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Tosi D, Campi AS. How schools affected the covid-19 pandemic in Italy: data analysis for Lombardy Region, Campania Region, and Emilia Region. Future Internet. 2021. Google Scholar Davoudian A, Liu M. Big Data systems: a software engineering perspective. ACM Comput Surv. 2020. Google Scholar Kushwaha AK, Kar AK. Language model-driven chatbot for business to address marketing and selection of products. In: Sharma SK, Dwivedi YK, Metri B, Rana NP, editors. Re-imagining diffusion and adoption of information technology and systems: a continuing conversation. Cham: Springer; 2020. p. 1628. Google Scholar Kushwaha AK, Kar AK. Micro-foundations of artificial intelligence adoption in business: making the shift. In: Sharma SK, Dwivedi YK, Metri B, Rana NP, editors. Re-imagining diffusion and adoption of information technology and systems: a continuing conversation. Cham: Springer; 2020. p. 24960. Google Scholar Dong W, Liao S, Zhang Z. Leveraging financial social media data for corporate fraud detection. J Manag Inf Syst. 2018;35(2):46187. Google Scholar Kushwaha AK, Mandal S, Pharswan R, Kar AK, Ilavarasan PV. Studying online political behaviours as rituals: a study of social media behaviour regarding the CAA. In: Sharma SK, Dwivedi YK, Metri B, Rana NP, editors. Re-imagining diffusion and adoption of information technology and systems: a continuing conversation. Cham: Springer; 2020. p. 31526. Google Scholar Fronzetti Colladon A, Gloor P, Iezzi DF. Editorial introduction: the power of words and networks. Int J Inf Manag. 2020;51: 102031. Google Scholar Kushwaha AK, Kar AK, Ilavarasan PV. Predicting retweet class using deep learning. In: Piuri V, Raj S, Genovese A, Srivastava R, editors. Trends in deep learning methodologies: hybrid computational intelligence for pattern analysis. Cambridge: Academic Press; 2021. p. 89112. Google Scholar Tosi D. Cell phone Big Data to compute mobility scenarios for future smart cities. Int J Data Sci Anal. 2017;4:26584. Google Scholar Chen H, Chiang RHL, Storey VC. Business intelligence and analytics: from Big Data to big impact. MIS Q. 2012;36(4):116588. Google Scholar Wamba SF, Ngai E, Riggins F, Akter S. Big Data and business analytics adoption and use: a step toward transforming operations and production management? Bingley: Emerald Group Publishing Limited; 2017. Google Scholar George G, Osinga EC, Lavie D, Scott BA. Big Data and data science methods for management research. Acad Manag. 2016. Google Scholar Curtin J, Kauffman RJ, Riggins FJ. Making the MOST out of RFID technology: a research agenda for the study of the adoption, usage and impact of RFID. Inf Technol Manag. 2007;8(2):87110. Google Scholar Kitchenham BA, Charters S. Guidelines for performing systematic literature reviews in software engineering. Technical Report EBSE 2007-001, Keele University and Durham University Joint Report. 2007. . Accessed 15 Jan 2024Tosi D, Morasca S. Supporting the semi-automatic semantic annotation of web services: a systematic literature review. Inf Softw Technol. 2015;61:1632. Google Scholar Tahir A, Tosi D, Morasca S. A systematic review on the functional testing of semantic web services. J Syst Softw. 2013;86(11):287789. Google Scholar Briner RB, Denyer D. 112 systematic review and evidence synthesis as a practice and scholarship tool. In: Rousseau DM, editor. The Oxford handbook of evidence-based management. Oxford: Oxford University Press; 2012. Google Scholar Tosi D, Marzorati S, LaRosa M, Dondossola G, Terruggia R. Big Data from cellular networks: how to estimate energy demand at real-time. In: 2015 IEEE International Conference on Data Science and Advanced Analytics (DSAA), IEEE. 2015. pp. 110. R, Casini L, Tosi D, Roccetti M. Questioning the seasonality of SARS-COV-2: a Fourier spectral analysis. BMJ Open. 2022. Google Scholar Naghib A, Jafari Navimipour N, Hosseinzadeh M, Sharifi A. A comprehensive and systematic literature review on the Big Data management techniques in the internet of things. Wirel Netw. 2023;29(3):1085144. Google Scholar Sarker S, Arefin MS, Kowsher M, Bhuiyan T, Dhar PK, Kwon O-J. A comprehensive review on Big Data for industries: challenges and opportunities. IEEE Access. 2023;11:74469. Google Scholar Bansal M, Chana I, Clarke S. A survey on IoT Big Data: current status, 13 Vs challenges, and future directions. ACM Comput Surv. 2020. Google Scholar Hordri NF, Samar A, Yuhaniz SS, Shamsuddin SM. A systematic literature review on features of deep learning in Big Data analytics. Int J Adv Soft Comput Appl. 2017;9(1):3249. Google Scholar Zhong Y, Chen L, Dan C, Rezaeipanah A. A systematic survey of data mining and Big Data analysis in internet of things. J Supercomput. 2022;78(17):1840553. Google Scholar Rashid ANMB. Access methods for Big Data: current status and future directions. EAI Endorsed Trans Scal Inf Syst. 2017;4(15):114. Google Scholar ODonovan P, Leahy K, Bruton K, OSullivan DTJ. An industrial Big Data pipeline for data-driven analytics maintenance applications in large-scale smart manufacturing facilities. J Big Data. 2015. Google Scholar Kushwaha AK, Kar AK, Dwivedi YK. Applications of Big Data in emerging management disciplines: a literature review using text mining. Int J Inf Manag Data Insights. 2021. Google Scholar Alkhalil A, Abdallah MAE, Alogali A, Aljaloud A. Applying Big Data analytics in higher education: a systematic mapping study. Int J Inf Commun Technol Educ. 2021;17(3):2951. Google Scholar Rahmani AM, Azhir E, Ali S, Mohammadi M, Ahmed OH, Ghafour MY, Ahmed SH, Hosseinzadeh M. Artificial intelligence approaches and mechanisms for Big Data analytics: a systematic study. PeerJ Computer Sci. 2021;7:128. Google Scholar Lundberg L. Bibliometric mining of research directions and trends for Big Data. J Big Data. 2023. Google Scholar Baig MI, Shuib L, Yadegaridehkordi E. Big Data adoption: state of the art and research challenges. Inf Process Manag. 2019. Google Scholar Ikegwu AC, Nweke HF, Anikwe CV, Alo UR, Okonkwo OR. Big Data analytics for data-driven industry: a review of data sources, tools, challenges, solutions, and research directions. Clust Comput. 2022;25(5):334387. Google Scholar Imran S, Mahmood T, Morshed A, Sellis T. Big Data analytics in healthcare: a systematic literature review and roadmap for practical implementation. IEEE/CAA J Autom Sin. 2021;8(1):122. Google Scholar Zahid H, Mahmood T, Morshed A, Sellis T. Big Data analytics in telecommunications: literature review and architecture recommendations. IEEE/CAA J Autom Sin. 2020;7(1):1838. Google Scholar Bazzaz Abkenar S, Haghi Kashani M, Mahdipour E, Jameii SM. Big Data analytics meets social media: a systematic review of techniques, open issues, and future directions. Telemat Inf. 2021. Google Scholar ElSayed IA, ElDahshan K, Hefny H, ElSayed EK. Big Data and its future in computational biology: a literature review. J Computer Sci. 2021;17(12):12228. Google Scholar Hajiali M. Big Data and sentiment analysis: a comprehensive and systematic literature review. Concurr Comput Pract Exp. 2020. Google Scholar Ahmadova U, Mustafayev M, Kiani Kalejahi B, Saeedvand S, Rahmani AM. Big Data applications on the internet of things: a systematic literature review. Int J Commun Syst. 2021. Google Scholar Baig MI, Shuib L, Yadegaridehkordi E. Big Data in education: a state of the art, limitations, and future research directions. Int J Educ Technol High Educ. 2020;17(1):123.Article Google Scholar Reshi AA, Shah ARIF, Shafi S, Qadri MH. Big Data in healthcare a comprehensive bibliometric analysis of current research trends. Scal Comput. 2023;24(3):53149. Google Scholar Pulikottil T, Estrada-Jimenez LA, Abada JJP, Carrera-Rivera A, Torayev A, Rehman HU, Mo F, Nikghadam-Hojjati S, Barata J. Big Data life cycle in shop-floor-trends and challenges. IEEE Access. 2023;11:3000826. Google Scholar Arshad I, Alsamhi SH, Afzal W. Big Data testing techniques: taxonomy, challenges and future trends. Computers Mater Contin. 2023;74(2):273970. Google Scholar Gupta S, Kar AK, Baabdullah A, Al-Khowaiter WAA. Big Data with cognitive computing: a review for the future. Int J Inf Manag. 2018;42:7889. Google Scholar Saltz JS, Krasteva I. Current approaches for executing Big Data science projects-a systematic literature review. PeerJ Computer Sci. 2022. Google Scholar Liu C, Peng G, Kong Y, Li S, Chen S. Data quality affecting Big Data analytics in smart factories: research themes, issues and methods. Symmetry. 2021. Google Scholar Ahmed A, Xi R, Hou M, Shah SA, Hameed S. Harnessing Big Data analytics for healthcare: a comprehensive review of frameworks, implications, applications, and impacts. IEEE Access. 2023;11:112891928. Google Scholar Karimi Y, Haghi Kashani M, Akbari M, Mahdipour E. Leveraging Big Data in smart cities: a systematic review. Concurr Comput Pract Exp. 2021. Google Scholar Gong Y, Janssen M. Roles and capabilities of enterprise architecture in Big Data analytics technology adoption and implementation. J Theor Appl Electron Commer Res. 2021;16(1):3751. Google Scholar Anawar S, Othman NF, Selamat SR, Ayop Z, Harum N, Rahim FA. Security and privacy challenges of Big Data adoption: a qualitative study in telecommunication industry. Int J Interact Mob Technol. 2022;16(19):8197. Google Scholar Rathore MM, Shah SA, Shukla D, Bentafat E, Bakiras S. The role of AI, machine learning, and Big Data in digital twinning: a systematic literature review, challenges, and opportunities. IEEE Access. 2021;9:3203052. Google Scholar Mohamed A, Najafabadi MK, Wah YB, Zaman EAK, Maskat R. The state of the art and taxonomy of Big Data analytics: view from new Big Data framework. Artif Intell Rev. 2020;53(2):9891037. Google Scholar Li Y, Liu Z, Zhu H. Enterprise search in the Big Data era: recent developments and open challenges. Proc VLDB Endow. 2014;7(13):17178. Google Scholar Lee D, Camacho D, Jung JJ. Smart mobility with Big Data: approaches, applications, and challenges. Appl Sci. 2023. Google Scholar Himeur Y, Elnour M, Fadli F, Meskin N, Petri I, Rezgui Y, Bensaali F, Amira A. AI-Big Data analytics for building automation and management systems: a survey, actual challenges and future perspectives. Artif Intell Rev. 2023;56(6):49295021. Google Scholar Cesario E. Big Data analytics and smart cities: applications, challenges, and opportunities. Front Big Data. 2023. Google Scholar Zwilling M. Big Data challenges in social sciences: an NLP analysis. J Computer Inf Syst. 2023;63(3):53754. Google Scholar Rani R, Khurana M, Kumar A, Kumar N. Big Data dimensionality reduction techniques in IoT: review, applications and open research challenges. Clust Comput. 2022;25(6):402749. Google Scholar Jagatheesaperumal SK, Rahouti M, Ahmad K, Al-Fuqaha A, Guizani M. The duo of artificial intelligence and Big Data for industry 4.0: applications, techniques, challenges, and future research directions. IEEE Internet Things J. 2022;9(15):1286185. Google Scholar Lundberg L, Grahn H. Research trends, enabling technologies and application areas for Big Data. Algorithms. 2022. Google Scholar Ali TAL, Khafagy MH, Farrag MH. Big Data challenges: preserving techniques for privacy violations. J Theor Appl Inf Technol. 2022;100(8):250517. Google Scholar Latifian A. How does cloud computing help businesses to manage Big Data issues. Kybernetes. 2022;51(6):191748. Google Scholar Rehman A, Naz S, Razzak I. Leveraging Big Data analytics in healthcare enhancement: trends, challenges and opportunities. Multimed Syst. 2022;28(4):133971. Google Scholar Al-Zahrani A, Al-Hebbi M. Big Data major security issues: challenges and defense strategies. Tehnicki Glasnik. 2022;16(2):197204. Google Scholar Song X, Zhang H, Akerkar R, Huang H, Guo S, Zhong L, Ji Y, Opdahl AL, Purohit H, Skupin A, Pottathil A, Culotta A. Big Data and emergency management: concepts, methodologies, and applications. IEEE Trans Big Data. 2022;8(2):397419. Google Scholar Singh N, Singh DP, Pant B. Big Data knowledge discovery as a service: recent trends and challenges. Wirel Pers Commun. 2022;123(2):1789807. Google Scholar Mohammadi E, Karami A. Exploring research trends in Big Data across disciplines: a text mining analysis. J Inf Sci. 2022;48(1):4456. Google Scholar Ambeth Kumar VD, Varadarajan V, Gupta MK, Rodrigues JJPC, Janu N. AI empowered Big Data analytics for industrial applications. J Univers Computer Sci. 2022;28(9):87781. Google Scholar Kumari S, Muthulakshmi P. Transformative effects of Big Data on advanced data analytics: open issues and critical challenges. J Computer Sci. 2022;18(6):46379. Google Scholar Tang S, He B, Yu C, Li Y, Li K. A survey on spark ecosystem: Big Data processing infrastructure, machine learning, and applications. IEEE Trans Knowl Data Eng. 2022;34(1):7191. Google Scholar Reyes-Veras PF, Renukappa S, Suresh S. Challenges faced by the adoption of Big Data in the Dominican Republic construction industry: an empirical study. J Inf Technol Constr. 2021;26:81231. Google Scholar Bentotahewa V, Hewage C, Williams J. Solutions to Big Data privacy and security challenges associated with COVID-19 surveillance systems. Front Big Data. 2021. Google Scholar Escobar CA, McGovern ME, Morales-Menendez R. Quality 4.0: a review of Big Data challenges in manufacturing. J Intell Manuf. 2021;32(8):231934. Google Scholar Mwitondi KS, Said RA. Dealing with randomness and concept drift in large datasets. Data. 2021. Google Scholar Kusal S, Patil S, Kotecha K, Aluvalu R, Varadarajan V. Ai based emotion detection for textual Big Data: techniques and contribution. Big Data Cognit Comput. 2021. Google Scholar Lee E, Jang J. Research trend analysis for sustainable QR code use: focus on Big Data analysis. KSII Trans Internet Inf Syst. 2021;15(9):322142. Google Scholar Rhahla M, Allegue S, Abdellatif T. Guidelines for GDPR compliance in Big Data systems. J Inf Secur Appl. 2021. Google Scholar Amovi M, Govedarica M, Radulovi A, Jankovi I. Big Data in smart city: management challenges. Appl Sci. 2021. Google Scholar Hoozemans J, Peltenburg J, Nonnemacher F, Hadnagy A, Al-Ars Z, Hofstee HP. FPGA acceleration for Big Data analytics: challenges and opportunities. IEEE Circuits Syst Mag. 2021;21(2):3047. Google Scholar Jalali SMJ, Park HW, Vanani IR, Pho K-H. Research trends on Big Data domain using text mining algorithms. Digit Scholarsh Hum. 2021;36(2):36170. Google Scholar Almutairi MM. Role of Big Data in education in KSA. Int J Inf Technol. 2021;13(1):36773. Google Scholar Ardagna D, Barbierato E, Gianniti E, Gribaudo M, Pinto TBM, Silva APC, Almeida JM. Predicting the performance of Big Data applications on the cloud. J Supercomput. 2021;77(2):132153. Google Scholar Mkrttchian V, Gamidullaeva L, Finogeev A, Chernyshenko S, Chernyshenko V, Amirov D, Potapova I. Big Data and internet of things (IoT) technologies influence on higher education: current state and future prospects. Int J Web-Based Learn Teach Technol. 2021;16(5):13757. Google Scholar Mourtzis D. Towards the 5th industrial revolution: a literature review and a framework for process optimization based on Big Data analytics and semantics. J Mach Eng. 2021;21(3):539. Google Scholar Dias MNR, Hassan S, Shahzad A. The impact of Big Data utilization on Malaysian government hospital healthcare performance. Int J eBus eGov Stud. 2021;13(1):5077. Google Scholar Babar M, Alshehri MD, Tariq MU, Ullah F, Khan A, Uddin MI, Almasoud AS. IoT-enabled Big Data analytics architecture for multimedia data communications. Wirel Commun Mob Comput. 2021. Google Scholar Bhat SA, Huang N-F. Big Data and AI revolution in precision agriculture: survey and challenges. IEEE Access. 2021;9:11020922. Google Scholar Zainab A, Ghrayeb A, Syed D, Abu-Rub H, Refaat SS, Bouhali O. Big Data management in smart grids: technologies and challenges. IEEE Access. 2021;9:7304659. Google Scholar Jabir B, Falih N. Big Data analytics opportunities and challenges for the smart enterprise. Int J Tech Phys Probl Eng. 2021;13(2):206. Google Scholar Zineb EF, Najat R, Jaafar A. An intelligent approach for data analysis and decision making in Big Data: a case study on e-commerce industry. Int J Adv Computer Sci Appl. 2021;12(7):72336. Google Scholar Syed D, Zainab A, Ghrayeb A, Refaat SS, Abu-Rub H, Bouhali O. Smart grid Big Data analytics: survey of technologies, techniques, and applications. IEEE Access. 2021;9:5956485. Google Scholar Talebkhah M, Sali A, Marjani M, Gordan M, Hashim SJ, Rokhani FZ. IoT and Big Data applications in smart cities: recent advances, challenges, and critical issues. IEEE Access. 2021;9:5546584. Google Scholar Dubuc T, Stahl F, Roesch EB. Mapping the Big Data landscape: technologies, platforms and paradigms for real-time analytics of data streams. IEEE Access. 2021;9:1535174. Google Scholar Ang KL-M, Seng JKP. Big Data and machine learning with hyperspectral information in agriculture. IEEE Access. 2021;9:36699718. Google Scholar Zeadally S, Siddiqui F, Baig Z, Ibrahim A. Smart healthcare: challenges and potential solutions using internet of things (IoT) and Big Data analytics. PSU Res Rev. 2020;4(2):14968. Google Scholar Thudumu S, Branch P, Jin J, Singh JJ. A comprehensive survey of anomaly detection techniques for high dimensional Big Data. J Big Data. 2020. Google Scholar Trang NH. Limitations of Big Data partitions technology. J Appl Data Sci. 2020;1(1):119. Google Scholar Cano-Lores S, Lapin A, Carretero J, Kropf P. Applying Big Data paradigms to a large scale scientific workflow: lessons learned and future directions. Future Gener Computer Syst. 2020;110:44052. Google Scholar Awaysheh FM, Alazab M, Gupta M, Pena TF, Cabaleiro JC. Next-generation Big Data federation access control: a reference model. Future Gener Computer Syst. 2020;108:72641. Google Scholar Valencia-Parra A, Varela-Vaca AJ, Parody L, Gomez-Lopez MT. Unleashing constraint optimisation problem solving in Big Data environments. J Comput Sci. 2020. MathSciNet Google Scholar Lpez-Martnez F, Nez-Valdez ER, Garca-Daz V, Bursac Z. A case study for a Big Data and machine learning platform to improve medical decision support in population health management. Algorithms. 2020. Google Scholar Iqbal R, Doctor F, More B, Mahmud S, Yousuf U. Big Data analytics and computational intelligence for cyber-physical systems: recent trends and state of the art applications. Future Gener Computer Syst. 2020;105:76678. Google Scholar Carnevale L, Celesti A, Fazio M, Villari M. A Big Data analytics approach for the development of advanced cardiology applications. Information. 2020. Google Scholar Shukla AK, Muhuri PK, Abraham A. A bibliometric analysis and cutting-edge overview on fuzzy techniques in Big Data. Eng Appl Artif Intell. 2020. Google Scholar Karim A, Siddiqa A, Safdar Z, Razzaq M, Gillani SA, Tahir H, Kiran S, Ahmed E, Imran M. Big Data management in participatory sensing: issues, trends and future directions. Future Gener Computer Syst. 2020;107:94255. Google Scholar Humayun M. Role of emerging IoT Big Data and cloud computing for real time application. Int J Adv Computer Sci Appl. 2020;11(4):494506. Google Scholar Rabanal F, Martnez C. Cryptography for Big Data environments: current status, challenges, and opportunities. Comput Math Methods. 2020. MathSciNet Google Scholar Ramesh T, Santhi V. Exploring Big Data analytics in health care. Int J Intell Netw. 2020;1:13540. Google Scholar Gautam A, Chatterjee I. Big Data and cloud computing: a critical review. Int J Oper Res Inf Syst. 2020;11(3):1938. Google Scholar Bajaber F, Sakr S, Batarfi O, Altalhi A, Barnawi A. Benchmarking Big Data systems: a survey. Computer Commun. 2020;149:24151. Google Scholar Maksimov P, Koiranen T. Application of novel Big Data processing techniques in process industries. Int J Computer Appl Technol. 2020;62(3):20015. Google Scholar Dash S, Shakyawar SK, Sharma M, Kaushik S. Big Data in healthcare: management, analysis and future prospects. J Big Data. 2019. Google Scholar Nagalakshmi N, Anand Babu GL, Reddy KS, Ashalatha T. Security challenges associated with Big Data in health care system. Int J Eng Adv Technol. 2019;9(1):405760. Google Scholar Dai H-N, Wong RC-W, Wang H, Zheng Z, Vasilakos AV. Big Data analytics for large-scale wireless networks: challenges and opportunities. ACM Comput Surv. 2019. Google Scholar Barika M, Garg S, Zomaya AY, Wang L, Moorsel AVAN, Ranjan R. Orchestrating Big Data analysis workflows in the cloud: research challenges, survey, and future directions. ACM Comput Surv. 2019. Google Scholar Hariri RH, Fredericks EM, Bowers KM. Uncertainty in Big Data analytics: survey, opportunities, and challenges. J Big Data. 2019. Google Scholar Latif Z, Lei W, Latif S, Pathan ZH, Ullah R, Jianqiu Z. Big Data challenges: prioritizing by decision-making process using analytic network process technique. Multimed Tools Appl. 2019;78(19):2712753. Google Scholar Kumari A, Tanwar S, Tyagi S, Kumar N. Verification and validation techniques for streaming Big Data analytics in internet of things environment. IET Netw. 2019;8(3):15563. Google Scholar Singh SP, Nayyar A, Kumar R, Sharma A. Fog computing: from architecture to edge computing and Big Data processing. J Supercomput. 2019;75(4):2070105. Google Scholar Raufi B, Ismaili F, Ajdari J, Zenuni X. Web personalization issues in Big Data and semantic web: challenges and opportunities. Turk J Electr Eng Computer Sci. 2019;27(4):237994. Google Scholar Rahman NA, Nor NM. Healthcare using social media: Big Data analytics perspective. J Adv Res Dyn Control Syst. 2019;11(8 Special Issue):116979. Google Scholar Mishra S, Pattnaik S, Mishra BB. Application of Big Data analysis in supply chain management: future challenges. J Adv Res Dyn Control Syst. 2019;11(8 Special Issue):25418. Google Scholar Ivanovic M, Klasnja-Milicevic A. Big Data and collective intelligence. Int J Embed Syst. 2019;11(5):57383. Google Scholar Qolomany B, Al-Fuqaha A, Gupta A, Benhaddou D, Alwajidi S, Qadir J, Fong AC. Leveraging machine learning and Big Data for smart buildings: a comprehensive survey. IEEE Access. 2019;7:9031656. Google Scholar Shah SA, Seker DZ, Hameed S, Draheim D. The rising role of Big Data analytics and IoT in disaster management: recent advances, taxonomy and prospects. IEEE Access. 2019;7:54595614. Google Scholar Lin W, Zhang Z, Peng S. Academic research trend analysis based on Big Data technology. Int J Comput Sci Eng. 2019;20(1):319. Google Scholar Hong L, Luo M, Wang R, Lu P, Lu W, Lu L. Big Data in health care: applications and challenges. Data Inf Manag. 2018;2(3):17597. Google Scholar Pal D, Triyason T, Padungweang P. Big Data in smart-cities: current research and challenges. Indones J Electr Eng Inf. 2018;6(4):35160. Google Scholar Li N, Mahalik NP. A Big Data and cloud computing specification, standards and architecture: agricultural and food informatics. Int J Inf Commun Technol. 2019;14(2):15974. Google Scholar Chiroma H, Abdullahi UA, Abdulhamid SM, Abdulsalam Alarood A, Gabralla LA, Rana N, Shuib L, Targio Hashem IA, Gbenga DE, Abubakar AI, Zeki AM, Herawan T. Progress on artificial neural networks for Big Data analytics: a survey. IEEE Access. 2019;7:7053551. Google Scholar Waheed H, Hassan S-U, Aljohani NR, Wasif M. A bibliometric perspective of learning analytics research landscape. Behav Inf Technol. 2018;37(1011):94157. Google Scholar Ray J, Johnny O, Trovati M, Sotiriadis S, Bessis N. The rise of Big Data science: a survey of techniques, methods and approaches in the field of natural language processing and network theory. Big Data Cognit Comput. 2018;2(3):118. Google Scholar Mantelero A. AI and Big Data: a blueprint for a human rights, social and ethical impact assessment. Computer Law Secur Rev. 2018;34(4):75472. Google Scholar Sultan K, Ali H, Zhang Z. Big Data perspective and challenges in next generation networks. Future Internet. 2018. Google Scholar Li Q, Chen Y, Wang J, Chen Y, Chen H. Web media and stock markets: a survey and future directions from a Big Data perspective. IEEE Trans Knowl Data Eng. 2018;30(2):38199. Google Scholar Jabbar S, Malik KR, Ahmad M, Aldabbas O, Asif M, Khalid S, Han K, Ahmed SH. A methodology of real-time data fusion for localized Big Data analytics. IEEE Access. 2018;6:2451020. Google Scholar Darwish TSJ, Abu Bakar K. Fog based intelligent transportation Big Data analytics in the internet of vehicles environment: motivations, architecture, challenges, and critical issues. IEEE Access. 2018;6:15679701. Google Scholar Zheng S, Chen S, Yang L, Zhu J, Luo Z, Hu J, Yang X. Big Data processing architecture for radio signals empowered by deep learning: concept, experiment, applications and challenges. IEEE Access. 2018;6:5590722. Google Scholar Stefanowski J, Krawiec K, Wrembel R. Exploring complex and Big Data. Int J Appl Math Computer Sci. 2017;27(4):66979. MathSciNet Google Scholar Harerimana G, Jang B, Kim JW, Park HK. Health Big Data analytics: a technology survey. IEEE Access. 2018;6:6566178. Google Scholar Ravi S, Jeyaprakash T. Combined ideas on the necessity of Big Data on internet of things and researchers point of view and its challenges, future directions. J Adv Res Dyn Control Syst. 2018;10(9 Special Issue):21404. Google Scholar Neggers J, Allix O, Hild F, Roux S. Big Data in experimental mechanics and model order reduction: todays challenges and tomorrows opportunities. Arch Comput Methods Eng. 2018;25(1):14364. MathSciNet Google Scholar Khan S, Liu X, Shakil KA, Alam M. A survey on scholarly data: from Big Data perspective. Inf Process Manag. 2017;53(4):92344. Google Scholar Costa C, Santos MY. Big Data: state-of-the-art concepts, techniques, technologies, modeling approaches and research challenges. IAENG Int J Computer Sci. 2017;44(3):285301. Google Scholar Lv Z, Song H, Basanta-Val P, Steed A, Jo M. Next-generation Big Data analytics: state of the art, challenges, and future research topics. IEEE Trans Ind Inf. 2017;13(4):18919. Google Scholar Memon MA, Soomro S, Jumani AK, Kartio MA. Big Data analytics and its applications. Ann Emerg Technol Comput. 2017;1(1):4554. Google Scholar Mantelero A. Regulating Big Data The guidelines of the Council of Europe in the context of the European data protection framework. Computer Law Secur Rev. 2017;33(5):584602. Google Scholar Zhou L, Pan S, Wang J, Vasilakos AV. Machine learning on Big Data: opportunities and challenges. Neurocomputing. 2017;237:35061. Google Scholar Yan J, Meng Y, Lu L, Li L. Industrial Big Data in an industry 4.0 environment: challenges, schemes, and applications for predictive maintenance. IEEE Access. 2017;5:2348491. Google Scholar Gonalves ME. The EU data protection reform and the challenges of Big Data: remaining uncertainties and ways forward. Inf Commun Technol Law. 2017;26(2):90115. MathSciNet Google Scholar Peng S, Wang G, Xie D. Social influence analysis in social networking Big Data: opportunities and challenges. IEEE Netw. 2017;31(1):117. Google Scholar LHeureux A, Grolinger K, Elyamany HF, Capretz MAM. Machine learning with Big Data: challenges and approaches. IEEE Access. 2017;5:777697. Google Scholar Manikyam NRH, Mohan Kumar S. Methods and techniques to deal with Big Data analytics and challenges in cloud computing environment. Int J Civil Eng Technol. 2017;8(4):66978. Google Scholar El-Seoud SA, El-Sofany HF, Abdelfattah M, Mohamed R. Big Data and cloud computing: trends and challenges. Int J Interact Mob Technol. 2017;11(2):3452. Google Scholar Ziga H, Diehl T. Citizenship, social media, and Big Data: current and future research in the social sciences. Soc Sci Computer Rev. 2017;35(1):39. Google Scholar Wang H, Xu Z, Pedrycz W. An overview on the roles of fuzzy set techniques in Big Data processing: trends, challenges and opportunities. Knowl-Based Syst. 2017;118:1530. Google Scholar Choi T-M, Chan HK, Yue X. Recent development in Big Data analytics for business operations and risk management. IEEE Trans Cybern. 2017;47(1):8192. Google Scholar Zhong RY, Newman ST, Huang GQ, Lan S. Big Data for supply chain management in the service and manufacturing sectors: challenges, opportunities, and future perspectives. Comput Ind Eng. 2016;101:57291. Google Scholar Bajaber F, Elshawi R, Batarfi O, Altalhi A, Barnawi A, Sakr S. Big Data 2.0 processing systems: taxonomy and open challenges. J Grid Comput. 2016;14(3):379405. Google Scholar De Gennaro M, Paffumi E, Martini G. Big Data for supporting low-carbon road transport policies in europe: applications, challenges and opportunities. Big Data Res. 2016;6:1125. Google Scholar Wang H, Xu Z, Fujita H, Liu S. Towards felicitous decision making: an overview on challenges and trends of Big Data. Inf Sci. 2016;367368:74765. Google Scholar Rodrguez-Mazahua L, Rodrguez-Enrquez C-A, Snchez-Cervantes JL, Cervantes J, Garca-Alcaraz JL, Alor-Hernndez G. A general perspective of Big Data: applications, tools, challenges and trends. J Supercomput. 2016;72(8):3073113. Google Scholar Bello-Orgaz G, Jung JJ, Camacho D. Social Big Data: recent achievements and new challenges. Inf Fus. 2016;28:4559. Google Scholar Zheng X, Chen W, Wang P, Shen D, Chen S, Wang X, Zhang Q, Yang L. Big Data for social transportation. IEEE Trans Intell Transp Syst. 2016;17(3):62030. Google Scholar Sahay S. Big Data and public health: challenges and opportunities for low and middle income countries. Commun Assoc Inf Syst. 2016;39(1):41938. Google Scholar Sharma N, Namratha B. Towards addressing the challenges of data intensive computing in Big Data analytics. Int J Control Theor Appl. 2016;9(23):5762. Google Scholar Yu S. Big privacy: challenges and opportunities of privacy study in the age of Big Data. IEEE Access. 2016;4:275163. Google Scholar Chen C-M. Use cases and challenges in telecom Big Data analytics. APSIPA Trans Signal Inf Process. 2016. Google Scholar Anagnostopoulos I, Zeadally S, Exposito E. Handling Big Data: research challenges and future directions. J Supercomput. 2016;72(4):1494516. Google Scholar Jothi B, Pushpalatha M, Krishnaveni S. Significance and challenges in Big Data: a survey. Int J Control Theor Appl. 2016;9(34):23543. Google Scholar Huang Y, Schuehle J, Porter AL, Youtie J. A systematic method to create search strategies for emerging technologies based on the Web of Science: illustrated for Big Data. Scientometrics. 2015;105(3):200522. Google Scholar Xu Z, Shi Y. Exploring Big Data analysis: fundamental scientific problems. Ann Data Sci. 2015;2(4):36372. Google Scholar Olshannikova E, Ometov A, Koucheryavy Y, Olsson T. Visualizing Big Data with augmented and virtual reality: challenges and research agenda. J Big Data. 2015. Google Scholar Assuno MD, Calheiros RN, Bianchi S, Netto MAS, Buyya R. Big Data computing and clouds: trends and future directions. J Parallel Distrib Comput. 2015;7980:315. Google Scholar Najafabadi MM, Villanustre F, Khoshgoftaar TM, Seliya N, Wald R, Muharemagic E. Deep learning applications and challenges in Big Data analytics. J Big Data. 2015. Google Scholar Nativi S, Mazzetti P, Santoro M, Papeschi F, Craglia M, Ochiai O. Big Data challenges in building the global earth observation system of systems. Environ Model Softw. 2015;68:126. Google Scholar Tian X, Han R, Wang L, Lu G, Zhan J. Latency critical Big Data computing in finance. J Finance Data Sci. 2015;1(1):3341. Google Scholar Perera C, Ranjan R, Wang L, Khan SU, Zomaya AY. Big Data privacy in the internet of things era. IT Prof. 2015;17(3):329. Google Scholar Jin X, Wah BW, Cheng X, Wang Y. Significance and challenges of Big Data research. Big Data Res. 2015;2(2):5964. Google Scholar Mao R, Xu H, Wu W, Li J, Li Y, Lu M. Overcoming the challenge of variety: Big Data abstraction, the next evolution of data management for AAL communication systems. IEEE Commun Mag. 2015;53(1):427. Google Scholar Philip Chen CL, Zhang C-Y. Data-intensive applications, challenges, techniques and technologies: a survey on Big Data. Inf Sci. 2014;275:31447. Google Scholar Ma Y, Wu H, Wang L, Huang B, Ranjan R, Zomaya A, Jie W. Remote sensing Big Data computing: challenges and opportunities. Future Gener Computer Syst. 2015;51:4760. Google Scholar Jeong SR, Ghani I. Semantic computing for Big Data: approaches, tools, and emerging directions (20112014). KSII Trans Internet Inf Syst. 2014;8(6):202242. Google Scholar Sun D, Liu C, Ren D. Prospects, challenges and latest developments in designing a scalable Big Data stream computing system. Int J Wirel Mob Comput. 2015;9(2):15560. Google Scholar Dobre C, Xhafa F. Intelligent services for Big Data science. Future Gener Computer Syst. 2014;37:26781. Google Scholar Qin HF, Li ZH. Research on the method of Big Data analysis. Inf Technol J. 2013;12(10):197480. Google Scholar Ji C, Li Y, Qiu W, Jin Y, Xu Y, Awada U, Li K, Qu W. Big Data processing: big challenges. J Interconnect Netw. 2012. Google Scholar Kambatla K, Kollias G, Kumar V, Grama A. Trends in Big Data analytics. J Parallel Distrib Comput. 2014;74(7):256173. Google Scholar Dong XL, Srivastava D. Big Data integration. Proc VLDB Endow. 2013;6(11):11889. Google Scholar Yin H, Jiang Y, Lin C, Luo Y, Liu Y. Big Data: transforming the design philosophy of future internet. IEEE Netw. 2014;28(4):149. Google Scholar Nti IK, Quarcoo JA, Aning J, Fosu GK. A mini-review of machine learning in Big Data analytics: applications, challenges, and prospects. Big Data Min Anal. 2022;5(2):8197. Google Scholar Yu Y, Li M, Liu L, Li Y, Wang J. Clinical Big Data and deep learning: applications, challenges, and future outlooks. Big Data Min Analy. 2019;2(4):288305. Google Scholar Amalina F, Targio Hashem IA, Azizul ZH, Fong AT, Firdaus A, Imran M, Anuar NB. Blending Big Data analytics: review on challenges and a recent study. IEEE Access. 2020;8:362945. Google Scholar Chen X-W, Lin X. Big Data deep learning: challenges and perspectives. IEEE Access. 2014;2:51425. Google Scholar Alam A, Ullah I, Lee Y-K. Video Big Data analytics in the cloud: a reference architecture, survey, opportunities, and open research issues. IEEE Access. 2020;8:152377422. Google Scholar Pham Q-V, Nguyen DC, Huynh-The T, Hwang W-J, Pathirana PN. Artificial intelligence (AI) and Big Data for coronavirus (COVID-19) pandemic: a survey on the state-of-the-arts. IEEE Access. 2020;8:13082039. Google Scholar Aydin AA. A comparative perspective on technologies of Big Data value chain. IEEE Access. 2023;11:11213346. Google Scholar Kalantari A, Kamsin A, Kamaruddin HS, Ale Ebrahim N, Gani A, Ebrahimi A, Shamshirband S. A bibliometric approach to tracking Big Data research trends. J Big Data. 2017. Google Scholar Tsai C-W, Lai C-F, Chao H-C, Vasilakos AV. Big Data analytics: a survey. J Big Data. 2015. Google Scholar Raghupathi W, Raghupathi V. Big Data analytics in healthcare: promise and potential. Health Inf Sci Syst. 2014;2(1):3. Google Scholar Ram Mohan Rao P, Murali Krishna S, Siva Kumar AP. Privacy preservation techniques in Big Data analytics: a survey. J Big Data. 2018. Google Scholar Ali A, Qadir J, Rasool RU, Sathiaseelan A, Zwitter A, Crowcroft J. Big Data for development: applications and techniques. Big Data Anal. 2016. Google Scholar Hasan MM, Popp J, Olh J. Current landscape and influence of Big Data on finance. J Big Data. 2020. Google Scholar Seyedan M, Mafakheri F. Predictive Big Data analytics for supply chain demand forecasting: methods, applications, and research opportunities. J Big Data. 2020. Google Scholar Chang V, Muoz VM, Ramachandran M. Emerging applications of internet of things, Big Data, security, and complexity: special issue on collaboration opportunity for IoTBDS and COMPLEXIS. Computing. 2020;102(6):13014. MathSciNet Google Scholar Biswas S, Khare N, Agrawal P, Jain P. Machine learning concepts for correlated Big Data privacy. J Big Data. 2021. Google Scholar Belcastro L, Cantini R, Marozzo F, Orsino A, Talia D, Trunfio P. Programming Big Data analysis: principles and solutions. J Big Data. 2022. Google Scholar Abdalla HB. A brief survey on Big Data: technologies, terminologies and data-intensive applications. J Big Data. 2022. Google Scholar Page 27Publication mediumName of the publishing conference, journal, book, or workshop (including volume, number, page...) Share copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution You must give appropriate credit , provide a link to the license, and indicate if changes were made . 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If you are unable to complete the above request please contact us using the below link, providing a screenshot of your experience. As the amount of data being generated continues to grow over the last two decades (Petroc, 2023), the need to process and analyze it became increasingly urgent. This led to the development of new tools and techniques for handling Big Data (Khalid and Yousaf, 2021), such as distributed computing frameworks like Hadoop and Apache Spark, as well as machine learning algorithms like neural networks and decision trees. As researchers and practitioners in various fields began to integrate Big Data into their work, a body of literature emerged discussing its implementation, characteristics and features, as well as its potential benefits and limitations. The concept of Big Data has become increasingly important for scientific research. Its characteristics have been extensively discussed in the literature, and numerous researchers have summarized the definitions of Big Data and its closely related features (Khan et al., 2014; Chebbi et al., 2015). Epistemological discussions are common (Kitchin, 2014; Ekbia et al., 2015; Succi and Coveney, 2019) and the recent emergence of new quantitative-based approaches, utilizing large text corpora,offers new opportunities to understand Big Data from different perspectives. Hansmann and Niemeyer (2014), for example, apply a text mining approach to extract and characterize the elements of the Big Data concept by analyzing 248 publications relevant to Big Data. They focus on the concept of the term Big Data and summarize four dimensions to describe it: the dimensions of data, IT infrastructure, applied methods, and an applications perspective. Van Altena et al. (2016), analyze a large number of articles from the biomedical literature to give a better understanding of the term Big Data by extracting relevant topics through topic modeling. Akoka et al. (2017) review studies using a systematic mapping approach based on more than a decade of academic papers relevant to Big Data. Their bibliometric review of Big Data publications shows that the research community has made a significant contribution in the field of Big Data, which is further evidenced by the continued increase in the number of scientific publications dealing with the concept. Despite the lack of consensus on an official definition of Big Data, research and studies have continued to progress based on this no consensus stance over the years. Many authors endeavor to provide comprehensive definitions of Big Data based on their research, aiming to better capture its essence. However, a universally accepted definition is yet to emerge. Instead, a commonly accepted description portrays Big Data through various V characteristics (volume, variety, velocity, etc.). Nonetheless, this widely accepted description does not ensure a profound common ground for discussing Big Data in different contexts. As a result, Big Data is still being perceived as a broad and vague concept, making it difficult to grasp in interdisciplinary contexts. Over the past few decades, there has been little systematic research on the position and practical implications of the term Big Data in research environments. When different authors spend significant portions of their studies discussing similar definitions and characteristics of Big Data, they are actually referring to different concepts (technology, platforms, or datasets), which is often not explicitly stated. Exploring this ambiguity is crucial, as it forms the basis for research and discussion. Many reviews aim to enrich a comprehensive understanding of Big Data, rather than retrospectively observing its actual usage in different contexts. we believe this inspection on the current useage sitation of Big Data will help to clarify the ambiguities and facilitates clearer communication among researchers by providing a understanding framework of what Big Data entails in different contexts. To address this gap, this paper presents a Systematic Literature (SLR) on secondary studies (Kitchenham et al., 2009, 2010) to provide a comprehensive overview of how Big Data is used and understood across different scientific domains. Our objective was to monitor the application of the Big Data concept in science, identify which technologies are prevalent in which fields, and investigate the discrepancies between the theoretical understanding and practical usage of the term. The rest of this paper is structured as follows: we first present our systematic literature review methodology. The results are then divided into four sections: an overview of the bibliographic information of the extracted articles, a summary of the most prominent technologies used, a discussion on the technologies that are considered to be Big Data, and a presentation of the perceived benefits and drawbacks of Big Data. Finally, before conclusion we discuss our findings in terms of the understanding of Big Data and its value, and suggest avenues for further research. 2 Methodology This study employs a SLR methodology to investigate the use of Big Data in scientific research. Our review, which follows the guidelines for SLR defined by Kitchenham et al. (2009) and Kitchenham et al. (2010), enables a structured and replicable procedure that increases the reliability of research findings. An SLR study is referred to as a tertiary study when it applies the SLR methodology on secondary studies, i.e. it surveys literature reviews instead of primary studies. We selected a tertiary approach for this study due to the extensive range of Big Data technologies and applications in research. Collecting primary data from a large number of papers across domains can be a laborious task. By analyzing secondary data sources instead, our approach offers a comprehensive and holistic overview of the landscape of Big Data in the scientific community. Adopting this approach allows us to better control the bibliographic selection and obtain a comprehensive overview of the field, thereby ensuring high-quality data analysis. The research questions addressed by this paper are: 1. Which technologies are considered as Big Data in different fields? 2. What Big Data implies in a scientific study context? 3. What is the perceived impact of the adoption of Big Data in each research domain? For the purpose of answering RQ1, we have referenced the Big Data technology taxonomy developed by Patgiri (2019). We anticipated that the reviewed papers would mention a broad spectrum of technologies, techniques, applications, and heterogeneities, which could pose a challenge in synthesizing the results. Therefore, we relied on Patgiri's taxonomy to guide our full-text review and data extraction process to identify the Big Data technologies utilized in the various scientific domains. This taxonomy offers a comprehensive overview of the various technical approaches to Big Data. By utilizing this taxonomy, we aim to initiate a discourse on what Big Data truly represents in each research domain, and how it has been understood by the respective scientific community. This discussion will enable us to further deliberate on RQ2, which examines the perception of Big Data in specific research domains. To structure our investigation for both research questions (RQ1 and RQ2) we utilize the subject taxonomy of Web of Science (WoS) to classify scientific fields, and apply no limitations to the scope of included scientific fields. As a result, both questions encompass a wide range of Big Data usage. RQ2 is rooted in the fact that the scope of Big Data technologies has yet to be strictly defined and reach a consensus. Through this question we aim to investigate which technologies or objects are perceived as constituting Big Data in specific research domains. By these means we attempt to shed light on how Big Data as a concept is implicitly understood in each domain by linking it to specific technologies. In addition to offering an overview of the technological landscape, RQ3 aims to delve deeper into the discussion of the impact of Big Data in each domain by examining the benefits and drawbacks of its adoption, as reported by the examined secondary studies. By doing so, we seek to gain a comprehensive understanding of the role of Big Data in scientific domains. 2.1 Study design This study uses the framework of Population Intervention Comparison Outcome and Context (PICOC) (Petticrew and Roberts, 2008) to guide the research questions and the systematic literature review process, with the aim of exploring the use of Big Data technologies across various scientific domains and understanding the perceived meaning and value of Big Data in the scientific community. The use of the PICOC standard allowed for a structured approach to conducting the study and ensured that all relevant aspects were considered in the data collection, refinement, extraction, and analysis processes (Mengist et al., 2020). The Population of interest consists of studies that explore the state of the art of Big Data in different research domains. Intervention refers to systematic secondary studies, such as systematic literature reviews, mapping studies, and surveys. The Comparison in this study is between the perception of Big Data as a concept and the adoption of related technologies. The desired Outcome of this study is a conceptual mapping of how the term Big Data applied in research across domains. In terms of Context, the study focuses on research domains that use the term Big Data to explore the potential of its technology and tool in advancing research without any restriction on the type of domains. Figure 1 summarizes the process followed by this SLR. Each of the steps in this process is discussed in more detail in the following. Figure 1. Process of the research methodology. 2.2 Data collection Our aim for data collection was to explore as wide a range of studies in as many different domains as possible. As a result, we decided to retrieve candidate studies through queries on the online databases of Elsevier Scopus, Web of Science, and PubMed. Scopus is a database containing 77 million records from almost 5,000 international publishers (Scopus Content Coverage Guide, 2023), Web of Science is one of the world's leading databases which covers all domains of science (Cumbley and Church, 2013), and PubMed is a comprehensive medicine and biomedical database (Falagas et al., 2007). Our search strategy for all three databases after a few stages of pilot searches, was to look for publications with the exact phrase big data and either technology, platform, application, or adoption in the title, along with review, survey, or mapping study in either title or keywords. The specific search query for each database is shown in Figure 2. As the databases use slightly different tags to identify search fields, the search query expression varied but had the same conceptual content. For example, Scopus used the tag TITLE for the title field, whereas WoS used TI and PubMed used square brackets behind the term. For the keywords field, Scopus automatically combined author keywords, index terms, trade names, and chemical names in the tag KEY. WoS provided two relevant fields for keywords, AK representing author keywords and KP representing keywords derived from the titles of article references based on a special algorithm. PubMed placed author keywords and other terms indicating major concepts in the field Other Term. We obtained 490 results from Scopus, 116 from WoS, and 18 from PubMed, resulting in a total of 624 articles before removing duplicates. Figure 2. Search queries and screening process. 2.3 Data selection We established inclusion and exclusion criteria listed in Table 1 to ensure the relevance of the retrieved studies to be included in our analysis. In terms of inclusion criteria, we only considered articles that were published in English between 2017 and 2022 (in order to ensure that the studies reflect the current state of the art in each field), and that were secondary studies. Specifically, we focused on comprehensive reviews or systematic literature reviews that provided an overview of Big Data adoption in a particular research field, rather than articles that focused solely on the application of Big Data technologies to address individual research questions or on the improvement of Big Data technologies themselves. Moreover, we only included articles that were published in their entirety in journals, rather than conference proceedings or abstracts. In contrast, we excluded early access and not final stage articles to avoid potential bias or incomplete information. Publications in languages other than English were also excluded due to language barriers. Additionally, we excluded primary studies, as our aim was to focus on the adoption, application, and implications of Big Data technologies in specific scientific domains, rather than specific research questions. Table 1. Inclusion and exclusion for data selection. By implementing these criteria, we were able to ensure that the articles selected for our analysis were recent, relevant, and provided a comprehensive view of the Big Data landscape. Moreover, by focusing on secondary studies, we were able to avoid redundant coverage of primary research studies and instead obtain a broader perspective on the field. Ultimately, this approach allowed us to generate a more comprehensive and robust understanding of the different Big Data technologies, applications, and techniques being used in various scientific domains. This step resulted in a corpus of 76 records after removing the duplicates. 2.4 Quality assessment To ensure that the papers selected for full-text review meet the requirements of our study, we then conducted a Quality Assessment (QA) based on five standards: 1. Is Big Data adoption discussed at sufficient depth? 2. Is a specific methodology being used in the secondary study? 3. Are the bibliographic sources used included in the study design? 4. Is the number of included primary studies clear in the study? 5. Are the results well-organized? Firstly, we examined whether the papers provide an overview of Big Data adoption in a particular research field, excluding other aspects such as the application of Big Data technologies that focus on individual research questions or the improvement of Big Data Technologies themselves. Secondly, we assessed whether the selected papers clearly define their research methodology or base it on a specific paradigm. Thirdly, we evaluated whether the papers clearly specify their bibliographic sources for the secondary studies. Fourthly, we documented whether the number of primary papers that are contained in the secondary studies is also clearly stated. Finally, we evaluated whether the results of the papers are well-organized around research questions. We scored the papers based on these criteria in a binary fashion (fulfilled/not fulfilled), and to be considered for inclusion in our study, we set a threshold of at least three out of five standards that must be fulfilled. While QA is not meant in principle to be used for an additional filtering, we decided that given the observed wide disparities in the quality of the collected secondary studies, setting this threshold is justified. The resulting selected articles primarily use systematic literature reviews, although some pure review articles that are relevant to our study have also been included. This step leads to 33 studies left for further processing. 2.5 Snowballing In addition to the papers collected, we employed the forward snowball sampling method (Wohlin, 2014) to supplement our database. For each article under full-text review passing the QA step, we reviewed all the titles of its references and the articles citing it. We added records that met our inclusion and exclusion criteria and were relevant to our topics. As we are only interested in recent studies on the topic, we did not perform backward snowballing. Ultimately, we selected only one additional study for inclusion, resulting in 34 studies in total for data extraction. All authors actively contributed to each step of the research process, engaging in thorough discussions and collaborations. In every stage outlined above, one researcher took the lead and collaborated with the other two authors to ensure comprehensive coverage and rigorous analysis. 2.6 Data extraction The data extraction form shown in Table 2 was designed to answer the research questions in this study. The extraction fields can be divided into three categories. The first part concerns demographics-related data to be extracted from each study in order to check for possible bias toward specific fields or publication venues. The second part is used to answer RQ1 and RQ2. For the Research Field aspect, we applied the subject classification from WoS to ensure consistency and heterogeneity of the level of the discipline described. This also enabled us to make cross-sectional comparisons and statistical summaries. Apart from the WoS categories, we added another field to specify the sub-level of the Application Domain in which the secondary study takes place. This helps us to better connect the technologies collected with their intended use cases. In terms of the technologies and applications that we collected, due to the wide range of information described from different perspectives and heterogeneity issues, we added one more column to clarify and support the documentation, namely Perspective. This column records the perspective from which the Big Data technologies are described. For example, some papers only summarized the use cases of machine learning methods as applications of Big Data. In this way, besides the concrete names of methods and models documented in the Technologies column (including also specific Big Data applications or platforms), the perspective will be marked as machine learning. This helps us to further analyze and categorize the discussed technologies. Reported shortcomings and benefits of the perceived impact of Big Data from the authors are extracted in the third part. This helps us to answer RQ3. Table 2. Fields of data extraction form. 2.7 Threats to validity The present study faces several potential threats to its validity. Firstly, the inclusion and exclusion criteria employed could introduce bias into the sample. If the criteria are too narrow, relevant articles may be omitted, while if they are too broad, irrelevant articles may be included, resulting in a less representative sample. To mitigate this threat, we thoroughly reviewed and refined our criteria through piloting to ensure their optimal balance between inclusivity and exclusivity. Secondly, the quality assessment of the chosen articles could be influenced by researcher bias, as different researchers might interpret the quality criteria differently. To address this issue, we utilized a standardized quality assessment tool during the evaluation process to ensure consistent interpretation of the criteria. Moreover, limiting the search to a specific publication date range could result in publication date bias, leading to an outdated or incomplete synthesis of the literature. To avoid this, we focused on secondary studies and restricted the publication date to the latest 5 years, which enabled us to include publications from a wide range of dates. To enhance the efficiency of the quality assessment, we established the quality assessment process before conducting the full-text review. This approach ensured that all selected articles were relevant to the topic and that their quality was assessed rigorously. Other possible threats to the validity of this study include publication bias and selective reporting of results. To mitigate these threats, we conducted a comprehensive search of multiple databases and employed the snowballing method, while carefully screening all articles for possible selective reporting. 3 Results This section presents the results of our study and is divided into several subsections. Firstly, we provide an overview of the background information of the articles in our corpus, including the distribution of disciplines, publishers, and popular databases cited for their secondary studies. The presentation of the results is using the classification of the secondary studies into research domains extracted for RQ1 and RQ2. In Section 3.2, we discuss our findings on the Big Data technologies extracted from our SLR in order to answer RQ1. In Section 3.3, we discuss the concepts that are perceived as Big Data as reported by the secondary studies in our corpus. Finally, we summarize the impact of the adoption of Big Data technologies in the various domains in Section 3.4. 3.1 Overview of bibliographic results The following section presents an overview of the created corpus used in the analysis, providing statistics on domain distribution, publishers, and bibliographic sources. Domain distribution helps to identify the research background of the analyzed articles, while publishers' distribution sheds light on those who are active in the field of Big Data. Additionally, the bibliographic sources used by secondary studies provide insights into the popularity of different databases and sources among researchers in the field. This information is crucial since it can affect the quality of the data and the generalizability of the findings and ensure transparency for analysis. Figure 3 shows the distribution of WoS-defined disciplines of the articles extracted for the study. Health care emerged as the discipline that includes the most Big Data articles, with COVID-19 as a distinct area of interest that we promoted to its own domain. Transportation and Business & Economics were the next most popular areas of study. While several cross-domain studies did not specify the application domain of Big Data, they did focus on a specific aspect of Big Data applications such as storage and cybersecurity. Disaster response studies identified in the Public, Environmental & Occupational Health category are also notable. Other disciplines appear only once; these include Material Science that focused on Aerospace, Telecommunications (e.g. mobile Big Data), Construction & Building Technology, and Agriculture. It should be noted that this distribution does not necessarily represent the entire scientific community, and no conclusions regarding the interest of studying or using Big Data can be drawn from this. Figure 3. Publisher distribution of included articles. Our analysis of the articles in our corpus, as summarized in Figure 4, showed that MDPI and Elsevier published the most studies related to Big Data (with nine each), followed by Springer and IEEE (with three each). Eight more publishers have one publication each in our corpus and are omitted from the figure. Figure 4. Publishers' distribution of the included secondary studies. In terms of databases chosen for secondary studies, Figure 5 shows that WoS and Scopus were the most popular sources, being in alignment with our choice of databases for our study, followed by IEEE, ScienceDirect, Google Scholar, Wiley Online Library, Sage, PubMed, and Association for Computing Machinery's (ACM) Digital Library. Figure 5. Popularity of databases used by the secondary studies. Overall, a wide diversity of publishing venues and data sources can be attested for our corpus, providing evidence toward a lack of selection bias for our review. 3.2 Big Data technologies To address RQ1, we refer to Patgiri (2019), who presents a taxonomy of Big Data consisting of seven key categories: Semantics, Compute Infrastructure, Storage System, Big Data Management, Big Data Mining, Big Machine Learning, and Security & Privacy. This taxonomy covers various aspects of Big Data technologies, including implementation tools, system architectures, and operational processes. We categorize and describe our findings based on the six perspectives (excluding Semantics) proposed by Patgiri. Since the Semantics perspective primarily concerns the conceptual understanding of Big Data, we exclude it from our summary of technologies. The data extraction results from our study reveal the use of various Big Data technologies already discussed in Patgiri (2019), including Xplenty, Apache Cassandra, MongoDB, Hadoop, Datawrapper, Rapidminer, Tableau, KNIME, Storm, Cloudera Distributed Hadoop(CDH), Kafka, Spark, Mapreduce, Hive, Pig, Flume, Sqoop, Apache Tez, Flink, and Storm. These technologies are used to extract, process, analyze, and visualize large volumes of data across a range of scientific domains. From the Compute Infrastructure perspective, the most commonly used technology is Hadoop, which is used for distributed computing and data processing. Various disciplines have been found utilizing Hadoop, including health care [S12, S63, S87, S133], environmental science [S77], and transportation [S194]. Other technologies, such as Apache Cassandra and MongoDB, are used for distributed data storage and retrieval. These technologies enable data processing at scale and facilitate parallel processing, enabling users to analyze large volumes of data quickly and efficiently. In terms of storage systems, Apache Cassandra, Hadoop Distributed File System (HDFS), HBase, and MongoDB are popular choices for distributed data storage. These technologies are designed to handle large volumes of data and provide high scalability and fault tolerance. The reported application domains for these technologies include Internet of Things (IoT), healthcare, decision making and electric power data [S94]. [S133] notes that NoSQL database systems such as MongoDB, Cassandra, and HDFS can be used to handle exponential data growth to replace the traditional database management systems. Additionally, technologies such as Flume and Sqoop enable the efficient transfer of data between different storage systems [S74]. Regarding the Big Data Management perspective, frameworks such as Hadoop, MapReduce, Hive, and Pig are used for managing and processing large volumes of data. These technologies enable users to process data in a distributed environment, thereby increasing efficiency and scalability [S74, S133, S194]. Other technologies, such as Apache Tez and Flink, provide high-performance data processing and streaming capabilities [S74]. From the Big Data Mining & Machine Learning aspect, a range of machine learning models are used to analyze large volumes of data, including Artificial Neural Network (ANN), fuzzy logic, Decision Tree (DT), regression, Support vector machine (SVM), Self-Organizing Map (SOM),

Fuzzy C-Means (FCM), K-means, Genetic algorithm (GA), and Convolution Neural Networks (CNN), DT, Random Forest, Rotation Forest, ANN, Bayesian, Boosted Regression Tree, Classification And Regression Trees (CART), Conditional Inference Tree, Maxent, K-means, Non-negative Matrix Fact, and others [S19, S27, S65, S96, S178, S203, S207]. These techniques enable users to extract insights from large volumes of data, identify patterns and trends, and make predictions based on data analysis. Finally, as for security and privacy, Intrusion Detection Systems (IDS) are used to detect anomalous behaviors in complex environments. Machine learning models such as unsupervised online deep neural networks and deep learning techniques are used to identify and analyze Controller Area Network (CAN-Bus) attacks. Log parsers such as Zookeeper, Proxifier, BGL, HPC and HDFS are used to secure data and ensure privacy in distributed environments [S88]. These technologies provide access control, authentication, and encryption capabilities to protect data against unauthorized access and misuse. Although many Big Data technologies and their applications are presented in this section, a significant portion of our research found that there are additional technologies and applications that are discussed outside of Patgiti's taxonomy, yet are still labeled as Big Data. In order to distinguish between these two cases and further deepen the understanding of Big Data and related technologies in the scientific field, we discuss the latter case in the following research question. 3.3 Perceptions of Big Data scope In this section, we aim to provide an overview of the landscape on how Big Data is actually used based on our analysis of the literature to answer RQ2. Initially, we attempted to use the WoS categories to structure the discussion around domains; however, due to the heterogeneity issue at different angles, the difference in technology use was found to be significant even within one subject. As a result, we summarize the technologies according to the Perspective field recorded in the data extraction form. Table 3 summarizes our findings. Table 3. Perceptions of Big Data scope. 3.3.1 Big Data as abstract concepts or collections for application domains In this category, the studies do not exemplify the Big Data technologies in concrete circumstances, but rather as concepts or collections for application domains. For example, [S67] discusses using text mining methods to explore the application of Big Data disciplines. The research focuses on the broad application of Big Data but does not include specific technologies. Based on the presented text mining method, Big Data technologies are identified automatically as keywords without further classification, and no concrete technologies and their use cases are explored. Similarly, [S104] studies the implementation of cloud computing, Big Data, and blockchain technology adoption in Enterprise Resource Planning (ERP), using only publication keywords generated from literature review and covering a broad spectrum. Why certain technologies are being referred to as Big Data, and how they are specifically utilized is missing, however. In another case, the term Big Data and related expressions such as Big Data Analytics and Big Data Applications are used as abstract concepts throughout the paper without a clear definition of the scope of the technology or little mention of the technology itself. For instance, in an attempt to identify privacy issues in Big Data applications, [S181] uses phrases such as Big Data analytics to refer to the technology, without focusing on any specific technologies. 3.3.2 Big Data as large data sources This category of studies focuses on newly established large data sources, such as databases, websites, and crowd-sourcing platforms, which are taken as the application target of Big Data. The term Big Data is not strictly focused on the technologies but rather the volume or velocity of the data, with no specific techniques linked to those data sources. The application of Big Data in this case mainly means the use of large volumes of data. For example, [S132] explores the utilization of Big Data, smart and digital technologies, and artificial intelligence in the field of psoriatic arthritis studies. The authors cite a series of examples of how Big Data, combined with techniques such as artificial neural networks, natural language processing, k-nearest neighbors, and Bayesian models, can help intercept patients with psoriatic arthritis early. In this case, Big Data mainly refers to the repositories, registries, and databases that are generated from surveys, medical insurance data, vital registration data, etc. A similar research study in healthcare is [S47]. The authors list a number of databases worldwide with concrete gastrointestinal and liver diseases sample sizes, and techniques that are briefly mentioned for analysis are R, python, statistics, and Natural Language Processing (NLP). Also in ecology, ecological datasets such as AmeriFlux are considered Big Data as indicated by [S16]. 3.3.3 Machine learning methods and models This category refers to Big Data as models, algorithms, and statistical methods for managing large data sets, closely related to Machine Learning, Artificial Intelligence, Data Mining, Internet of Things, etc. Big Data technology is equivalent to the definition of machine learning or artificial intelligence, sometimes referred to as deep learning. Specific machine learning models are mentioned, such as ANN, Neural Network (NN), SVM, K-means, decision trees, and also improved models that are based on those methods, to solve practical problems, such as prediction for a certain disease, optimization of transportation. In our research, the majority of the technologies and applications extracted fall into this category. Popular models and techniques summarized are decision trees, random forests and support vector logistic regression models, naive Bayes models, decision trees, and k-nearest neighbors (k-NN) classic linear statistic models, Bayesian networks, and CNNs. There are also some studies (e.g. [S203, S207]) that summarize the applications of Big Data from their research field by discussing a series of concrete improvements of existing models. 3.3.4 Big Data ecosystem The Big Data ecosystem category represents a comprehensive structure of the different levels of technology solutions that exist. Various applications such as Hadoop, MapReduce, and NoSQL are commonly mentioned in this category. The authors of those studies show a strong familiarity with how these technologies fit into their respective disciplines, demonstrating a deep understanding of the subject matter. In one study [S194], for example, the authors explained the different layers in an architecture for Big Data relating to traffic, and how applications such as Hadoop, MapReduce, HDFS, Apache Spark, Apache Hive, Hut, and Apache Kafka work together in the system. The article provides valuable insights into the role that these applications play in the overall architecture. Another study [S216] focused on the use of MapReduce and HDFS functionality in Big Data Architecture. 3.3.5 Outside of the classification Some articles in our study did not fit into the categories outlined in our classification, as it is challenging to extract useful information from them. For instance, some studies e.g., [S12,S63,S77,S172] presented a comparison of Big Data frameworks sourced from other literature without exploring how these frameworks are utilized in their respective fields after introducing their background discipline. While these frameworks can be categorized into the fourth category, we found it difficult to ascertain how Big Data is applied and understood in these disciplines. As a result, we did not include them in Table 3. Articles that do not fit into this classification do not imply that the classification is invalid for the study, but rather that we cannot accurately estimate the authors' understanding of Big Data. 3.4 Added value of Big Data In this section, we summarize the perceived impact of Big Data adoption to each domain, as stated in the secondary studies and in order to answer RQ3. The impact of Big Data is categorized into benefits and shortcomings, which will be introduced below. Table 4 provides a summary of the main points extracted from the texts. Table 4. Summary of benefits and shortcomings of Big Data. 3.4.1 Benefits The advantages of Big Data in various fields have been extensively researched and documented. Big Data tools have the ability to store, process and analyze large volumes and varieties of data in real time, enabling researchers to extract valuable insights and improve their performance. In healthcare, the integration of different scientific fields such as informatics, clinical sciences, and analytics has been facilitated by the application of Big Data [S12]. Further reported benefits of Big Data in healthcare include, for example, cost reduction in medical treatments, elimination of illness-related risk factors, disease prediction, and improved preventative care and medication efficiency analysis [S12, S47, S132, S181]. Large sample sizes have enabled reliable capture of small variations in incidence or disease flare, and epidemiological/clinical Big Data has been instrumental in guiding public and global health policies [S47, S132]. In the field of transportation, Big Data technologies have been used to improve the effectiveness of traffic crash detection and prediction research, with the aim of preventing the occurrences of traffic crashes and secondary crashes [S178, S194]. In the ecosystem service research, Big Data and machine learning tools have been used to address data availability, uncertainty, and socio-ecological gaps [S16]. In addition, Big Data analytics platforms have been useful in revealing previously overlooked correlations, market trends, and valuable information from a large amount of Big Data [S66]. Machine learning has also been used in the smart grid area to sift through Big Data and extract useful information that can aid in demand and generation pattern recognition [S51]. Overall, the benefits of Big Data are diverse and far-reaching, and its application has the potential to revolutionize research and improve outcomes in various fields. 3.4.2 Shortcomings One of the primary challenges with Big Data is the assumption that having vast amounts of data guarantees accurate results. As [S74] notes, Big Data can give a false sense of security because having a lot of data does not necessarily mean that the results are valid. In the field of Psoriatic Arthritis, for example, there are significant variations in socio-demographic characteristics, co-morbidities, and major complication rates between individual (single- or multi-center) and database-based studies [S132]. This inconsistency raises concerns when critically appraising rheumatological and dermatological research, as well as risk adjustment modeling. Another challenge with Big Data is that unnecessary utilization of Big Data can lead to a waste of resources, as it ties up computer resources [S74]. With the exponential growth of data, the storage and processing demands for Big Data have increased significantly. Unnecessary utilization of Big Data can exhaust computer resources and make them less available for other important tasks. This can result in increased costs for organizations, as they need to invest in more powerful computer systems to handle the increased demand. Big Data also poses physical challenges to current IT architecture, servers, and software. As pointed out by [S51], IoT devices generate a huge amount of data, which cannot be handled through conventional analysis techniques. While many data storage technologies have been proposed to store and process growing data, more efficient technologies are required for data acquisition, processing, pre-processing, storage, and management of Big Data [S94]. Security and privacy issues also arise with Big Data. In the healthcare industry, data security and patient privacy issues are a significant concern for authorities and patients [S66]. In the research concerning COVID-19 [S207], for example, there are ethical issues surrounding privacy, the use of personal data to limit the pandemic spread, and the need for security to protect data from being overused by technology. Finally, there are challenges in managing data consistency, scalability, and integration. For instance, challenges in using Big Data in environmental Sciences include data cleansing, lack of labeled datasets, mismatched data ingestion, high costs of platforms, and lack of data governance and socio-technical infrastructure [S135].The transportation industry faces difficulties in collecting data from diverse sources and addressing quality concerns. When using Big Data in transportation, data collected from different sources needs to be analyzed to extract meaningful insights. However, this data often contains noise and uncertainty that must be addressed before use [S194]. In conclusion, several challenges need to be addressed to ensure that the use of Big Data is effective. These challenges include the need for integrated and comprehensive systems, efficient data acquisition and management technologies, security and privacy concerns, data consistency, scalability, as well as integration issues. 4 Discussion Going beyond our findings as reported in the previous section, in the following we identify three specific topics emerging from our analysis that need further consideration. These are how Big Data is being understood across scientific domains, how the adoption of the Big Data occurs across disciplines, and how the perception of the added value that Big Data technologies bring looks like. 4.1 Understanding of Big Data The challenge in analyzing research using Big Data technologies stems from the lack of a clear definition of what a Big Data technology is. The authors of the secondary studies surveyed through this study elaborate on their understanding of Big Data and its applications from different perspectives. This results in a wide spectrum of technologies which are labeled as Big Data, while significant differences between them remain, even when applied in the same field. Additionally, terms closely related to Big Data technology, such as AI, ML, Big Data analytics, Big Data platform, IoT, and Deep Learning are often used interchangeably. While these terms may not require definition in each individual article surveyed, their meanings and scope may overlap in practice. Therefore, to gain a clear understanding of Big Data, it would be helpful to have a clear distinction and consistent use of each term with more precision to avoid confusion. In other words, we argue that when reviewing the literature, the primary task is to understand what authors mean when they use concepts such as Big Data and Big Data technology, rather than simply extracting relevant technical applications and their context. The results show that the concept of Big Data technology can be very broad. At the same time, these tools and technologies may be specific to a particular discipline and may not have interdisciplinary significance. This ambiguity has led to the widespread use of Big Data terminology in some cases. Our findings also revealed that some articles provide a vague description of Big Data, making it difficult to extract useful information that cannot be categorized under any of the categories in Section 3.3. These articles focus on the theoretical knowledge of Big Data and do not delve into its practical applications in different domains. As a result, they provide a pure comparison of Big Data frameworks cited in other literature without exploring how these frameworks are used in their respective domains. This approach contributes to pervasive references to Big Data, however, without providing a clear understanding of its practical applications. In conclusion, this study highlights the need for a clear and comprehensive definition of Big Data technology and its practical applications in different domains. By doing so, we can avoid the misuse of Big Data terminology and gain a better understanding of the tools and technologies that are truly related to Big Data. 4.2 Range of disciplines represented in Big Data applications In this study, we conducted a rigorous systematic literature review to investigate the applications of Big Data and used the WoS subject classification to categorize the related research fields. However, we acknowledge that this approach may not capture the full range of disciplines, as indicated by our analysis of the discipline distribution. While disciplines such as astronomy and high-energy physics are typically associated with managing large volumes of data (Jacobs, 2009), we found that they were not represented in the papers we extracted. The lack of such data-intensive disciplines led us to question why they were not included, since our primary objective was to provide an overview of Big Data applications across the entire scientific community. We took great care to ensure that our SLR was not biased toward any specific domain by carefully selecting keywords and defining our inclusion and exclusion criteria. Additionally, we used comprehensive databases and an auditable and repeatable methodology. The absence of data-intensive subjects in our review suggests that some disciplines may be utilizing Big Data technologies without explicitly using the term Big Data in their research papers. One hypothesis is that computer science and related fields may consider the scale of data used as the norm, hence not explicitly mentioning Big Data. To understand this phenomenon better, we suggest a further step to investigate the underlying assumptions, such as the choice of terminologies, used in these disciplines as part of future work. 4.3 Value of Big Data The enthusiasm surrounding Big Data arises from the belief that vast amount of information with the development of technologies, algorithms and machine learning techniques, can provide innovative insights that traditional research methods cannot achieve (Agrawal et al., 2011; Chen and Zhang, 2014; Khalid and Yousaf, 2021). However, these optimistic views are not undisputed. As Big Data knowledge infrastructures emerge, researchers are increasingly discussing the challenges and limitations they present. Numerous papers extol the merits of Big Data, with the main claim being that it offers unparalleled opportunities for scientific breakthroughs, leading to transformative research, as discussed in Section 3.4. The most significant advantage of the Big Data approach is its ability to address problems on larger and finer temporal and spatial scales, as well as provide information on which data are reliable or uncertain, thereby mapping ignorance (Hampton et al., 2013; Harford, 2014; Isaac et al., 2020). Big Data also highlights blind spots and uncertainties in research, revealing gaps in existing knowledge (Hortal et al., 2015). In this study, we have explored the benefits of Big Data tools. They can store, process, and analyze large volumes and varieties of data in real-time, enabling researchers to extract valuable insights and improve their performance. Big Data analytics platforms have proven useful in revealing previously overlooked correlations, market trends, and valuable information from large datasets. Additionally, machine learning has aided in sifting through Big Data to extract useful information for demand and generation pattern recognition in the smart grid. However, according to Ekbia et al. (2015), Big Data presents both conceptual and practical dilemmas based on a broad range of literature. They argue that an epistemological shift in science occurs due to the use of Big Data, where predictive modeling and simulation gain more importance than causal explanations based on repeatable experiments testing hypotheses. The authors Rosenheim and Gratton (2017) reject what they perceive as the suggestion of the most fervent proponents of Big Data that knowledge of correlation alone can replace knowledge of causality. They point out that understanding cause-and-effect relationships is critical in fields such as agricultural entomology, where research-oriented recommendations enable farmers to implement management actions that lead to desired outcomes. The study in Harford (2014) points out that conducting a correlation-based analysis without a theoretical framework is inherently vulnerable. Without understanding the underlying factors influencing a correlation, it becomes impossible to anticipate and account for factors that could potentially compromise its validity. Similarly to the above, in our research, we found critical questions regarding whether vast amounts of data guarantee accurate results. Brady (2019) argues that social scientists must grasp the meaning of concepts and predictions generated by convoluted algorithms, weigh the relative value of prediction vs. causal inference, and cope with ethical challenges as their methods. Another notable challenge posed by Big Data that we found is managing data consistency, scalability and heterogeneity in different fields. Additionally, large amounts of data also pose challenges to IT architecture, servers and software. This was also testified by Fan et al. (2014). They point out that the massive sample size and high dimensionality of Big Data introduce unique computational and statistical challenges, including scalability and storage bottleneck, noise accumulation, spurious correlation, incidental endogeneity and measurement errors. Furthermore, we found that the misuses of Big Data arouse ethical issues. This concern has already been widely discussed in previous literature, see for example Cumbley and Church (2013) and Knoppers and Thorogood (2017). In conclusion, while Big Data has generated much enthusiasm as a powerful tool for scientific breakthroughs, it is not without its challenges and limitations. Despite these challenges, Big Data holds promise as a tool for innovative research, and future work should continue to address these concerns while exploring new opportunities for knowledge discovery. 5 Conclusion The lack of a clear definition and scope for Big Data results in scientific research and communication lacking a common ground. Even with the popular V characteristics, Big Data remains elusive. The term is broad and is used differently in research, often referring to entirely different concepts, which is rarely stated explicitly in papers. While many studies and reviews attempt to draw a comprehensive understanding of Big Data, there is a need to first retrospectively observe what Big Data actually means and refers to in concrete studies. This will help clarify ambiguities and enhance understanding of the role of Big Data in science. It will facilitate clearer communication among researchers by providing a framework for a common understanding of what Big Data entails in different contexts, which is crucial for interdisciplinary collaboration. To address this gap, we conducted a systematic literature review (SLR) of secondary studies to provide a comprehensive overview of how Big Data is used and understood across different scientific domains. Our objective was to monitor the application of the Big Data concept in science, identify which technologies are prevalent in which fields, and investigate the discrepancies between the theoretical understanding and practical usage of the term. Our study found that various Big Data technologies are being used in different scientific fields, including machine learning algorithms, distributed computing frameworks, and other tools. These manifestations of Big Data can be classified into four major categories: abstract concepts, large datasets, machine learning techniques, and the Big Data ecosystem. All these aspects combined represent the true meaning of Big Data. This study revealed that despite the general agreement on the V characteristics, researchers in different scientific fields have varied implicit understandings of Big Data. These implicit understandings significantly influence the content and discussions of studies involving Big Data, although they are often not explicitly stated. We call for a clearer articulation of the meaning of Big Data in research to facilitate smoother scientific communication. Author contributions XH: Conceptualization, Writing original draft. OG: Conceptualization, Supervision, Writing review & editing. VA: Conceptualization, Methodology, Supervision, Validation, Writing review & editing. Funding The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article. Conflict of interest The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. Publisher's note All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher. Footnotes References

Agrawal, D., Bernstein, P. A., Bertino, E., Davidson, S. B., Dayal, U., Franklin, M. J., et al. (2011). Challenges and opportunities with big data. Cyber Center Technical Reports, 20111. Available at: Google Scholar Akoka, J., Comyn-Wattiau, I., and Laoufi, N. (2017). Research on Big Data a systematic mapping study. Comput. Stand. Interf. 54, 105115. doi: 10.1016/j.csi.2017.01.004 Crossref Full Text | Google Scholar Brady, H. E. (2019). The challenge of Big Data and data science. Ann. Rev. Polit. Sci. 22, 297323. doi: 10.1146/annurev-polisci-090216-023229 Crossref Full Text | Google Scholar Chebbi, I., Boulila, W., and Farah, I. R. (2015). Big data: concepts, challenges and applications, inComputational Collective Intelligence, eds. M. Nez, N. T. Nguyen, D. Camacho, and B. Trawiski (Cham: Springer International Publishing), 638647. doi: 10.1007/978-3-319-24306-1_62 Crossref Full Text | Google Scholar Chen, C., and Zhang, C.-Y. (2014). Data-intensive applications, challenges, techniques and technologies: a survey on Big Data. Inf. Sci. 275, 314347. doi: 10.1016/j.ins.2014.01.015 PubMed Abstract | Crossref Full Text | Google Scholar Cumbley, R., and Church, P. C. (2013). Is Big Data" creepy? Comput. Law Secur. Rev. 29, 601609. doi: 10.1016/j.clsr.2013.07.007 Crossref Full Text | Google Scholar Ekbia, H. R., Mattioli, M., Kouper, I., Arave, G., Ghazinejad, A., Bowman, T. D., et al. (2015). Big data, bigger dilemmas: a critical review. J. Assoc. Inform. Sci. Technol. 66, 15231545. doi: 10.1002/asi.23294 Crossref Full Text | Google Scholar Falagas, M. E., Pitsouni, E., Malietzis, G., and Pappas, G. (2007). Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses. FASEB J. 22, 338342. doi: 10.1096/fj.07-9492LSF PubMed Abstract | Crossref Full Text | Google Scholar Hampton, S. E., Strasser, C., Tewksbury, J. J., Gram, W. K., Budden, A. E., Batcheller, A. L., et al. (2013). Big data and the future of ecology. Front. Ecol. Environ. 11, 156162. doi: 10.1890/120103 Crossref Full Text | Google Scholar Hansmann, T., and Niemeyer, P. (2014). Big Data - characterizing an emerging research field using topic models, in 2014 IEEE/WIC/ACM International Joint Conferences on Web Intelligence (WI) and Intelligent Agent Technologies (IAT) (New York, NY: ACM). doi: 10.1109/WI-IAT.2014.15 PubMed Abstract | Crossref Full Text | Google Scholar Hortal, J., De Bello, F., Diniz-Filho, J. A. F., Lewinsohn, T. M., Lobo, J. M., and Ladle, R. J. (2015). Seven shortfalls that beset large-scale knowledge of biodiversity. Annu. Rev. Ecol. Evol. Syst. 46, 523549. doi: 10.1146/annurev-ecolsys-112414-054400 Crossref Full Text | Google Scholar Isaac, N. J. B., Jarzyna, M. A., Keil, P., Dambly, L. I., Boersch-Supan, P. H., Browning, E., et al. (2020). Data integration for large-scale models of species distributions. Trends Ecol. Evol. 35, 5667. doi: 10.1016/j.tree.2019.08.006 PubMed Abstract | Crossref Full Text | Google Scholar Khalid, M., and Yousaf, M. H. (2021). A comparative analysis of big data frameworks: an adoption perspective. Appl. Sci. 11:11033. doi: 10.3390/app112211033 Crossref Full Text | Google Scholar Khan, M. A.-U.-D., Uddin, M. J., and Gupta, N. (2014). Seven V's of Big Data understanding Big Data to extract value. doi: 10.1109/ASEEZone1.2014.6820689 Crossref Full Text | Google Scholar Kitchenham, B., Brereton, O. P., Budgen, D., Seed, P. T., Bailey, J. E., Linkman, S., et al. (2009). Systematic literature reviews in software engineering a systematic literature review. Inf. Softw. Technol. 51, 715. doi: 10.1016/j.infsof.2008.09.009 Crossref Full Text | Google Scholar Kitchenham, B., Pretorius, R., Budgen, D., Brereton, O. P., Seed, P. T., Niazi, M., et al. (2010). Systematic literature reviews in software engineering a tertiary study. Inf. Softw. Technol. 52, 792805. doi: 10.1016/j.infsof.2010.03.006 Crossref Full Text | Google Scholar Kitchin, R. (2014). Big Data, new epistemologies and paradigm shifts. Big Data Soc. 1:205395171452848. doi: 10.1177/2053951714528481 Crossref Full Text | Google Scholar Knoppers, B. M., and Thorogood, A. (2017). Ethics and Big Data in health. Curr. Opin. Syst. Biol. 4, 5357. doi: 10.1016/j.coisb.2017.07.001 Crossref Full Text | Google Scholar Mengist, W., Soromessa, T., and Legese, G. (2020). Method for conducting systematic literature review and meta-analysis for environmental science research. MethodsX 7:100777. doi: 10.1016/j.mex.2019.100777 PubMed Abstract | Crossref Full Text | Google Scholar Petticrew, M., and Roberts, H. (2008). Systematic Reviews in the Social Sciences. Hoboken, NJ: John Wiley & Sons. Google Scholar Rosenheim, J. A., and Gratton, C. (2017). Ecoinformatics (Big Data) for agricultural entomology: pitfalls, progress, and promise. Annu. Rev. Entomol. 62, 399417. doi: 10.1146/annurev-ento-031616-035444 PubMed Abstract | Crossref Full Text | Google Scholar Van Altena, A. J., Moerland, P. D., Zwinderman, A. H., and Olabarriaga, S. D. (2016). Understanding big data themes from scientific biomedical literature through topic modeling. J. Big Data 3. doi: 10.1186/s40537-016-0057-0 PubMed Abstract | Crossref Full Text | Google Scholar Wohlin, C. (2014). Guidelines for snowballing in systematic literature studies and a replication in software engineering, in Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering. doi: 10.1145/2601248.2601268 Crossref Full Text | Google Scholar

Appendix Table A1. Secondary studies included in our review. ,the free encyclopedia that anyone can edit.117,937 active editors 7,000,660 articles in EnglishAndrea Navagero (14831529) was a Venetian diplomat and writer. He entered the Great Council of Venice at the age of twenty, five years younger than was normal at the time. He edited manuscripts at the Aldine Press, garnering a reputation as a scholar and a highly skilled writer. In 1515, he was appointed the official historian of the Republic of Venice as well as the caretaker of a library containing the collection of the scholar Bessarion. Navagero was named the Venetian ambassador to Spain in 1523 and navigated the volatile diplomatic climate caused by the conflict between CharlesV of Spain and FrancisI of France. By the time Navagero arrived back in Venice in 1528, he had grown disillusioned with politics and wished to return to editing manuscripts and cultivating his prized gardens. Much to his dismay, he was appointed ambassador to France in January 1529. After traveling to meet with FrancisI, he fell ill and died that May. (Fullarticle...)Recently featured: Nosy KombaMcDonnell Douglas Phantom in UK serviceTransportation during the 2024 Summer Olympics and ParalympicsArchiveBy emailMore featured articlesAboutEngraving of the Great Pyramid of Giza... that the 1572 Eight Wonders of the World (engraving pictured) is the source of the modern list of classical Seven Wonders of the World?... that Hedwig Tam gained 20 pounds to play a postpartum mother in Montages of a Modern Motherhood?... that the Alfonsine Ordinances punished Jews and Muslims with enslavement if they disguised their identity with the intention of "sinning with Christian women"?... that even though he had never seen a field hockey game, Willy Miranda became a high school coach and went on to win over 450 games across a 42-year tenure?... that a false viral rumour claimed 42 people committed suicide after their homoerotic fan art was included in the film Crazy About One Direction?... that an Arizona TV station put a satellite dish in a vacant swimming pool?... that 42 years after Jilly Cooper's How to Stay Married was first published, she described it as "terribly politically incorrect"?... that wrestler Kurt Howell won all 108 of his matches in high school?... that the second-place candidate in the 2018 Taipei mayoral election lost by just 0.23%, demanded a recount, and ended up losing by even more?ArchiveStart a new articleNominate an articlenosato Daikinosato Daiki (pictured) becomes sumo's 75th yokozuna.In association football, Liverpool win the Premier League title.In motor racing, lex Palou wins the Indianapolis 500.In basketball, the EuroLeague concludes with Fenerbahe winning the Final Four Playoff.Ongoing: Gaza warM23 campaignRussian invasion of UkrainetimelineSudanese civil wartimelineRecent deaths: Phil RobertsonMary K. GaillardPeter DavidAlan YentobGerry ConnollySebastio SalgadoNominate an articleMay 29: Feast day of Saint PaulVI (Catholicism)Headline in the New York Times1233 MongolJin War: The Mongols entered and began looting Kaifeng, the capital of the Jin dynasty of China, after a 13-month siege.1416 A squadron of the Venetian navy captured many Ottoman ships at the Battle of Gallipoli, confirming Venetian naval superiority in the Aegean Sea for the next few decades.1913 During the premiere of the ballet Le Sacre du printemps by Igor Stravinsky at the Thtre des Champs-lyses in Paris, the avant-garde nature of the music and choreography caused a near-riot in the audience (report pictured).1999 Charlotte Perrelli, representing Sweden, won the Eurovision Song Contest, the first edition not to feature an orchestra or live accompaniment.2011 Residents of Portland, Oregon, held a rally called Hands Across Hawthorne in response to an attack against a gay couple holding hands while crossing the Hawthorne Bridge.Benedetto Pistrucci (b.1783)G.K. Chesterton (b.1874)Hubert Opperman (b.1904)Uro Drenovi (d.1944)More anniversaries: May 28May 29May 30ArchiveBy emailList of days of the yearAboutThe Australian white ibis (Threskiornis molucca) is a wading bird of the ibis family, Threskiornithidae. It is widespread across much of Australia, and has a predominantly white plumage with a bare, black head, long downcurved bill, and black legs. While it is closely related to the African sacred ibis, the Australian white ibis is a native Australian bird. Due to its increasing presence in the urban environment and its habit of rummaging in garbage, the species has acquired a variety of colloquial names such as "tip turkey" and "bin chicken". This Australian white ibis was photographed at the Royal Botanic Garden, Sydney.Photograph credit: Charles J. SharpRecently featured: Hell Gate BridgeAnemonoides blandaBluespotted ribbontail rayArchiveMore featured picturesCommunity portal The central hub for editors, with resources, links, tasks, and announcements.Village pump Forum for discussions about Wikipedia itself, including policies and technical issues.Site news Sources of news about Wikipedia and the broader Wikimedia movement.Teahouse Ask basic questions about using or editing Wikipedia.Help desk Ask questions about using or editing Wikipedia.Reference desk Ask research questions about encyclopedic topics.Content portals A unique way to navigate the encyclopedia.Wikipedia is written by volunteer editors and hosted by the Wikimedia Foundation, a non-profit organization that also hosts a range of other volunteer projects: CommonsFree media repository MediaWikiWiki software development Meta-WikiWikimedia project coordination WikibooksFree textbooks and manuals WikidataFree knowledge base WikinewsFree-content news WikiquoteCollection of quotations WikisourceFree-content library WikispeciesDirectory of species WikiversityFree learning tools WikivoyageFree travel guide WiktionaryDictionary and thesaurusThis Wikipedia is written in English. Many other Wikipedias are available; some of the largest are listed below. 1,000,000+ articles DeutschEspaolFranaisItalianoNederlandsPolskiPortugusSvenskaTing Vit 250,000+ articles Bahasa IndonesiaBahasa MelayuBn-lm-gCataletinaDanskEestiEsperantoEuskaraMagyarNorsk bokmlRomnSimple EnglishSloveninaSrpskiSrpskohrvatskiSuomiTrkeOzbekcha 50,000+ articles AsturianuAzrbaycancaBosanskiFryskGaeilgeGalegoHrvatskiKurdLatvieuLietuviNorsk nynorskShqipSlovenina Retrieved from " 2Calendar yearYearsMillennium2ndmillenniumCenturies12thcentury13thcentury 14thcenturyDecades1210s1220s1230s 1240s1250sYears1230123112321233 123412351236vte1233 by topicLeadersPolitical entitiesState leadersReligious leadersBirth and death categoriesBirths DeathsEstablishments and disestablishments categoriesEstablishments DisestablishmentsArt and literature1233 in poetryvte1233 in various calendarsGregorian calendar1233MCCXXXIIIAb urbe condita1986Armenian calendar682 Assyrian calendar5983Balinese saka calendar11541155Bengali calendar639640Berber calendar2183English Regnal year17Hen.318Hen.3Buddhist calendar1777Burmese calendar595Byzantine calendar67416742Chinese calendar (WaterDragon)3930 or 3723to (WaterSnake)3931 or 3724Coptic calendar949950Discordian calendar2399Ethiopian calendar12251226Hebrew calendar49934994Hindu calendars- Vikram Samvat12891290- Shaka Samvat11541155- Kali Yuga43334334Holocene calendar11233Igbo calendar233234Iranian calendar611612Islamic calendar630631Japanese calendarJei 2 / Tenpuku 1()Javanese calendar11421143Julian calendar1233MCCXXXIIIKorean calendar3566Minguo calendar679 before ROC679Nanakshahi calendar235Thai solar calendar17751776Tibetan calendar(male Water-Dragon)1359 or 978 or 206to(female Water-Snake)1360 or 979 or 207 Henry I of Cyprus receives a messageYear 1233 (MCCXXXIII) was a common year starting on Saturday of the Julian calendar.War of the Lombards: Lombard forces at Kyrenia surrender to John of Beirut, after a 10-month siege. The defenders, with their personal belongings, are allowed to retire to Tyre. Captured prisoners are exchanged for those held by Richard Filangieri, commander of the Lombards, at Tyre. Cyprus is wholly restored under the rule of the 16-year-old King Henry I ("the Fat"). His vassals are rewarded, and loans that they have made are repaid.[1]August 20 Oath of Bereg: King Andrew II of Hungary vows to the Holy See that he will not employ Jews and Muslims to administer royal revenues, which causes diplomatic complaints and ecclesiastical censures.[2]Winter Reconquista: King Ferdinand III of Castile ("the Saint") conquers the cities of Trujillo and beda. The Castilian army besieges the city of Peniscola. Ferdinand forces Ibn Hud, ruler of the Taifa of Zaragoza, to sign a truce.[3]August Richard Marshal, 3rd Earl of Pembroke, signs an alliance with Llywelyn the Great, to join forces to revolt against King Henry III. Richard is faced by demands from royal bailiffs in September where the garrison of Usk Castle is forced to surrender.November Henry III's army camped at Grosmont Castle is attacked in the night, by a force of Welsh and English rebels. Several of Henry's supporters are captured, and the castle is returned to Hubert de Burgh, one of the rebels.May 29 MongolJin War: The Mongol army led by gedei Khan captures Kaifeng, the capital of the Jin dynasty ('Great Jin'), after the 13-month Siege of Kaifeng (1232). The Mongols plunder the city, while Emperor Aizong of Jin flees for the town of Caizhou. Meanwhile, gedei departs and leaves the final conquest to his favoured general, Subutai.December Siege of Caizhou: The Mongols under gedei Khan besiege Caizhou and ally themselves with the Chinese Song dynasty to eliminate the Jin Dynasty.Gendt receives its city rights from Otto II ("the Lame"), count of Guelders (modern Netherlands).Pope Gregory IX establishes the Papal Inquisition, to regularize the persecution of heresy.June/July Ibn Manzur, Arab lexicographer and writer (d. 1312)August 15 Philip Benizi de Damiani, Italian religious leader (d. 1285)October Al-Nawawi, Syrian scholar, jurist and writer (d. 1277)Adelaide of Burgundy, duchess of Brabant (d. 1273)Choe Ui, Korean military leader and dictator (d. 1258)Ibn al-Quff, Ayyubid physician and surgeon (d. 1286)Sancho of Castile, archbishop of Toledo (d. 1261)January 6 Matilda of Chester, Countess of Huntingdon (or Maud), English noblewoman (b. 1171)January 18 Yang (or Gongsheng), Chinese empress (b. 1162)February 12 Ermengarde de Beaumont, queen of ScotlandMarch 1 Thomas I (or Tommaso), count of Savoy (b. 1178)May Simon of Joinville, French nobleman and knight (b. 1175)June Yolanda de Courtenay, queen consort of HungaryJuly 8 Konoe Motomichi, Japanese nobleman (b. 1160)July 26 Wilbrand of Oldenburg, prince-bishop of UtrechtJuly 27 Ferdinand (or Ferrand), count of Flanders (b. 1188)July 29 Savari de Maulon, French nobleman (b. 1181)July 30 Konrad von Marburg, German priest (b. 1180)October 8 Ugo Canefri, Italian health worker (b. 1148)October 22 Fujiwara no Shunshi, Japanese empress consort (b. 1209)November 22 Helena, duchess of Brunswick-LneburgNovember 27 Shi Miyuan, Chinese politician (b. 1164)Ibn al-Athir, Seljuk historian and biographer (b. 1160)Bertran de Born lo Filhs, French troubadour (b. 1179)Bohemond IV ("the One-Eyed"), prince of Antioch (b. 1175)Gkbri ("Blue-Wolf"), Ayyubid general and ruler (b. 1154)Guilln Prez de Guzmn, Spanish nobleman (b. 1180)John Apokaukos, Byzantine bishop and theologianMathilde of Angoulme, French noblewoman (b. 1181)Sayf al-Din al-Amidi, Ayyubid scholar and jurist (b. 1156)William Comyn, Scoto-Norman nobleman (b. 1163)^ Steven Runciman (1952). A History of The Crusades. Vol III: The Kingdom of Acre, pp. 169170. ISBN978-0-241-29877-0.^ Berend, Nora (2001). At the Gate of Christendom: Jews, Muslims and "Pagans" in Medieval Hungary, c. 1000-c.1300. Cambridge University Press. p.158. ISBN978-0-521-02720-5.^ Lourie, Elena (2004). Jews, Muslims, and Christians in and around the Crown of Aragon: essays in honour of Professor Elena Lourie. Brill. p.270. ISBN90-04-12951-0.[permanent dead link]Retrieved from " 3One hundred years, from 1101 to 1200See also: Renaissance of the 12th centuryMillennia2ndmillenniumCenturies11thcentury12thcentury13thcenturyTimelines11thcentury12thcentury13thcenturyState leaders11thcentury12thcentury13thcenturyDecades1100s1110s1120s1130s1140s1150s1160s1170s1180s1190sCategories:Births Deaths Establishments DisestablishmentsvteEastern Hemisphere at the beginning of the 12th centuryThe 12th century is the period from 1101 to 1200 in accordance with the Julian calendar. In the history of European culture, this period is considered part of the High Middle Ages and overlaps with what is often called the "'Golden Age' of the Cistercians". The Golden Age of Islam experienced significant development, particularly in Islamic Spain.In Song dynasty China, an invasion by Jurchens caused a political schism of north and south. The Khmer Empire of Cambodia flourished during this century, while the Fatimids of Egypt were overtaken by the Ayyubid dynasty. Following the expansions of the Ghaznavids and Ghurid Empire, the Muslim conquests in the Indian subcontinent took place at the end of the century.The Ghurid Empire converted to Islam from Buddhism.1101: In July, the Treaty of Alton is signed between Henry I of England and his older brother Robert, Duke of Normandy in which Robert agrees to recognize Henry as king of England in exchange for a yearly stipend and other concessions. The agreement temporarily ends a crisis in the succession of the Anglo-Norman kings.11011103: David the Builder takes over Kakheti and Hereti (now parts of Georgia).1102: King Coloman unites Hungary and Croatia under the Hungarian Crown.1102: Muslims conquer Seoro de Valencia.11031104: A church council is convened by King David the Builder in Urbnisi to reorganize the Georgian Orthodox Church.1104: In the Battle of Ertsukhi, King David the Builder defeats an army of Seljuks.1104: King Jayawarsa of Kadiri (on Java) ascends to the throne.[citation needed]1106: Battle of Tinchebray.11071111: Sigurd I of Norway becomes the first Norwegian king to embark on a crusade to the Holy Land. He fights in Lisbon and on various Mediterranean isles and helps the King of Jerusalem to take Sidon from the Muslims.1108: By the Treaty of Devol, signed in September, Bohemond I of Antioch has to submit to the Byzantine Empire, becoming the vassal of Alexius I.1109: On June 10, Bertrand of Toulouse captures the County of Tripoli (northern Lebanon/western Syria).1109: In the Battle of Nako, Boleslaus III Wrymouth defeats the Pomeranians and re-establishes Polish access to the sea.1109: On August 24, in the Battle of Hundsfeld, Boleslaus III Wrymouth defeats Emperor Henry V of Germany and stops German expansion eastward.1111: On April 14, during Henry V's first expedition to Rome, he is crowned Holy Roman Emperor.1113: Paramavishnulok is crowned as King Suryavarman II in Cambodia. He expands the Khmer Empire and builds Angkor Wat during the first half of the century. He establishes diplomatic relations with China.1115: The Georgian army occupies Rustavi in the war with the Muslims.1115: In Java, King Kamesvara of Kadiri ascends to the throne. Janggala ceases to exist and comes under Kadiri domination, highly possible under royal marriage. During his reign, Mpu Dharmaja writes Kakawin Smaradahana, a eulogy for the king which become the inspiration for the Panji cycle tales, which spread across Southeast Asia.[1]1116: The Byzantine army defeats the Turks at Philomelion.1116: Death of doa Jimena Daz, governor of Valencia from 1099 to 1102.c. 1119: The Knights Templar are founded to protect Christian pilgrims in Jerusalem.A Black and White Photo of the 12th century Cuenca Cathedral (built from 1182 to 1270) in Cuenca, Spain1120: On January 16, the Council of Nablus, a council of ecclesiastic and secular lords in the crusader Kingdom of Jerusalem, establishes the first written laws for the kingdom.1120: On November 25, William Adelin, the only legitimate son of King Henry I of England, drowns in the White Ship Disaster, leading to a succession crisis which will bring down the Norman monarchy of England.1121: On August 12, in the Battle of Didgori, the greatest military victory in Georgian history, King David the Builder with 45,000 Georgians, 15,000 Kipchak auxiliaries, 500 Alan mercenaries and 100 French Crusaders defeats a much larger Seljuk-led Muslim coalition army.1121: On December 25, St. Norbert and 29 companions make their solemn vows in Premontre, France, establishing the Premonstratensian Order.1122: The Battle of Beroia (Modern-day Stara Zagora, Bulgaria) results in the disappearance of the Pechenegs Turkish tribe as an independent force.1122: On September 23, the Concordat of Worms (Pactum Calixtinum) is drawn up between Emperor Henry V and Pope Calixtus II bringing an end to the first phase of the power struggle between the papacy and the Holy Roman Empire.1122: King David the Builder captures Tbilisi and declares it the capital city of Georgia, ending 400 years of Arab rule.1123: The Jurchen dynasty of China forces Koryo (now Korea) to recognize their suzerainty.1124: In April or May, David I is crowned King of the Scots.1125: On June 11, in the Battle of Azaz, the Crusader states, led by King Baldwin II of Jerusalem, defeat the Seljuk Turks.1125: In November, the Jurchens of the Jin dynasty declare war on the Song dynasty, beginning the JinSong wars.1125: Lothair of Supplinburg, duke of Saxony, is elected Holy Roman Emperor instead of the nearest heir, Frederick of Swabia, beginning the great struggle between Guelphs and Ghibellines.1127: The Northern Song dynasty loses power over northern China to the Jin dynasty.1128: On June 24, the Kingdom of Portugal gains independence from the Kingdom of Len at the Battle of So Mamede; (recognised by Len in 1143).The temple complex of Angkor Wat, built during the reign of Suryavarman II in Cambodia of the Khmer Era.11301180: 50-year drought in what is now the American Southwest.11301138: Papal schism, Pope Innocent II vs. Antipope Anacletus II.1130: On March 26, Sigurd I of Norway dies. A golden era of 95 years comes to an end for Norway as civil wars between the members of Harald Fairhair's family line rage for the remainder of the century.1130: On Christmas Day, Roger II is crowned King of Sicily, the royal title being bestowed on him by Antipope Anacletus II.1132: The Southern Song dynasty establishes China's first permanent standing navy, although China had a long naval history prior. The main admiral's office is at the port of Dinghai.11321183: the Chinese navy increases from a mere 3,000 to 52,000 marine soldiers stationed in 20 different squadrons. During this time, hundreds of treadmill-operated paddle wheel craft are assembled for the navy to fight the Jin dynasty in the north.1135: King Jayabaya of Kadiri ascends to the throne.[2]11351154: The Anarchy takes place, during a period of civil war in England.1136: Suger begins rebuilding the abbey church at St Denis north of Paris, which is regarded as the first major Gothic building.1137: On July 22, the future King Louis VII of France marries Eleanor, the Duchess of Aquitaine.1138: On October 11, the 1138 Aleppo earthquake devastates much of northern Syria.1139: in April, the Second Lateran Council ends the papal schism.1139: On July 5, in the Treaty of Mignano, Pope Innocent II confirms Roger II as King of Sicily, Duke of Apulia, and Prince of Capua and invests him with his titles.1139: On July 25, the Portuguese defeat the Almoravids led by Ali ibn Yusuf in the Battle of Ourique; Prince Afonso Henriques is acclaimed King of Portugal by his soldiers.Averroes in a 14th-century painting by Andrea di Bonaiuto11401150: Collapse of the Ancestral Puebloan culture at Chaco Canyon (modern-day New Mexico).1141: The Treaty of Shaoxing ends the conflict between the Jin dynasty and Southern Song dynasty, legally establishing the boundaries of the two countries and forcing the Song dynasty to renounce all claims to its former territories north of the Huai River. The treaty reduces the Southern Song into a quasi-tributary state of the Jurchen Jin dynasty.1143: Manuel I Komnenos is crowned as Byzantine emperor after the death of John II Komnenos.1143: Afonso Henriques is proclaimed King of Portugal by the cortes.1143: The Treaty of Zamora recognizes Portuguese independence from the Kingdom of Len. Portugal also recognizes the suzerainty of the pope.1144: On December 24, Edessa falls to the Atabeg Zengi.11451148: The Second Crusade is launched in response to the fall of the County of Edessa.1147: On October 25, the four-month-long Siege of Lisbon successfully brings the city under definitive Portuguese control, expelling the Moorish overlords.1147: A new Berber dynasty, the Almohads, led by Emir Abd al-Mu'min, takes North Africa from the Almoravides and soon invades the Iberian Peninsula. The Almohads began as a religious movement to rid Islam of impurities.1147: The Wendish Crusade against the Polabian Slavs (or "Wends") in what is now northern and eastern Germany.1150: Ramon Berenguer IV, Count of Barcelona marries Petronilla, the Queen of Aragon.1151: The Treaty of Tudiln is signed by Alfonso VII of Len and Raymond Berengar IV, Count of Barcelona, recognizing the Aragonese conquests south of the Jcar and the right to expand in and annex the Kingdom of Murcia.1153: The Treaty of Wallingford, ends the civil war between Empress Matilda and her cousin King Stephen of England fought over the English crown. Stephen acknowledges Matilda's son Henry of Anjou as heir.1153: The First Treaty of Constance is signed between Emperor Frederick I and Pope Eugene III, by the terms of which, the emperor is to prevent any action by Manuel I Comnenus to reestablish the Byzantine Empire on Italian soil and to assist the pope against his enemies in revolt in Rome.1154: the Moroccan-born Muslim geographer Muhammad al-Idrisi publishes his Geography.1154: On December 27, Henry II is crowned King of England at Westminster Abbey.1155: Pope Adrian IV grants overlordship of Ireland to Henry II of England in the bull Laudabiliter.1156: On June 18, the Treaty of Benevento is entered into by Pope Adrian IV and the Norman Kingdom of Sicily. After years of turbulent relations, the popes finally settles down to peace with the Hauteville kings. The kingship of William I is recognized over all Sicily, Apulia, Calabria, Campania, and Capua. The tribute to the pope of 600 schifati agreed upon by Roger II in 1139 at Mignano is affirmed and another 400 shift is added for the new lands.1158: The Treaty of Sahagn ends the war between Castile and Len.The Liuhe Pagoda of Hangzhou, China, 11651161: the Song dynasty Chinese navy, employing gunpowder bombs launched from trebuchets, defeats the enormous Jin dynasty navy in the East China Sea in the Battle of Tangdao and on the Yangtze River in the Battle of Caishi.1161: Kilij Arslan II, Sultan of Rum, makes peace with the Byzantine Empire, recognizing the emperor's primacy.1161: In the siege of Ani, troops from the Kingdom of Georgia take control over the city, only to have it sold for the second time to the Shaddadids, a Kurdish dynasty.1162: Genghis Khan, the founder of the Mongol Empire, is born as Temjin in present-day Mongolia.1163: The Norwegian Law of Succession takes effect.11651182: Tensions and disputes between the Pagan Empire and the Kingdom of Polonnaruwa causes the Sinhalese under Parakramabahu the Great to raid Burma.1168: King Valdemar I of Denmark conquers Arkona on the Island of Rgen, the strongest pagan fortress and temple in northern Europe.1169: Political disputes within the Pandya Empire sparks the decade-long Pandyan Civil War.1169: On May 1, the Norman invasion of Ireland begins. Richard fitzGilbert de Clare ('Strongbow') allies with the exiled Irish chief, Dermot MacMurrough, to help him recover his kingdom of Leinster.The defense of the Carroccio during the battle of Legnano (1176) by Amos Cassioli (18321891)1170: The Treaty of Sahagn is signed by Alfonso VIII of Castile and Alfonso II of Aragon. Based on the terms of the accord, Alfonso VIII agrees to provide Alfonso II with three hostages, to be used as tribute payments owed by Ibn Mardan of Valencia and Murcia.1170: On December 29, Thomas Becket is murdered in Canterbury Cathedral.1171: Saladin deposes the last Fatimid Caliph Al-'id and establishes the Ayyubid dynasty.1171: On November 11, Henry II of England lands in Ireland to assert his claim as Lord of Ireland.1172: The Pandyan city of Madurai is sacked by the Sinhalese army due to an attempt to drive off the rival throne claimant, Kulasekara Pandyan.1173: Sinhalese king Parakramabahu the Great gains a decisive victory by invading the Chola Empire as an ally of the Pandyas in the Pandyan Civil War.1174: On July 12, William I of Scotland is captured by the English in the Battle of Alnwick. He accepts the feudal overlordship of the English crown and pays ceremonial allegiance at York.1175: Hnen Shnin (Genk) founds the Jdo sh (Pure Land) sect of Buddhism.1175: The Treaty of Windsor is signed by King Henry II of England and the High King of Ireland, Ruaidr Ua Conchobair.1176: On May 29, Frederick Barbarossa's forces are defeated in the Battle of Legnano by the Lombard League which results in the emperor's acknowledgment of the pope's sovereignty over the Papal States and Alexander acknowledging the emperor's overlordship of the imperial Church.1176: On September 17, The Battle of Myriokephalon (Myriocephalum; Turkish: Miryakefalon Sava) is fought between the Byzantine Empire and the Seljuk Turks in Phrygia. It is a serious reversal for the Byzantine forces and will be the final, unsuccessful, effort by the Byzantines to recover the interior of Anatolia from the Seljuk Turks.1177: The Treaty or Peace of Venice is signed by the papacy and its allies, and Frederick I, Holy Roman Emperor. The Norman Kingdom of Sicily also participates in negotiations and the treaty thereby determines the political course of all of Italy for the next several years.1178: Chinese writer Zhou Qufei, a Guangzhou customs officer, writes of an island far west in the Indian Ocean (possibly Madagascar), from where people with skin "as black as lacquer" and with frizzy hair were captured and purchased as slaves by Arab merchants.1179: The Treaty of Cazola (Cazorla) is signed by Alfonso II of Aragon and Alfonso VIII of Castile, dividing Andalusia into separate zones of conquest for the two kingdoms, so that the work of the Reconquista would not be stymied by internecine feuding.1180: The Portuguese Navy defeats a Muslim fleet off the coast of Cape Espichel.11801185: the Genpei War in Japan.1181: Parakramabahu the Great conducts a large-scale raid on Burma, after a ship transporting a Sinhalese princess to the Khmer Empire is attacked by Burmese naval fleets.1182: Religious reformations of Theravada Buddhism in Pagan Burma under the patronage of Narapatisithu are continued with the end of the Polonnaruwa-Pagan War.1182: Revolt of the people of Constantinople against the Latins, whom they massacre, proclaiming Andronicus I Comnenus as co-emperor.1183: On January 25, the final Peace of Constance between Frederick Barbarossa, the pope and the Lombard towns is signed, confirming the Peace of Venice of 1177.1183: On September 24, Andronicus I Comnenus has his nephew Alexius II Comnenus strangled.1184: On March 24, Queen Tamar, King of Georgia, accedes to the throne as sole ruler after reigning with her father, George III, for six years.1184: Diet of Pentecost organised by Emperor Frederick I in Mainz.1185: The Uprising of Asen and Peter against the Byzantine Empire leads to the restoration of the Bulgarian Empire.1185: Andronicus I Comnenus is deposed and, on September 12, executed as a result of the Norman massacre of the Greeks of Thessalonika.1185: The cathedral school (Katedralskolan) in Lund, Sweden, is founded. The school is the oldest in northern Europe and one of the oldest in all of Europe.1185: Beginning in this year the Kamakura shogunate deprives the emperor of Japan of political power.1186: On January 27, the future Holy Roman Emperor Henry VI marries Constance of Sicily, the heiress to the Sicilian throne.1187: On July 4, in the Battle of Hattin, Saladin defeats the king of Jerusalem.1187: In August, the Swedish royal and commercial center Sigtuna is attacked by raiders from Karelia, Couronia, and/or Estonia.[3]1188: The Riah were introduced into the Habt and south of Tetouan by the Almohad caliph, Abu Yusuf Yaqub al-Mansur, and Jochem and Acem were introduced in Tamesna.[4]1189: On September 3, Richard I is crowned King of England at Westminster.1189: On November 11, William II of Sicily dies and is succeeded by his illegitimate cousin Tancred, Count of Lecce instead of Constance.11891192: The Third Crusade is an attempt by European leaders to wrest the Holy Land from Saladin.Richard I of England, or Richard the Lionheart.1190: On June 10, Emperor Frederick Barbarossa drowns in the River Salef, leaving the Crusader army under the command of the rivals Philip II of France and Richard I of England, which ultimately leads to the dissolution of the army.1191: Holy Roman Emperor Henry VI attacked the Kingdom of Sicily from May to August but fails and withdrawn, with Empress Constance captured (released 1192).1191: On September 7, Saladin is defeated by Richard I of England at the Battle of Arsuf.1192: In April, Isabella I begins her reign as Christian Queen of the Kingdom of Jerusalem1192: In the Battle of Jaffa, King Richard the Lionheart defeats Saladin.1192: In June, the Treaty of Ramla is signed by Saladin and Richard Lionheart. Under the terms of the agreement, Jerusalem will remain under Muslim control. However, the city will be open to Christian pilgrims. The Latin Kingdom is reduced to a coastal strip that extends from Tyre to Jaffa.1192: Minamoto no Yoritomo is appointed Sei-i Taishgun, "barbarian-subduing great general", shgun for short, the first military dictator to bear this title.1192: Sultan Shahbuddin Muhammad Ghori establishes the first Muslim empire in India for 14 years (11921206) by defeating Prithviraj Chauhan.1193: Nalanda, the great Indian Buddhist educational centre, is destroyed.1194: Emperor Henry VI conquers the Kingdom of Sicily.1195: On June 16, the struggle of Shamqori. Georgian forces annihilate the army of Abu Baqar.1198: The brethren of the Crusader hospital in Acre are raised to a military order of knights, the Teutonic Knights, formally known as the Order of the Knights of the Hospital of St. Mary of the Teutons in Jerusalem.1199: Pope Innocent III writes to Kaloyan, inviting him to unite the Bulgarian Church with the Roman Catholic Church.1200: Construction begins on the Grand Village of the Natchez near Natchez, Mississippi. This ceremonial center for the Natchez people is occupied and built until the early 17th century.[5]Eastern Hemisphere at the end of the 12th centuryChina is under the Northern Song dynasty. Early in the century, Zhang Zeduan paints Along the River During the Qingming Festival. It will later end up in the Palace Museum, Beijing.In southeast Asia, there is conflict between the Khmer Empire and the Champa. Angkor Wat is built under the Hindu king Suryavarman II. By the end of the century, the Buddhist Jayavarman VII becomes the ruler.Japan is in its Heian period. The Chj-jinbutsu-giga is made and attributed to Toba Sj. It ends up at the Kzan-ji, Kyoto.In Oceania, the Tui Tonga Empire expands to a much greater area.Europe undergoes the Renaissance of the 12th century. The blast furnace for the smelting of cast iron is imported from China, appearing around Lapphyttan, Sweden, as early as 1150.Alexander Neckam is the first European to document the mariner's compass, first documented by Shen Kuo during the previous century.Christian humanism becomes a self-conscious philosophical tendency in Europe. Christianity is also introduced to Estonia, Finland, and Karelia.The first medieval universities are founded. Pierre Abelard teaches.Middle English begins to develop, and literacy begins to spread outside the Church throughout Europe.[6] In addition, churchmen are increasingly willing to take on secular roles. By the end of the century, at least a third of England's bishops also act as royal judges in secular matters.[7]The Ars antiqua period in the history of the medieval music of Western Europe begins.The earliest recorded miracle play is performed in Dunstable, England.Gothic architecture and trouvre music begin in France.During the middle of the century, the Cappella Palatina is built in Palermo, Sicily, and the Madrid Skylitzes manuscript illustrates the Synopsis of Histories by John Skylitzes.Fire and plague insurance first become available in Iceland, and the first documented outbreaks of influenza there happens.The medieval state of Serbia is formed by Stefan Nemanja and then continued by the Nemanji dynasty.By the end of the century, both the Capetian dynasty and the House of Anjou are relying primarily on mercenaries in their militaries. Paid soldiers are available year-round, unlike knights who expected certain periods off to maintain their manor lifestyles.[8]In India, Hoysala architecture reaches its peak.In the Middle East, the icon of Theotokos of Vladimir is painted probably in Constantinople. Everything but the faces will later be retouched, and the icon will go to the Tretyakov Gallery of Moscow.The Georgian poet Shota Rustaveli composes his epic poem The Knight in the Panther's Skin.Shahab al-Din Suhrawardi founds his "school of illumination".In North Africa, the kasbah of Marrakesh is built, including the city gate Bab Agnaou and the Koutoubia mosque.In sub-Saharan Africa, Kente cloth is first woven.In France, the first piedfort coins were minted.The city of Tula burns down, marking the end of the Toltec EmpireIn West Africa the Ife Empire is established.See also: Timeline of historic inventions 12th century1104: The Venice Arsenal of Venice, Italy, is founded. It employed some 16,000 people for the mass production of sailing ships in large assembly lines, hundreds of years before the Industrial Revolution.1106: Finished building of Gelati.1107: The Chinese engineer Wu Deren combines the mechanical compass vehicle of the south-pointing chariot with the distance-measuring odometer device.1111: The Chinese Donglin Academy is founded.1165: The Liuhe Pagoda of Hangzhou, China, is built.1170: The Roman Catholic notion of Purgatory is defined.[9]1185: First record of windmills.Wikimedia Commons has media related to 12th century.^ Soekmono, R, Drs., Pengantar Sejarah Kebudayaan Indonesia 2, 2nd ed. Penerbit Kanisius, Yogyakarta, 1973, 5th reprint edition in 1988 p.57^ Britannica, T. Editors of Encyclopaedia (1998, July 20). Kairi. Encyclopedia Britannica.^ Enn Tarvel (2007). Sigtuna hukkumine. Archived 2017-10-11 at the Wayback Machine Haridus, 2007 (7-8), p 3841^ Notice sur les Arabes hilaliens. Ismal Hamet. p.248.^ Francine Weiss and Mark R. Barnes (May 3, 1989). "National Register of Historic Places Registration: Grand Village of the Natchez Site / Fatherland Plantation Site (22-Ad-501)" (pdf). National Park Service. and Accompanying 3 photos, from 1989.(680KB)^ Warren 1961, p.129.^ Warren 1961, p.159.^ Warren 1961, p.60-61.^ Le Goff, Jacques (1986). The Birth of Purgatory. Chicago: University of Chicago Press. ISBN0226470822.Warren, Wilfred Lewis (1961). King John. University of California Press. p.362. ISBN9780520036437. {{cite book}}: ISBN / Date incompatibility (help)Retrieved from " 4The following pages link to 12th century External tools(link counttransclusion countsorted list) See help page for transcluding these entriesShowing 50 items.View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)Antisemitism in Christianity (links | edit)Catharism (links | edit)List of decades, centuries, and millennia (links | edit)Dialect (links | edit)House of Habsburg (links | edit)House of Hohenzollern (links | edit)History of Mali (links | edit)Maimonides (links | edit)Passport (links | edit)Sumba (links | edit)Taoism (links | edit)Weregild (links | edit)Zanzibar (links | edit)20th century (links | edit)1040 (links | edit)15th century (links | edit)16th century (links | edit)17th century (links | edit)18th century (links | edit)14th century (links | edit)1st century (links | edit)13th century (links | edit)4th century (links | edit)11th century (links | edit)1282 (links | edit)7th century (links | edit)10th century (links | edit)9th century (links | edit)8th century (links | edit)6th century (links | edit)5th century (links | edit)3rd century (links | edit)2nd century (links | edit)4th century BC (links | edit)1st century BC (links | edit)2nd century BC (links | edit)3rd century BC (links | edit)5th century BC (links | edit)6th century BC (links | edit)21st century BC (links | edit)11th century BC (links | edit)1000s (decade) (links | edit)1040s (links | edit)1299 (links | edit)1154 (links | edit)1163 (links | edit)1160s (links | edit)1141 (links | edit)1135 (links | edit)1204 (links | edit)View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)Retrieved from " WhatLinksHere/12th_century"

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