers.virustotal.com/reference>. ↑132
- [209] Yang, Timothy, Galen Andrew, Hubert Eichner, Haicheng Sun, Wei Li, Nicholas Kong, Daniel Ramage, and Françoise Beaufays. "Applied federated learning: Improving google keyboard query suggestions." *arXiv preprint arXiv:1812.02903* (2018). ↑133
- [210] Sheller, Micah J., Brandon Edwards, G. Anthony Reina, Jason Martin, Sarthak Pati, Aikaterini Kotrotsou, Mikhail Milchenko et al. "Federated learning in medicine: facilitating multi-institutional collaborations without sharing patient data." *Scientific reports* 10, no. 1 (2020): 1-12. ↑133
- [211] Ulfar Erlingsson, Vasyl Pihur, and Aleksandra Korolova. RAPPOR: Randomized aggregatable privacy preserving ordinal response. In *ACM CCS*, 2014. ISBN 978-1-4503-2957-6. doi: 10.1145/2660267.2660348. ↑133
- [212] Timothy Yang, Galen Andrew, Hubert Eichner, Haicheng Sun, Wei Li, Nicholas Kong, Daniel Ramage, and Françoise Beaufays. Applied federated learning: Improving Google keyboard query suggestions. *arXiv preprint 1812.02903*, 2018. ↑133
- [213] Mingqing Chen, Rajiv Mathews, Tom Ouyang, and Françoise Beaufays. Federated learning of out-of-vocabulary words. *arXiv preprint 1903.10635*, 2019. ↑133

-
- [214] Swaroop Ramaswamy, Rajiv Mathews, Kanishka Rao, and Françoise Beaufays. Federated learning for emoji prediction in a mobile keyboard. arXiv preprint 1906.04329, 2019. [↑133](#)
- [215] Your chats stay private while Messages improves suggestions, 2019. [Online] Available at: URL <https://support.google.com/messages/answer/9327902>. [↑133](#)
- [216] Apple. Private Federated Learning (NeurIPS 2019 Expo Talk Abstract). https://nips.cc/ExpoConferences/2019/schedule?talk_id=40, 2019. [↑133](#)
- [217] Apple. Designing for privacy (video and slide deck). Apple WWDC, <https://developer.apple.com/videos/play/wwdc2019/708>, 2019. [↑133](#)
- [218] David Leroy, Alice Coucke, Thibaut Lavril, Thibault Gisselbrecht, and Joseph Dureau. Federated learning for keyword spotting. arXiv preprint arXiv:1810.05512, 2018. [↑133](#)
- [219] Wainakh, Aidmar, Alejandro Sanchez Guinea, Tim Grube, and Max Mühlhäuser. "Enhancing privacy via hierarchical federated learning." In 2020 IEEE European Symposium on Security and Privacy Workshops (EuroS&PW), pp. 344-347. IEEE, 2020. [↑133](#) [↑142](#)
- [220] Wang, Jiayi, Shiqiang Wang, Rong-Rong Chen, and Mingyue Ji. "Local Averaging Helps: Hierarchical Federated Learning and Convergence Analysis." arXiv preprint arXiv:2010.12998 (2020). [↑133](#) [↑142](#)
- [221] Singh, A. K., and Navneet Goyal. "Understanding and Mitigating Threats from Android Hybrid Apps Using Machine Learning." In 2020 IEEE International Conference on Big Data (Big Data), pp. 1-9. IEEE, 2020. [↑134](#)
- [222] Milosevic, Nikola, Ali Dehghantaha, and Kim-Kwang Raymond Choo. "Machine learning aided Android malware classification." Computers & Electrical Engineering 61 (2017): 266-74. [↑134](#)
- [223] Li, Jin, Lichao Sun, Qiben Yan, Zhiqiang Li, Witawas Srisa-An, and Heng Ye. "Significant permission identification for machine-learning-based android malware detection." IEEE Transactions on Industrial Informatics 14, no. 7 (2018): 3216-3225. [↑134](#)
- [224] Ma, Zhuo, Haoran Ge, Yang Liu, Meng Zhao, and Jianfeng Ma. "A combination method for android malware detection based on control flow graphs and machine learning algorithms." IEEE Access 7 (2019): 21235-21245. [↑134](#)

-
- [225] Al-Rubaie, Mohammad, and J. Morris Chang. "Privacy-preserving machine learning: Threats and solutions." *IEEE Security & Privacy* 17, no. 2 (2019): 49-58. [↑134](#)
- [226] Kairouz, Peter, H. Brendan McMahan, Brendan Avent, Aurélien Bellet, Mehdi Bennis, Arjun Nitin Bhagoji, Keith Bonawitz et al. "Advances and open problems in federated learning." *arXiv preprint arXiv:1912.04977* (2019). [↑135](#)
- [227] Yang, Qiang, Yang Liu, Tianjian Chen, and Yongxin Tong. "Federated machine learning: Concept and applications." *ACM Transactions on Intelligent Systems and Technology (TIST)* 10, no. 2 (2019): 1-19. [↑135](#)
- [228] Zhuang, Fuzhen, et al. "A comprehensive survey on transfer learning." *Proceedings of the IEEE* 109.1 (2020): 43-76. [↑110](#) [↑139](#)
- [229] Implementation of LSTM based Autoencoder. [Online] Available at: <https://www.kaggle.com/aksingh2411/stage-i-unsupervisedlearning-webcontent-javascript>. [↑139](#)
- [230] Bonawitz, Keith, Vladimir Ivanov, Ben Kreuter, Antonio Marcedone, H. Brendan McMahan, Sarvar Patel, Daniel Ramage, Aaron Segal, and Karn Seth. "Practical secure aggregation for federated learning on user-held data." *arXiv preprint arXiv:1611.04482* (2016). [↑140](#)
- [231] Abadi, Martin, Andy Chu, Ian Goodfellow, H. Brendan McMahan, Ilya Mironov, Kunal Talwar, and Li Zhang. "Deep learning with differential privacy." In *Proceedings of the 2016 ACM SIGSAC Conference on Computer and Communications Security*, pp. 308-318. 2016. [↑140](#)
- [232] Code for Federated Learning based Android Web Security Experiment and simulation. [Online] Available at: https://colab.research.google.com/drive/135eNF4si3F4zT_Cxhhc3A_8SqmdHuxKT?usp=sharing. [↑141](#) [↑145](#)
- [233] Chen, Bryant, et al. "Detecting backdoor attacks on deep neural networks by activation clustering." *arXiv preprint arXiv:1811.03728* (2018). [↑141](#)
- [234] Tran, Brandon, Jerry Li, and A Madry. "Spectral signatures in backdoor attacks." *Advances in Neural Information Processing Systems*. 2018. [↑141](#)
- [235] Cao, Xiaoyu, Jinyuan Jia, and Neil Zhenqiang Gong. "Provably Secure Federated Learning against Malicious Clients." *arXiv preprint arXiv:2102.01854* (2021). [↑141](#)

-
- [236] Adversarial Robustness Toolbox (ART). [Online] Available at: <https://adversarial-robustness-toolbox.org/>. ↑142 ↑167
- [237] Source Code of Adversarial Robustness Checks on FL Model. Available at: <https://github.com/aksingh2411/Adversarial-Robustness-on-Federated-Learning>. ↑142
- [238] Source code of Hierarchical Federated Learning based Android Web Security. Available at: <https://gist.github.com/aksingh2411/6f6091fd3105e30d93298b4d72edfdea>. ↑143
- [239] Zhao, Yue, Meng Li, Liangzhen Lai, Naveen Suda, Damon Civin, and Vikas Chandra. "Federated learning with non-iid data." arXiv preprint arXiv:1806.00582 (2018). ↑144
- [240] Tensorflow Federated. [Online] Available at: https://www.tensorflow.org/federated/api_docs/python/tff. ↑145 ↑170
- [241] Source Code Hosted on Git Hub. [Online] Available at: https://github.com/aksingh2411/JSADO/blob/master/Copy_of_Federated_Deep_Learning_Approach_to_Websecurity_Run_with_TFF_Wrapper.ipynb. ↑145
- [242] The Android SDK. [Online] Available at: <https://developer.android.com/>. ↑167
- [243] Android Studio IDE. [Online] Available at: <https://developer.android.com/studio>. ↑167
- [244] Google Colab. [Online] Available at: <https://colab.research.google.com/>. ↑167
- [245] JupyterLab IDE. [Online] Available at: <https://jupyter.org/>. ↑168
- [246] Kaggle. [Online] Available at: <https://www.kaggle.com/>. ↑168
- [247] NetBeans IDE and Profiler. [Online] Available at: <https://netbeans.apache.org/>. ↑169
- [248] NumPy Library. [Online] Available at: <https://numpy.org/>. ↑169
- [249] PostgreSQL. [Online] Available at: <https://www.postgresql.org/>. ↑169
- [250] Seaborn Data Visualization Library. [Online] Available at: <https://seaborn.pydata.org/>. ↑170
- [251] Tensor Processing Unit. [Online] Available at: <https://cloud.google.com/tpu>. ↑170
- [252] TensorBoard Visualization Library. [Online] Available at: <https://www.tensorflow.org/tensorboard>. ↑170