

Appendix 1

Table A1 Research papers categorization by key findings, supported research question and type of study

No.	Article	Key findings	Supported research question	Type of study
1	Abdeen, W., Chen, X. and Unterkalmsteiner, M. (2023) ‘An approach for performance requirements verification and test environments generation’, <i>Requirements Engineering</i> , 28(1), pp. 117–144. Available at: https://doi.org/10.1007/s00766-022-00379-3 .	The PRO-TEST approach significantly enhances the identification, verification, and generation of performance-related test environments	RQ1, RQ4	empirical research
2	Abdelnabi, E.A., Maatuk, A.M. and Hagal, M. (2021) ‘Generating UML Class Diagram from Natural Language Requirements: A Survey of Approaches and Techniques’, in <i>IEEE Int. Maghreb Meet. Conf. Sci. Techniques Autom. Control Comput. Eng., MI-STA - Proc. 2021 IEEE 1st International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic Control and Computer Engineering, MI-STA 2021 - Proceedings</i> , Institute of Electrical and Electronics Engineers Inc., pp. 288–293. Available at: https://doi.org/10.1109/MI-STA52233.2021.9464433 .	Surveyed methods for generating UML class diagrams from NL requirements	RQ2, RQ3	literature review/survey
3	Abeba, G. and Alemneh, E. (2022) ‘Identification of Nonfunctional Requirement Conflicts: Machine Learning Approach’, in Berihun M.L. (ed.) <i>Lect. Notes Inst. Comput. Sci. Soc. Informatics Telecommun. Eng. Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering, LNICST</i> , Springer Science and Business Media Deutschland GmbH, pp. 435–445. Available at: https://doi.org/10.1007/978-3-030-93709-6_29 .	identifies conflicts in non-functional requirements, utilizing NLP for preprocessing and vectorization to enhance conflict resolution in software development	RQ2, RQ3	empirical research

4	Aceituna, D., Do, H. and Lee, S.-W. (2011) 'Interactive requirements validation for reactive systems through virtual requirements prototype', in Model-Driven Requir. Eng. Workshop, MoDRE. 2011 Model-Driven Requirements Engineering Workshop, MoDRE 2011, pp. 1–10. Available at: https://doi.org/10.1109/MoDRE.2011.6045361 .	Developed a virtual prototype for validating requirements in reactive systems, offering a cost-effective alternative to physical prototypes and reducing the time for stakeholder feedback.	RQ4	empirical research
5	Ahmad, A. et al. (2020) 'A Systematic Literature Review on Using Machine Learning Algorithms for Software Requirements Identification on Stack Overflow', Security and Communication Networks, 2020. Available at: https://doi.org/10.1155/2020/8830683 .	Reviewed the use of ML algorithms like LDA for identifying software requirements on Stack Overflow, highlighting effectiveness and limitations.	RQ1, RQ4	literature review/survey
6	Ahmad, A. et al. (2019) 'An empirical evaluation of machine learning algorithms for identifying software requirements on stack overflow: Initial results', in Li W. and Babu M.S.P. (eds) Proc.IEEE Int. Conf. Software Eng. Serv. Sci., ICSESS. Proceedings of the IEEE International Conference on Software Engineering and Service Sciences, ICSESS, IEEE Computer Society, pp. 689–693. Available at: https://doi.org/10.1109/ICSESS47205.2019.9040720 .	Evaluated ML algorithms for identifying software requirements on Stack Overflow, highlighting the effectiveness of LDA topic modeling.	RQ1, RQ4	empirical research
7	Ahmed, H., Hussain, A. and Baharom, F. (2018) 'The role of Natural Language Processing in requirement engineering', International Journal of Engineering and Technology(UAE), 7(4.19 Special Issue 19), pp. 168–171.	Reviewed various NLP approaches to address the ambiguities of natural language in software requirements specification, highlighting the role of NLP in improving requirement analysis.	RQ1, RQ2	tool or prototype development
8	Ahmed, M.A. et al. (2021) 'A Novel Natural Language Processing approach to automatically Visualize Entity-Relationship Model from Initial Software Requirements', in Int. Conf. Commun. Technol., ComTech. 3rd International Conference on Communication Technologies, ComTech 2021, Institute of Electrical and Electronics Engineers Inc., pp. 39–43. Available at: https://doi.org/10.1109/ComTech52583.2021.9616949 .	Developed a fully automated NLP approach to generate ER models from software requirements, validated through benchmark case studies.	RQ2, RQ4	case study

9	Ahmed, M.A. et al. (2017) 'A novel natural language processing (NLP) approach to automatically generate conceptual class model from initial software requirements', in Kim K. and Joukov N. (eds) Lect. Notes Electr. Eng. Lecture Notes in Electrical Engineering, Springer Verlag, pp. 476–484. Available at: https://doi.org/10.1007/978-981-10-4154-9_55 .	Proposed a fully automated NLP approach to generate conceptual class models from software requirements, showing improved automation and accuracy.	RQ1, RQ2	tool or prototype development
10	Ahmed, S., Ahmed, A. and Eisty, N.U. (2022) 'Automatic Transformation of Natural to Unified Modeling Language: A Systematic Review', in Jo J. et al. (eds) IEEE/ACIS Int. Conf. Softw. Eng. Res., Manag. Appl., SERA. 2022 IEEE/ACIS 20th International Conference on Software Engineering Research, Management and Applications, SERA 2022, Institute of Electrical and Electronics Engineers Inc., pp. 112–119. Available at: https://doi.org/10.1109/SERA54885.2022.9806783 .	highlighting the need for a common dataset and evaluation framework	RQ1, RQ3	empirical research
11	Airlangga, G. and Liu, A. (2022) 'Investigating Software Domain Impact in Requirements Quality Attributes Prediction', Journal of Information Science and Engineering, 38(2), pp. 295–316. Available at: https://doi.org/10.6688/JISE.202203_38(2).0002 .	Investigated the impact of software domain in quality attributes prediction using deep learning	RQ4	empirical research
12	Akour, M. et al. (2016) 'An effective approach for transforming use cases specifications into class diagram', Advanced Science Letters, 22(10), pp. 2972–2976. Available at: https://doi.org/10.1166/asl.2016.7070 .	Suggested using NLP techniques to transform use case specifications into class diagrams, identifying classes, relationships, and internal structures, which aids in bridging the gap between software requirements and design.	RQ2	empirical research
13	Al Kilani, N., Tailakh, R. and Hanani, A. (2019) 'Automatic Classification of Apps Reviews for Requirement Engineering: Exploring the Customers Need from Healthcare Applications', in Alsmirat M. and Jararweh Y. (eds) Int. Conf. Soc. Networks Anal., Manag. Secur., SNAMS. 2019 6th International Conference on Social Networks Analysis, Management and Security, SNAMS 2019, Institute of Electrical and Electronics Engineers Inc., pp. 541–548. Available at: https://doi.org/10.1109/SNAMS.2019.8931820 .	Used machine learning and NLP to classify user reviews of healthcare apps into categories like bugs and feature requests, improving information extraction for RE.	RQ1, RQ4	empirical research

14	AlDhafer, O., Ahmad, I. and Mahmood, S. (2022) 'An end-to-end deep learning system for requirements classification using recurrent neural networks', <i>Information and Software Technology</i> , 147. Available at: https://doi.org/10.1016/j.infsof.2022.106877 .	This study introduces a deep learning system using BiGRU for multilabel classification of software requirements	RQ2, RQ3	empirical research
15	Alhoshan, W., Batista-Navarro, R. and Zhao, L. (2019b) 'Using frame embeddings to identify semantically related software requirements', in Spoletini P. et al. (eds) <i>CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS</i> . Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85068085263&partnerID=40&md5=f69694214eacec0d57a8097e862dfe5f .	Introduced a method using frame embeddings to measure semantic relatedness between software requirements, showing substantial improvement over baseline systems in identifying related requirements.	RQ2, RQ3	empirical research
16	Alhoshan, W., Batista-Navarro, R. and Zhao, L. (2018) 'Towards a corpus of requirements documents enriched with semantic frame annotations', in Amyot D., Maalej W., and Ruhe G. (eds) <i>Proc. - IEEE Int. Requir. Eng. Conf., RE. Proceedings - 2018 IEEE 26th International Requirements Engineering Conference, RE 2018, Institute of Electrical and Electronics Engineers Inc.</i> , pp. 428–431. Available at: https://doi.org/10.1109/RE.2018.00055 .	Developed a corpus of requirements documents annotated with semantic frames to support semantic parsing in requirements engineering, aiming to improve the formalization of natural language requirements.	RQ1, RQ2	empirical research
17	Alhoshan, W., Batista-Navarro, R. and Zhao, L. (2019a) 'Semantic frame embeddings for detecting relations between software requirements', in <i>IWCS - Proc. Int. Conf. Comput. Semant. - Stud. Pap. IWCS 2019 - Proceedings of the 13th International Conference on Computational Semantics - Student Papers, Association for Computational Linguistics (ACL)</i> , pp. 44–51. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85096988497&partnerID=40&md5=27e90fb3bde9d90ec9a8da379e40b1dd .	Describes a resource using frame embeddings trained on a large corpus of requirements to support the detection of relations between software requirements, enhancing RE analysis tasks.	RQ2, RQ4	tool or prototype development
18	Al-Hroob, A., Imam, A.T. and Al-Heisa, R. (2018) 'The use of artificial neural networks for extracting actions and actors from requirements document', <i>Information and Software Technology</i> , 101, pp. 1–15. Available at: https://doi.org/10.1016/j.infsof.2018.04.010 .	Explored the combination of NLP and ANNs to automatically extract actors and actions from natural language requirements, achieving varying	RQ1, RQ3	empirical research

		levels of precision and recall across different use cases.		
19	Alkhader, Y., Hudaib, A. and Hammo, B. (2006) 'Experimenting with extracting software requirements using NLP approach', in Int Conf Inf. Autom., ICIA. 2nd International Conference on Information and Automation, ICIA 2006, pp. 349–354. Available at: https://doi.org/10.1109/ICINFA.2006.374136 .	Presented a framework that automates the generation of UML class diagrams from natural language software requirements.	RQ2	case study
20	Almanaseer, A.M. et al. (2022) 'A proposed model for eliminating non-functional requirements in Agile Methods using natural language processes', in Int. Conf. Emerg. Trends Comput. Eng. Appl., ETCEA - Proc. 2022 International Conference on Emerging Trends in Computing and Engineering Applications, ETCEA 2022 - Proceedings, Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.1109/ETCEA57049.2022.10009796 .	Introduces a model to automatically elicit nonfunctional requirements in agile settings, significantly reducing time and effort.	RQ1, RQ3	empirical research
21	Almazroi, A.A. et al. (2021) 'Class Diagram Generation from Text Requirements: An Application of Natural Language Processing', in Signals Commun. Technol. Springer Science and Business Media Deutschland GmbH, pp. 55–79. Available at: https://doi.org/10.1007/978-3-030-79778-2_4 .	Proposed a new NLP method to generate UML class diagrams from textual requirements	RQ2	empirical research
22	Alzayed, A. and Al-Hunaiyyan, A. (2021) 'A Bird's Eye View of Natural Language Processing and Requirements Engineering', International Journal of Advanced Computer Science and Applications, 12(5), pp. 81–90. Available at: https://doi.org/10.14569/IJACSA.2021.0120512 .	Comprehensive review indicates NLP's pervasive role in all phases of RE, underlining the need for continued human-NLP interaction for addressing ambiguities.	RQ1, RQ2, RQ4	empirical research
23	Amalia, A.E. and Na'An, M.Z. (2021) 'Mining User Reviews for Software Requirements of A New Mobile Banking Application', in Int. Semin. Res. Inf. Technol. Intell. Syst., ISRITI. 2021 4th International Seminar on Research of Information Technology and Intelligent Systems, ISRITI 2021, Institute of Electrical and Electronics Engineers Inc., pp. 86–90. Available at: https://doi.org/10.1109/ISRITI54043.2021.9702813 .	Demonstrated the use of NLP to mine user reviews for software requirement elicitation, identifying the potential and limitations in classification accuracy.	RQ2, RQ4	case study
24	Ansari, A. et al. (2017) 'Constructing Test cases using Natural Language Processing', in Ramesh P.L.N. and Moorthi M. (eds) Proc. IEEE Int.	Developed a system for automatic generation of test cases	RQ1, RQ2	tool or prototype development

	Conf. Adv. Electr. Electron., Inf., Commun. Bio-Inf., AEEICB. Proceedings of the 3rd IEEE International Conference on Advances in Electrical and Electronics, Information, Communication and Bio-Informatics, AEEICB 2017, Institute of Electrical and Electronics Engineers Inc., pp. 95–99. Available at: https://doi.org/10.1109/AEEICB.2017.7972390 .	from SRS documents using NLP, aimed at reducing effort and time for testers.		
25	Apaza, R.D.G. et al. (2018) ‘ERS-Tool: Hybrid model for software requirements elicitation in Spanish language’, in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery, pp. 27–30. Available at: https://doi.org/10.1145/3220228.3220255 .	Proposes a controlled syntax and writing rules adapted to the Spanish language to improve software requirements elicitation, showing high accuracy and reduced ambiguity in a case study.	RQ1, RQ3	tool or prototype development
26	Apte, S. et al. (2023) ‘Automatic Extraction of Software Requirements Using Machine Learning’, in Choudrie J. et al. (eds) Lect. Notes Networks Syst. Lecture Notes in Networks and Systems, Springer Science and Business Media Deutschland GmbH, pp. 361–370. Available at: https://doi.org/10.1007/978-981-99-3758-5_33 .	Compared machine learning algorithms to classify software requirements from SRS documents, assessing their precision and accuracy.	RQ1, RQ4	empirical research
27	Arnon, B., Harel, D. and Gordon-Kiwkowitz, M. (2020) ‘Using system models to resolve co-reference in translating natural language requirements into code’, in IADIS Int. Conf. Inf. Syst. , IS. Proceedings of the 13th IADIS International Conference Information Systems 2020, IS 2020, IADIS, pp. 115–122. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85086572709&partnerID=40&md5=98c565c794551e9bc96c14b0e491423e .	Proposed a system-model-based anaphora resolution approach to improve the translation of natural language requirements into executable code.	RQ1, RQ3	tool or prototype development
28	Arora, C. et al. (2014) ‘Improving requirements glossary construction via clustering: Approach and industrial case studies’, in Int. Symp. Empir. Softw. Eng. Meas. International Symposium on Empirical Software Engineering and Measurement, IEEE Computer Society. Available at: https://doi.org/10.1145/2652524.2652530 .	Develops an automated approach for extracting and clustering glossary terms from natural language requirements documents, demonstrating higher accuracy and usefulness in industrial case studies.	RQ1, RQ3	tool or prototype development

29	Arora, C. et al. (2017) 'Automated Extraction and Clustering of Requirements Glossary Terms', IEEE Transactions on Software Engineering, 43(10), pp. 918–945. Available at: https://doi.org/10.1109/TSE.2016.2635134 .	Automated the identification and clustering of glossary terms to improve the construction of requirements glossaries.	RQ2	empirical research
30	Arruda, D. et al. (2019) 'A Chatbot for Goal-Oriented Requirements Modeling', in Misra S. et al. (eds) Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Verlag, pp. 506–519. Available at: https://doi.org/10.1007/978-3-030-24305-0_38 .	Describes a chatbot (KAOSbot) that assists novice requirements engineers in creating KAOS models using NLP, showing its perceived effectiveness through quasi-experimental evaluation.	RQ1, RQ2	case study
31	Asyrofi, R., Siahaan, D.O. and Priyadi, Y. (2020) 'Extraction Dependency Based on Evolutionary Requirement Using Natural Language Processing', in Wibowo F.W. (ed.) Int. Semin. Res. Inf. Technol. Intell. Syst., ISRITI. 2020 3rd International Seminar on Research of Information Technology and Intelligent Systems, ISRITI 2020, Institute of Electrical and Electronics Engineers Inc., pp. 332–337. Available at: https://doi.org/10.1109/ISRITI51436.2020.9315489 .	Proposed a method to identify dependencies among requirements to address changes in SRS, aiming to improve requirement specification accuracy.	RQ1, RQ3	empirical research
32	Atoum, I. (2019) 'A Scalable Operational Framework for Requirements Validation Using Semantic and Functional Models', in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery, pp. 1–6. Available at: https://doi.org/10.1145/3305160.3305166 .	Proposes a framework using semantic similarity models and Integration Functional Definition methods to automate and enhance the productivity of requirements validation.	RQ2, RQ3	tool or prototype development
33	Bajaj, D. et al. (2022) 'MUCE: a multilingual use case model extractor using GPT-3', International Journal of Information Technology (Singapore), 14(3), pp. 1543–1554. Available at: https://doi.org/10.1007/s41870-022-00884-2 .	Presents a GPT-3 based multilingual tool for automatically extracting use case models from requirements, improving speed and accuracy across languages.	RQ1, RQ3, RQ4	tool or prototype development

34	Bajwa, I.S. et al. (2011) 'A controlled natural language interface to class models', in ICEIS - Proc. Int. Conf. Enterpr. Inf. Syst. ICEIS 2011 - Proceedings of the 13th International Conference on Enterprise Information Systems, pp. 102–110. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84862129022&partnerID=40&md5=95599f10d49408ecfed5f14a39125664 .	Presented a method to generate class models from NL requirements using a controlled natural language interface, reducing ambiguities and improving accuracy in automated model generation.	RQ1	empirical research
35	Bajwa, I.S., Samad, A. and Mumtaz, S. (2009) 'Object oriented software modeling using NLP based knowledge extraction', European Journal of Scientific Research, 35(1), pp. 22–33.	Discussed an automated system that uses NLP to convert NL requirements into object-oriented models and generate code, enhancing the transition from requirements to design.	RQ4	empirical research
36	Bakar, N.H. et al. (2016) 'Extracting features from online software reviews to aid requirements reuse', Applied Soft Computing Journal, 49, pp. 1297–1315. Available at: https://doi.org/10.1016/j.asoc.2016.07.048 .	Proposed a semi-automated method, FENL, to extract software features from online reviews to initiate the requirements reuse process, demonstrating effectiveness in feature extraction and grouping.	RQ4	empirical research
37	Bäumer, F.S., Dollmann, M. and Geierhos, M. (2017) 'Studying software descriptions in sourceforge and app stores for a better understanding of real-life requirements', in Sarro F. et al. (eds) WAMA - Proc. ACM SIGSOFT Int. Workshop App Market Anal., Co-located FSE. WAMA 2017 - Proceedings of the 2nd ACM SIGSOFT International Workshop on App Market Analytics, Co-located with FSE 2017, Association for Computing Machinery, Inc, pp. 19–25. Available at: https://doi.org/10.1145/3121264.3121269 .	Analyzed software descriptions to understand the characteristics of functional requirements and enhance requirement elicitation and refinement.	RQ1, RQ2	case study
38	Bäumer, F.S. and Geierhos, M. (2018) 'NLP in OTF Computing: Current Approaches and Open Challenges', in Damasevicius R. and Vasiljeviene G. (eds) Commun. Comput. Info. Sci. Communications in Computer and Information Science, Springer Verlag, pp. 559–570. Available at: https://doi.org/10.1007/978-3-319-99972-2_46 .	Reviews the state of the art in OTF Computing for automatic detection and compensation of inaccuracies in natural	RQ2, RQ4	empirical research

		language service descriptions, identifying open challenges.		
39	Bäumer, F.S. and Geierhos, M. (2016) 'Running out of words: How similar user stories can help to elaborate individual natural language requirement descriptions', in Dregvaite G. and Damasevicius R. (eds) Commun. Comput. Info. Sci. Communications in Computer and Information Science, Springer Verlag, pp. 549–558. Available at: https://doi.org/10.1007/978-3-319-46254-7_44 .	Presented an approach to clarify requirements by detecting knowledge gaps in user stories, using predicate argument structures and context information to provide tailored suggestions for more precise descriptions.	RQ4	empirical research
40	Bäumer, F.S., Kersting, J. and Geierhos, M. (2019) 'Natural language processing in OTF computing: Challenges and the need for interactive approaches', Computers, 8(1). Available at: https://doi.org/10.3390/computers8010022 .	Discussed challenges and proposed interactive approaches in OTF Computing to handle inaccuracies and incompleteness in requirement descriptions.	RQ1, RQ4	empirical research
41	Berhanu, F. and Alemneh, E. (2023) 'Classification and Prioritization of Requirements Smells Using Machine Learning Techniques', in Alemneh E., Nigussie E., and Mekuria F. (eds) Int. Conf. Inf. Commun. Technol. Dev. Africa, ICT4DA. 2023 International Conference on Information and Communication Technology for Development for Africa, ICT4DA 2023, Institute of Electrical and Electronics Engineers Inc., pp. 49–54. Available at: https://doi.org/10.1109/ICT4DA59526.2023.10302263 .	Developed a machine learning-based approach for the classification and prioritization of requirement smells, using textual requirements preprocessing and feature extraction techniques such as TF-IDF and BOW	RQ4	empirical research
42	Bharadwaj, A.K., Agrawal, V.K. and Jayashree, R. (2023) 'Transforming Natural Language Requirements into Petri Nets - A Semi-Automated Approach', in Stephen J. et al. (eds) Int. Conf. Adv. Comput., Control, Telecommun. Technol., ACT. 14th International Conference on Advances in Computing, Control, and Telecommunication Technologies, ACT 2023, Grenze Scientific Society, pp. 2176–2188. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85174415416&partnerID=40&md5=88c458332485b32dd085cd36be25b116 .	Proposed a methodology to transform natural language requirements into Petri nets, facilitating better modeling and error analysis.	RQ1, RQ4	empirical research

43	Bhatia, J., Breaux, T.D. and Schaub, F. (2016) ‘Mining privacy goals from privacy policies using hybridized task recomposition’, ACM Transactions on Software Engineering and Methodology, 25(3). Available at: https://doi.org/10.1145/2907942 .	Introduced a semi-automated framework combining crowd-sourced annotations and NLP techniques to extract privacy goals from policies, showing improvements in coverage, precision, and recall.	RQ2	empirical research
44	Bhatia, K., Mishra, S. and Sharma, A. (2020) ‘Clustering glossary terms extracted from large-sized software requirements using fasttext’, in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery. Available at: https://doi.org/10.1145/3385032.3385039 .	Utilized neural word embeddings for clustering glossary terms from large-sized requirements documents based on semantic similarity.	RQ2, RQ4	empirical research
45	Biébow, B. and Szulman, S. (1994) ‘Acquisition and validation of software requirements’, Knowledge Acquisition, 6(4), pp. 343–367. Available at: https://doi.org/10.1006/knac.1994.1017 .	Presents DASERT, a knowledge-based tool that uses natural language processing and knowledge base engineering to acquire and validate functional requirements from informal natural language inputs.	RQ4	empirical research
46	Bozyigit, F., Aktaş, Ö. and Kiliç, D. (2019) ‘Automatic concept identification of software requirements in Turkish’, Turkish Journal of Electrical Engineering and Computer Sciences, 27(1), pp. 453–470. Available at: https://doi.org/10.3906/elk-1803-172 .	Proposes a model for automatically identifying concept elements from Turkish software requirements, demonstrating high performance in transforming requirements into UML class diagrams.	RQ1, RQ2	tool or prototype development
47	Bras, M. and Toussaint, Y. (1993) ‘Artificial intelligence tools for software engineering: Processing natural language requirements’, in Appl Artif Intell Eng. Applications of Artificial Intelligence in Engineering, Publ by Computational Mechanics Publ, pp. 275–290. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-0027237982&partnerID=40&md5=e3e86126342cdfc09cf6b1096263492e .	Proposes using linguistic engineering tools to build semantic representations of software requirements, then using AI tools to handle these representations to assist engineers in	RQ4	empirical research

		defining traceability links between requirements.		
48	Budake, R., Bhoite, S. and Kharade, K. (2023b) 'Identification and Classification of Functional and Nonfunctional Software Requirements Using Machine Learning', in Doss A.S.A., Short M., and Schilberg D. (eds) AIP Conf. Proc. AIP Conference Proceedings, American Institute of Physics Inc. Available at: https://doi.org/10.1063/5.0178116 .	Focuses on classification and thematic analysis of NLP applications in SRE, examining the use of AI and machine learning	RQ2, RQ3	empirical research
49	Budake, R., Bhoite, S. and Kharade, K. (2023a) 'A Study of AI-based Techniques for Requirement Analysis in Software Engineering', in Doss A.S.A., Short M., and Schilberg D. (eds) AIP Conf. Proc. AIP Conference Proceedings, American Institute of Physics Inc. Available at: https://doi.org/10.1063/5.0178114 .	Discussed the application of AI in requirement analysis, identifying potential AI techniques to address common issues during the SDLC process.	RQ1, RQ3	empirical research
50	Bugayenko, Y. (2021) 'Combining object-oriented paradigm and controlled natural language for requirements specification', in Bugayenko Y. et al. (eds) BCNC - Proc. ACM SIGPLAN Int. Workshop Beyond Code: No Code, co-located SPLASH. BCNC 2021 - Proceedings of the 1st ACM SIGPLAN International Workshop on Beyond Code: No Code, co-located with SPLASH 2021, Association for Computing Machinery, Inc, pp. 11–17. Available at: https://doi.org/10.1145/3486949.3486963 .	Developed a controlled natural language that compiles into UML, bridging the gap between technical and non-technical stakeholders.	RQ3, RQ4	tool or prototype development
51	Carrillo De Gea, J.M. et al. (2016) 'Co-located and distributed natural-language requirements specification: Traditional versus reuse-based techniques', Journal of Software: Evolution and Process, 28(3), pp. 205–227. Available at: https://doi.org/10.1002/smr.1772 .	Explored traditional and reuse-based requirements specification techniques in both co-located and distributed settings, finding that reuse techniques can improve productivity and reduce perceived difficulty in co-located settings.	RQ2, RQ4	empirical research
52	Carver, J.C., Minku, L.L. and Penzenstadler, B. (2017) 'Requirements, Human Values, and the Development Technology Landscape', in IEEE Software. IEEE Software, IEEE Computer Society, pp. 13–15. Available at: https://doi.org/10.1109/MS.2017.6 .	Explores current trends in software engineering research, including performance and security requirements, the integration of human values into	RQ1, RQ2	empirical research

		software, and the broader software development technology landscape.		
53	Cascini, G., Fantechi, A. and Spinicci, E. (2004) ‘Natural language processing of patents and technical documentation’, Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics). Edited by Marinai S. et al., 3163, pp. 508–520. Available at: https://doi.org/10.1007/978-3-540-28640-0_48 .	Described the application of NLP for functional analysis of patents and technical documentation using Subject-Action-Object (SAO) triples to extract and analyze interactions among entities, which is also applicable to software requirements documents.	RQ2	empirical research
54	Chao, C., Yang, Q. and Tu, X. (2022) ‘Research on Test Case Generation Method of Airborne Software Based on NLP’, in Niu S. and Sang J. (eds) CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS, pp. 28–37. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85144615482&partnerID=40&md5=ee069704eee9940b69c64f7ed714744d .	Proposed a Bi-LSTM-CRF model for generating test cases for airborne software, achieving high accuracy and reducing manual effort.	RQ1, RQ4	empirical research
55	Chatzipetrou, P., Unterkalmsteiner, M. and Gorschek, T. (2019) ‘Requirements’ Characteristics: How do they Impact on Project Budget in a Systems Engineering Context?’, in Staron M., Capilla R., and Skavhaug A. (eds) Proc. - Euromicro Conf. Softw. Eng. Adv. Appl., SEAA. Proceedings - 45th Euromicro Conference on Software Engineering and Advanced Applications, SEAA 2019, Institute of Electrical and Electronics Engineers Inc., pp. 260–267. Available at: https://doi.org/10.1109/SEAA.2019.00048 .	Analyzed the impact of different characteristics of system requirements on project budget and change requests, providing insights into the cost implications of software requirements quality.	RQ3, RQ4	empirical research
56	Chaudhri, V.K., Dinesh, N. and Inclezan, D. (2013) ‘Three lessons in creating a knowledge base to enable reasoning, explanation and dialog’, in Schuller P. and Baral C. (eds) CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS, pp. 7–26. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84924363454&partnerID=40&md5=be2ef6ebfe3ae9219d6a00c3b28b2a56 .	Discussed the development of a knowledge base from a biology textbook, highlighting key strategies for extracting and structuring knowledge to support reasoning and explanations, thereby enhancing	RQ2	empirical research

		the understanding and use of automated methods in knowledge generation.		
57	Chen, X. et al. (2023) 'NL2PD: A Tool for Problem Diagram Generation from Requirements in Natural Language', in Schneider K., Dalpiaz F., and Horkoff J. (eds) Proc. Int. Conf. Requir. Eng. Proceedings of the IEEE International Conference on Requirements Engineering, IEEE Computer Society, pp. 361–362. Available at: https://doi.org/10.1109/RE57278.2023.00052 .	constructing problem diagrams from requirements	RQ2	case study, tool or prototype development
58	Choi, S., Park, S. and Sugumaran, V. (2006) 'Function point extraction method from goal and scenario based requirements text', in Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Verlag, pp. 12–24. Available at: https://doi.org/10.1007/11765448_2 .	Explored a method to extract function points from requirements texts to estimate software development cost and schedule, establishing traceability between function points and requirements text.	RQ4	empirical research
59	Chow, M.Y. (2023) 'Analysis of Embedded System's Functional Requirement using BERT-based Name Entity Recognition for Extracting IO Entities', Journal of Information Processing, 31, pp. 143–153. Available at: https://doi.org/10.2197/ipsjip.31.143 .	BERT model effectively recognizes IO entities in embedded systems, enhancing industrial productivity.	RQ3, RQ4	empirical research
60	Chu, M.-H. et al. (2017) 'USL: Towards precise specification of use cases for model-driven development', in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery, pp. 401–408. Available at: https://doi.org/10.1145/3155133.3155194 .	Introduced the Use case Specification Language (USL) to enable precise specification of use cases and facilitate model-driven development.	RQ1, RQ2	tool or prototype development
61	Corral, A., Sanchez, L.E. and Antonelli, L. (2022) 'Building an integrated requirements engineering process based on Intelligent Systems and Semantic Reasoning on the basis of a systematic analysis of existing proposals', Journal of Universal Computer Science, 28(11), pp. 1136–1168. Available at: https://doi.org/10.3897/jucs.78776 .	Proposed a new methodology using NLP and ontologies for an integrated requirements engineering process	RQ1, RQ2	empirical research, conceptual methodology
62	Cruz, B.D. et al. (2017) 'Detecting Vague Words & Phrases in Requirements Documents in a Multilingual Environment', in Proc. - IEEE Int. Requir. Eng. Conf., RE. Proceedings - 2017 IEEE 25th International	Developed approaches to automatically identify vagueness in multilingual requirements	RQ1, RQ2	empirical research

	Requirements Engineering Conference, RE 2017, Institute of Electrical and Electronics Engineers Inc., pp. 233–242. Available at: https://doi.org/10.1109/RE.2017.24 .	documents, enhancing maintenance and translation practices.		
63	Da Silva, M.C., Cizotto, A.A.J. and Paraiso, E.C. (2020) ‘A Developer Recommendation Method Based on Code Quality’, in Proc Int Jt Conf Neural Networks. Proceedings of the International Joint Conference on Neural Networks, Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.1109/IJCNN48605.2020.9207116 .	Developed a method to assign change requests based on developer profiles and code quality metrics, showing improvements over traditional methods.	RQ1, RQ3	empirical research
64	Dalpiaz, F. et al. (2018) ‘Natural Language Processing for Requirements Engineering: The Best Is Yet to Come’, IEEE Software, 35(5), pp. 115–119. Available at: https://doi.org/10.1109/MS.2018.3571242 .	Reviewed the use of NLP in RE, summarizing a workshop discussion on future directions in the integration of NLP and RE.	RQ1, RQ4	literature review/survey
65	Dalpiaz, F. et al. (2019) ‘Detecting terminological ambiguity in user stories: Tool and experimentation’, Information and Software Technology, 110, pp. 3–16. Available at: https://doi.org/10.1016/j.infsof.2018.12.007 .	Explored a tool-supported approach combining NLP and information visualization to identify terminological ambiguities in software requirements, comparing its effectiveness with manual inspection.	RQ2, RQ4	case study
66	Dalpiaz F. et al. (eds) (2019) ‘CEUR Workshop Proceedings’, in CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85068041763&partnerID=40&md5=a3b5b0f353a1bd2c4471c4b7e4283caf .		RQ1, RQ2, RQ3	empirical research, tool or prototype development, literature review/survey
67	Das, S. et al. (2023) ‘Zero-shot Learning for Named Entity Recognition in Software Specification Documents’, in Schneider K., Dalpiaz F., and Horkoff J. (eds) Proc. Int. Conf. Requir. Eng. Proceedings of the IEEE International Conference on Requirements Engineering, IEEE Computer Society, pp. 100–110. Available at: https://doi.org/10.1109/RE57278.2023.00019 .	Implemented zero-shot learning approaches for NER in requirements engineering, achieving high accuracy in entity recognition without labeled data.	RQ2	empirical research
68	Dave, D. and Anu, V. (2022) ‘Identifying Functional and Non-functional Software Requirements from User App Reviews’, in Chakrabarti S. et al.	Proposed ML models to extract and classify software	RQ1, RQ2	case study

	(eds) IEEE Int. IOT, Electron. Mechatronics Conf., IEMTRONICS. 2022 IEEE International IOT, Electronics and Mechatronics Conference, IEMTRONICS 2022, Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.1109/IEMTRONICS55184.2022.9795770 .	requirements from user app reviews		
69	Deeptimahanti, D.K. and Sanyal, R. (2009) 'An innovative approach for generating static UML models from natural language requirements', in Kim T. et al. (eds) Commun. Comput. Info. Sci. Communications in Computer and Information Science, pp. 147–163. Available at: https://doi.org/10.1007/978-3-642-10242-4_13 .	Proposed a semi-automated technique to generate UML models from natural language requirements using NLP, focusing on generating use-case diagrams and analysis class models, which also provides requirement traceability.	RQ2	empirical research
70	Deeptimahanti, D.K. and Sanyal, R. (2011) 'Semi-automatic generation of UML models from natural language requirements', in Proc. India Softw. Eng. Conf., ISEC. Proceedings of the 4th India Software Engineering Conference 2011, ISEC'11, pp. 165–174. Available at: https://doi.org/10.1145/1953355.1953378 .	Developed a tool, SUGAR, that generates static UML models from natural language requirements using NLP tools, enhancing the integration of requirement analysis and design phases with improved accuracy and usability.	RQ2	empirical research
71	Delaney, S., Ki Chan, C.C. and Smith, D. (2018) 'Natural language processing for productivity metrics for software development profiling in enterprise applications', in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery, pp. 83–87. Available at: https://doi.org/10.1145/3299819.3299830 .	Utilized NLP for defining productivity metrics in software development, aiming to objectively measure and improve productivity.	RQ1, RQ4	tool or prototype development
72	Deshpande, G. (2019) 'SReYantra: Automated software requirement inter-dependencies elicitation, analysis and learning', in Proc. - IEEE/ACM Int. Conf. Softw. Eng.: Companion, ICSE-Companion. Proceedings - 2019 IEEE/ACM 41st International Conference on Software Engineering: Companion, ICSE-Companion 2019, Institute of Electrical and Electronics Engineers Inc., pp. 186–187. Available at: https://doi.org/10.1109/ICSE-Companion.2019.00076 .	Addressed challenges in eliciting, analyzing, and maintaining requirement inter-dependencies using NLP and verb classifiers, aiming to assist project managers in making effective decisions.	RQ1, RQ3	tool or prototype development

73	Diamantopoulos, T. et al. (2017) ‘Software requirements as an application domain for natural language processing’, <i>Language Resources and Evaluation</i> , 51(2), pp. 495–524. Available at: https://doi.org/10.1007/s10579-017-9381-z .	Explored the use of semantic role labeling to map functional requirements to formal models, facilitating early detection of issues and software reuse.	RQ1, RQ2	empirical research
74	Do, Q.A. and Bhowmik, T. (2018) ‘Automated generation of creative software requirements: A data-driven approach’, in Honavar V. et al. (eds) <i>WASPI - Proc. ACM SIGSOFT Int. Workshop Autom. Specif. Inference, Co-located FSE. WASPI 2018 - Proceedings of the 1st ACM SIGSOFT International Workshop on Automated Specification Inference, Co-located with FSE 2018</i> , Association for Computing Machinery, Inc, pp. 9–12. Available at: https://doi.org/10.1145/3278177.3278180 .	Proposed a system using Hidden Markov Model to generate creative software requirements, demonstrating potential to aid advanced feature generation.	RQ1, RQ4	case study
75	Dollmann, M. and Geierhos, M. (2016) ‘On- And off-topic classification and semantic annotation of user-generated software requirements’, in <i>EMNLP - Conf. Empir. Methods Nat. Lang. Process., Proc. EMNLP 2016 - Conference on Empirical Methods in Natural Language Processing, Proceedings</i> , Association for Computational Linguistics (ACL), pp. 1807–1816. Available at: https://doi.org/10.18653/v1/d16-1186 .	REaCT1 was developed to identify and semantically annotate on-topic parts of user-generated software requirements using NLP.	RQ2	empirical research
76	Dwarakanath, A., Ramnani, R.R. and Sengupta, S. (2013) ‘Automatic extraction of glossary terms from natural language requirements’, in <i>IEEE Int. Requir. Eng. Conf., RE - Proc. 2013 21st IEEE International Requirements Engineering Conference, RE 2013 - Proceedings</i> , IEEE Computer Society, pp. 314–319. Available at: https://doi.org/10.1109/RE.2013.6636736 .	Presented a method for extracting glossary terms from natural language requirements using linguistic techniques to handle ambiguities and identify terms with high precision.	RQ2	empirical research
77	Ebrahimi, A.M. and Barforoush, A.A. (2019) ‘Preprocessing Role in Analyzing Tweets Towards Requirement Engineering’, in <i>ICEE - Iranian Conf. Electr. Eng. ICEE 2019 - 27th Iranian Conference on Electrical Engineering</i> , Institute of Electrical and Electronics Engineers Inc., pp. 1905–1911. Available at: https://doi.org/10.1109/IranianCEE.2019.8786652 .	Analyzed the impact of preprocessing techniques on the classification performance of requirements-related tweets, highlighting the importance of preprocessing in NLP applications.	RQ1, RQ2	empirical research

78	Ehresmann M.; Beyer J.; Fasoulas S.; Schorfmann M.; Brudna T.; Schoolmann I.; Brüggmann J.; Hönle A.; Gerlich R.; Gerlich R. (2023) 'ExANT: Exploring NLP AI Systems for Requirements Development'. 74th International Astronautical Congress.	ExANT uses advanced NLP and AI to automate the development and quality assessment of software requirements	RQ1, RQ2, RQ3	empirical research
79	Ellis-Braithwaite, R. et al. (2017) 'Repetition between stakeholder (user) and system requirements', Requirements Engineering, 22(2), pp. 167–190. Available at: https://doi.org/10.1007/s00766-015-0239-x .	Investigated the redundancy between user and system requirements, highlighting the need for better quality control and documentation practices.	RQ1, RQ2	empirical research
80	Elmasry, I., Wassif, K. and Bayomi, H. (2021) 'Extracting Software Design from Text: A Machine Learning Approach', in Proc. - IEEE Int. Conf. Intell. Comput. Inf. Syst., ICICIS. Proceedings - 2021 IEEE 10th International Conference on Intelligent Computing and Information Systems, ICICIS 2021, Institute of Electrical and Electronics Engineers Inc., pp. 486–492. Available at: https://doi.org/10.1109/ICICIS52592.2021.9694186 .	Machine learning techniques were used to extract classes and attributes from software requirements documents	RQ2	empirical research
81	Emebo, O., Olawande, D. and Charles, A. (2018) 'Promirar: Tool for identifying and managing implicit Requirements in SRS documents', in Grundfest W.S., Douglas C., and Ao S.I. (eds) Lect. Notes Eng. Comput. Sci. Lecture Notes in Engineering and Computer Science, Newswood Limited, pp. 108–112. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85061941653&partnerID=40&md5=afb6c71bb9104c72cdf781d12197aa .	Presents PROMIRAR, a tool that integrates NLP, Ontology, and Analogy-based Reasoning to manage implicit requirements in SRS documents, demonstrating its usefulness in targeted domains.	RQ1, RQ4	tool or prototype development
82	Fadhlurrohman, D.H. et al. (2023) 'Naive Bayes Classification Model for Precondition-Postcondition in Software Requirements', in Int. Conf. Data Sci. Appl., ICoDSA. 2023 International Conference on Data Science and Its Applications, ICoDSA 2023, Institute of Electrical and Electronics Engineers Inc., pp. 123–128. Available at: https://doi.org/10.1109/ICoDSA58501.2023.10277397 .	Developed a Naive Bayes model to classify software requirements into labels indicating the presence of preconditions and post-conditions	RQ1, RQ3	empirical research
83	Fatwanto, A. (2013a) 'Natural language requirements specification analysis using Part-of-Speech Tagging', in Int. Conf. Future Gener. Commun. Technol., FGCT. 2nd International Conference on Future	Proposed a method for analyzing natural language software requirements using Part-	RQ2	empirical research

	Generation Communication Technologies, FGCT 2013, IEEE Computer Society, pp. 98–102. Available at: https://doi.org/10.1109/FGCT.2013.6767215 .	of-Speech tagging to transform them into formal models.		
84	Fatwanto, A. (2012) ‘Specifying translatable software requirements using constrained natural language’, in ICCSE - Proc. Int. Conf. Comput. Sci. Educ. ICCSE 2012 - Proceedings of 2012 7th International Conference on Computer Science and Education, pp. 1047–1052. Available at: https://doi.org/10.1109/ICCSE.2012.6295244 .	Proposed a method using constrained natural language for specifying translatable and dynamic software requirements, aiming to reduce ambiguities and incorporate dynamic aspects of systems effectively.	RQ2	empirical research
85	Fatwanto, A. (2013b) ‘Software requirements specification analysis using natural language processing technique’, in Int. Conf. Qual. Res., QiR - Conjunction ICCS: Int. Conf. Civ. Space. 2013 International Conference on Quality in Research, QiR 2013 - In Conjunction with ICCS 2013: The 2nd International Conference on Civic Space, pp. 105–110. Available at: https://doi.org/10.1109/QiR.2013.6632546 .	Proposed a method to transform natural language software requirements into formal specifications using NLP techniques, aiming to reduce ambiguity and incompleteness in software requirements documentation.	RQ2	empirical research
86	Ferreira, D.D.A. and Silva, A.R.D. (2009) ‘A controlled natural language approach for integrating requirements and model-driven engineering’, in Int. Conf. Softw. Eng. Adv., ICSEA, Incl. SEDES: Simp. Estud. Doutoramento Eng. Softw. 4th International Conference on Software Engineering Advances, ICSEA 2009, Includes SEDES 2009: Simposio para Estudantes de Doutoramento em Engenharia de Software, pp. 518–523. Available at: https://doi.org/10.1109/ICSEA.2009.81 .	Proposed integrating Requirements Engineering with Model-Driven Engineering using a controlled natural language for requirements specification to automatically extract and verify requirements models.	RQ4	empirical research
87	Fliedl, G. et al. (2007) ‘Deriving static and dynamic concepts from software requirements using sophisticated tagging’, Data and Knowledge Engineering, 61(3), pp. 433–448. Available at: https://doi.org/10.1016/j.datak.2006.06.012 .	Discussed a method for translating natural language requirements specifications into conceptual predesign schemata using a semantic model, which facilitates user	RQ2	empirical research

		participation in the design and validation process.		
88	Friesen, E., Bäumer, F.S. and Geierhos, M. (2018) 'CORDULA: Software requirements extraction utilizing chatbot as communication interface', in Dalpiaz F. et al. (eds) CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045428517&partnerID=40&md5=d4b4abace7d7289b989dbb84feab5d57 .	Utilized a chatbot interface to interactively clarify and refine software requirements, helping to address unstructured and incomplete requirement descriptions through direct user engagement.	RQ2	empirical research
89	Gao, X. and Singh, M.P. (2014) 'Extracting normative relationships from business contracts', in Int. Conf. Auton. Agents Multiagent Syst., AAMAS. 13th International Conference on Autonomous Agents and Multiagent Systems, AAMAS 2014, International Foundation for Autonomous Agents and Multiagent Systems (IFAAMAS), pp. 101–108. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84911401191&partnerID=40&md5=0bfeea5bedbd7249d7ece5b79e1b5b97 .	Applied NLP and ML to extract normative relationships such as commitments and authorizations from business contracts.	RQ2	empirical research
90	Geetha, S. and Anandha Mala, G.S. (2014) 'Automatic database construction from natural language requirements specification text', ARPN Journal of Engineering and Applied Sciences, 9(8), pp. 1260–1266.	Proposed a method to automatically extract database schema and relationships from natural language requirements specification text, aiming to build a real-time automated database that can query and acquire domain knowledge.	RQ2	empirical research
91	Geetha, S. and Mala, G.S.A. (2013) 'Extraction of key attributes from natural language requirements specification text', in IET Semin Dig. IET Seminar Digest, Institution of Engineering and Technology, pp. 374–379. Available at: https://doi.org/10.1049/ic.2013.0341 .	Described a method to automate the extraction of database schema and relationships from SRS using NLP, aimed at improving the analysis and utilization of requirements in software development.	RQ4	empirical research

92	Geierhos, M., Schulze, S. and Bäumer, F.S. (2015) ‘What did you mean?: Facing the challenges of user-generated software requirements’, in Loiseau S. et al. (eds) ICAART - Int. Conf. Agents Artif. Intell., Proc. ICAART 2015 - 7th International Conference on Agents and Artificial Intelligence, Proceedings, SciTePress, pp. 277–283. Available at: https://doi.org/10.5220/0005346002770283 .	Introduced a method to help non-experts clarify their software requirements, using ontology-based extraction and similarity retrieval to resolve ambiguity and vagueness in natural language descriptions.	RQ4	empirical research
93	Gerancon, B. and Trudel, S. (2022) ‘Improving Quality of Software Requirements by Using a Triplet Structure’, in Proc. - Int. Conf. Comput. Sci. Comput. Intell., CSCI. Proceedings - 2022 International Conference on Computational Science and Computational Intelligence, CSCI 2022, Institute of Electrical and Electronics Engineers Inc., pp. 1884–1888. Available at: https://doi.org/10.1109/CSCI58124.2022.00339 .	Introduced a new technique using NLP and AI to reduce ambiguities and inconsistencies in software requirements	RQ2, RQ3	empirical research
94	Ghandorh, H., Capretz, L.F. and Nassif, A.B. (2015) ‘In need of a domain-specific language modeling notation for smartphone applications with portable capability’, in Younas M., Awan I., and Mecella M. (eds) Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Verlag, pp. 218–227. Available at: https://doi.org/10.1007/978-3-319-23144-0_20 .	Highlighted the need for a domain-specific language to address smartphone application portability across different platforms, suggesting a modeling notation that aligns with software portability principles.	RQ4	empirical research
95	Giganto, R. (2008) ‘Generating class models through controlled requirements’, in New Zealand Comput. Sci. Res. Stud. Conf., NZCSRSC - Proc. New Zealand Computer Science Research Student Conference, NZCSRSC 2008 - Proceedings, pp. 208–211. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84880086012&partnerID=40&md5=25a1aad6cae99e710984ba4cbd9bb794 .	Addressed the challenges of ambiguity in natural language for generating class models and discussed initial experiments and future research plans to overcome these issues.	RQ2	empirical research
96	Glavaš, G., Fertalj, K. and Šnajder, J. (2012) ‘From requirements to code: Syntax-based requirements analysis for data-driven application development’, in Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture	Proposed a rule-based syntax parsing approach to extract domain entities and relationships from software requirements, aiming to facilitate the	RQ1	empirical research

	Notes in Bioinformatics), pp. 339–344. Available at: https://doi.org/10.1007/978-3-642-31178-9_44 .	transition from requirements to code in data-driven applications.		
97	Gnanasekaran, R.K. et al. (2021) ‘Using recurrent neural networks for classification of natural language-based non-functional requirements’, in Aydemir F.B. et al. (eds) CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85105594735&partnerID=40&md5=3481a6af2d56ad341e9baac10996f72e .	Leveraged RNNs to classify NFRs into categories such as maintainability and security	RQ1, RQ2, RQ3	empirical research
98	Gribermane, V. and Nazaruka, E. (2021) ‘Text Processing Techniques in Approaches for Automated Composition of Domain Models’, in Ali R. et al. (eds) International Conference on Evaluation of Novel Approaches to Software Engineering, ENASE - Proceedings. International Conference on Evaluation of Novel Approaches to Software Engineering, ENASE - Proceedings, Science and Technology Publications, Lda, pp. 489–500. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85137956349&partnerID=40&md5=42339325fba98d4ac8bbdc31ee412d71 .	Discussed text processing techniques	RQ2	empirical research
99	Gulia, S. and Choudhury, T. (2016) ‘An efficient automated design to generate UML diagram from Natural Language Specifications’, in Bansal A. and Singhal A. (eds) Proc. Int. Conf. - Cloud Syst. Big Data Eng., Confluence. Proceedings of the 2016 6th International Conference - Cloud System and Big Data Engineering, Confluence 2016, Institute of Electrical and Electronics Engineers Inc., pp. 641–648. Available at: https://doi.org/10.1109/CONFLUENCE.2016.7508197 .	Proposed a new technique to automatically generate UML diagrams from natural language specifications, enhancing the transition from requirements to design with reduced errors and improved modeling efficiency.	RQ2	empirical research
100	Guo, W., Zhang, L. and Lian, X. (2021) ‘Putting software requirements under the microscope: Automated extraction of their semantic elements’, in Moreira A. et al. (eds) Proc. Int. Conf. Requir. Eng. Proceedings of the IEEE International Conference on Requirements Engineering, IEEE Computer Society, pp. 416–417. Available at: https://doi.org/10.1109/RE51729.2021.00048 .	Proposed a method for automatically identifying diverse relationships in software requirements by extracting semantic elements, significantly improving analysis accuracy.	RQ2, RQ4	empirical research

101	Gupta, A.K., Deraman, A. and Siddiqui, S.T. (2019) 'A survey of software requirements specification ambiguity', <i>ARPN Journal of Engineering and Applied Sciences</i> , 14(17), pp. 3046–3061.	Summarized research contributions on controlling SRS ambiguity, providing insights into techniques for improving SRS quality.	RQ1, RQ4	literature review/survey
102	Habib, M.K., Wagner, S. and Graziotin, D. (2021) 'Detecting Requirements Smells with Deep Learning: Experiences, Challenges and Future Work', in Yue T. and Mirakhorli M. (eds) <i>Proc. Int. Conf. Requir. Eng. Proceedings of the IEEE International Conference on Requirements Engineering</i> , IEEE Computer Society, pp. 153–156. Available at: https://doi.org/10.1109/REW53955.2021.00027 .	Examines the use of AI and machine learning technologies alongside NLP in SRE	RQ3	empirical research
103	Halim, F. and Siahaan, D. (2019) 'Detecting Non-Atomic Requirements in Software Requirements Specifications Using Classification Methods', in <i>Int. Conf. Cybern. Intell. Syst., ICORIS. 2019 1st International Conference on Cybernetics and Intelligent System, ICORIS 2019</i> , Institute of Electrical and Electronics Engineers Inc., pp. 269–273. Available at: https://doi.org/10.1109/ICORIS.2019.8874888 .	Developed a model to detect non-atomic requirements in SRS using Bayes Net, evaluated for reliability against human annotators.	RQ1, RQ2	case study
104	Hamza, M. and Walker, R.J. (2015) 'Recommending features and feature relationships from requirements documents for software product lines', in <i>Proc. - Int. Workshop Realiz. Artif. Intell. Synerg. Softw. Eng., RAISE. Proceedings - 4th International Workshop on Realizing Artificial Intelligence Synergies in Software Engineering, RAISE 2015</i> , Institute of Electrical and Electronics Engineers Inc., pp. 25–31. Available at: https://doi.org/10.1109/RAISE.2015.12 .	Developed FFRE, a prototype RSSE tool for automating the extraction of features and their relationships from SRS documents using NLP and heuristics, aimed at enhancing feature model management in software product lines.	RQ4	empirical research
105	Hamza, Z.A. and Hammad, M. (2019) 'Generating UML use case models from software requirements using natural language processing', in <i>Int. Conf. Model. Simul. Appl. Optim., ICMSAO. 2019 8th International Conference on Modeling Simulation and Applied Optimization, ICMSAO 2019</i> , Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.1109/ICMSAO.2019.8880431 .	Provided an NLP-based approach to automatically generate UML use case diagrams from software requirements, demonstrating high accuracy through experimental evaluations on public software projects.	RQ1, RQ3	tool or prototype development

106	Handa, N., Sharma, A. and Gupta, A. (2019) 'Non functional requirements analysis using data analytics', International Journal of Advanced Science and Technology, 27(1), pp. 383–392.	Discussed the application of machine learning techniques for extracting non-functional requirements from natural language documents, highlighting improvements in precision, recall, and F-measure.	RQ1, RQ3	empirical research
107	Haris, M.S. and Kurniawan, T.A. (2020) 'Automated requirement sentences extraction from software requirement specification document', in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery, pp. 142–147. Available at: https://doi.org/10.1145/3427423.3427450 .	Automated the extraction of requirement sentences from SRS documents using NLP and boilerplate patterns, enhancing the accuracy of requirement reuse.	RQ1, RQ2	empirical research
108	Harmain, H.M. and Gaizauskas, R. (2000) 'CM-Builder: An automated NL-based CASE tool', in Proc. ASE: IEEE Int. Conf. Autom. Softw. Eng. Proceedings ASE 2000: 15th IEEE International Conference on Automated Software Engineering, Institute of Electrical and Electronics Engineers Inc., pp. 45–53. Available at: https://doi.org/10.1109/ASE.2000.873649 .	Describes CM-Builder, a CASE tool that uses NLP to automatically generate initial UML class models from natural language requirements, demonstrating potential for significant contributions to the software development process.	RQ4	empirical research
109	Harmain, H.M. and Gaizauskas, R. (2003) 'CM-Builder: A natural language-based CASE tool for object-oriented analysis', in Autom Software Eng. Automated Software Engineering, pp. 157–181. Available at: https://doi.org/10.1023/A:1022916028950 .	Focuses on CM-Builder's capability to use NLP for analyzing software requirements texts and automatically constructing UML class models, enhancing the analysis stage of software development.	RQ4	empirical research
110	Hasegawa, R. et al. (2009) 'Extracting conceptual graphs from Japanese documents for software requirements modeling', in Conf. Res. Pract. Inf. Technol. Ser. Conferences in Research and Practice in Information Technology Series. Available at:	Developed a tool to extract conceptual graphs from Japanese text documents, aiding the generation of software	RQ1	empirical research

	https://www.scopus.com/inward/record.uri?eid=2-s2.0-84864554839&partnerID=40&md5=c644e2930c0302e0ad5c4dbd73d555c8 .	requirements models and potentially serving as a domain ontology during requirements analysis activities.		
111	Hassan, T. and Hassan, S. (2016) 'Notice of Removal: Design semantic framework for software requirement specification', 2016 6th International Conference on IT Convergence and Security, ICITCS 2016 [Preprint]. Available at: https://doi.org/10.1109/ICITCS.2016.7740324 .	Addressed the need for a semantic framework to improve the semantic analysis of software requirements specifications, advocating for the integration of semantic technologies to enhance understanding and processing of natural language requirements.	RQ1	empirical research
112	Hassan, T. et al. (2017) 'Semantic analysis of natural language software requirement', in Int. Conf. Innov. Comput. Technol., INTECH. 2016 6th International Conference on Innovative Computing Technology, INTECH 2016, Institute of Electrical and Electronics Engineers Inc., pp. 459–463. Available at: https://doi.org/10.1109/INTECH.2016.7845013 .	Enhanced semantic analysis of software requirements using a semantic framework, improving interpretation and analysis accuracy.	RQ1, RQ2	empirical research
113	Hassert, N., Ménard, P.A. and Galy, E. (2021) 'UD on Software Requirements: Application and Challenges', in de Lhoneux M. et al. (eds) UDW - Workshop Univers. Depend., Proc. - To be held as part SyntaxFest. UDW 2021 - 5th Workshop on Universal Dependencies, Proceedings - To be held as part of SyntaxFest 2021, Association for Computational Linguistics (ACL), pp. 62–74. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85138671814&partnerID=40&md5=6648c4a709892fb8597e4db2a0226a1d .	Created an annotated corpus of software requirement texts with UD, highlighting unique challenges and structural phenomena, proposing enhancements for technical texts.	RQ2, RQ4	empirical research
114	Hayrapetian, A. and Raje, R. (2018) 'Empirically analyzing and evaluating security features in software requirements', in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery. Available at: https://doi.org/10.1145/3172871.3172879 .	Developed a semi-automatic methodology using NLP and ML to analyze software requirements for security features, linking document analysis to compliance with security standards.	RQ3	empirical research

115	Hochstetter, J. et al. (2022) ‘Classification of Speech Acts in Public Software Tenders’, IEEE Access, 10, pp. 41564–41573. Available at: https://doi.org/10.1109/ACCESS.2022.3165585 .	Developed a tool to automatically classify speech acts in public software tenders, helping tenderers decide whether to bid by generating metrics from the analysis, improving efficiency and saving effort in identifying relevant tenders.	RQ2, RQ4	empirical research
116	Hovorushchenko, T. and Pavlova, O. (2019) ‘Intelligent system for determining the sufficiency of metric information in the software requirements specifications’, in Bodyanskiy Y. et al. (eds) CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS, pp. 253–266. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85065475950&partnerID=40&md5=83e434de705726bc6396fd7e41e8190c .	Developed a system to assess the sufficiency of metric information in SRS, enhancing the metric sufficiency to potentially 100%.	RQ1, RQ2	tool or prototype development
117	Hu, J. et al. (2020) ‘Constructing formal specification models from domain specific natural language requirements’, in Proc. - Int. Symp. Syst. Softw. Reliab., ISSSR. Proceedings - 2020 6th International Symposium on System and Software Reliability, ISSSR 2020, Institute of Electrical and Electronics Engineers Inc., pp. 52–60. Available at: https://doi.org/10.1109/ISSSR51244.2020.00017 .	Proposed a framework for translating domain-specific natural language requirements into formal specification models, enhancing the precision and reliability of software requirements in safety-critical domains.	RQ1, RQ2	empirical research
118	Hu, W. et al. (2014) ‘Requires analysis based on software maintainability’, in En Y. and Ji C. (eds) ICRMS - Proc. Int. Conf. Reliab., Maintainab. Saf.: More Reliab. Products, More Secur. Life. ICRMS 2014 - Proceedings of 2014 10th International Conference on Reliability, Maintainability and Safety: More Reliable Products, More Secure Life, Institute of Electrical and Electronics Engineers Inc., pp. 354–357. Available at: https://doi.org/10.1109/ICRMS.2014.7107202 .	Introduced a method using NLP techniques and grey system theory to classify software requirements based on their impact on software maintainability, aiding in prioritization and management.	RQ2	empirical research
119	Huertas, C. and Juárez-Ramírez, R. (2012) ‘NLARE, a natural language processing tool for automatic requirements evaluation’, in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, pp. 371–378. Available at: https://doi.org/10.1145/2381716.2381786 .	Developed NLARE tool for automated evaluation of software requirements using disciplined sentence structure	RQ2	empirical research

		guidelines for quality assessment.		
120	Husain, M.S. (2021) ‘Exploiting Artificial Immune System to Optimize Association Rules for Word Sense Disambiguation’, International Journal of Intelligent Systems and Applications in Engineering, 9(4), pp. 184–190. Available at: https://doi.org/10.18201/IJISAE.2021473638 .	Introduces a new approach using Artificial Immune System for optimizing WSD in requirement specifications, showing significant accuracy improvements.	RQ3	empirical research
121	Husain, M.S. and Akheela Khanum, M. (2016) ‘Word sense disambiguation in software requirement specifications using Wordnet and association mining rule’, in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery. Available at: https://doi.org/10.1145/2905055.2905179 .	Introduced a framework using WordNet and association rule mining to clarify ambiguities in software requirements documents.	RQ2	empirical research
122	Hussain, I., Kosseim, L. and Ormandjieva, O. (2008) ‘Using linguistic knowledge to classify non-functional requirements in SRS documents’, in Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), pp. 287–298. Available at: https://doi.org/10.1007/978-3-540-69858-6_28 .	Applied text classification techniques to automate the detection and classification of NFR sentences in SRS documents.	RQ2	empirical research
123	Hussain, I., Kosseim, L. and Ormandjieva, O. (2013) ‘Approximation of COSMIC functional size to support early effort estimation in Agile’, in Data Knowl Eng. Data and Knowledge Engineering, pp. 2–14. Available at: https://doi.org/10.1016/j.datak.2012.06.005 .	Presented an approach to approximate COSMIC functional size from informal requirements, demonstrating applicability in agile processes.	RQ2	empirical research
124	Hussain, I., Ormandjieva, O. and Kosseim, L. (2007) ‘Automatic quality assessment of SRS text by means of a decision-tree-based text classifier’, in Proc. Int. Conf. Qual. Softw. Proceedings - International Conference on Quality Software, pp. 209–218. Available at: https://doi.org/10.1109/QSIC.2007.4385497 .	Proposed a decision-tree-based text classifier for automatic quality assessment of SRS text to detect ambiguities and improve document quality.	RQ2	empirical research
125	Iftikhar, A., Iftikhar, E. and Mehmood, M.K. (2017) ‘Domain specific query generation from natural language text’, in Int. Conf. Innov. Comput. Technol., INTECH. 2016 6th International Conference on Innovative	Discusses translating natural language texts to structured query language, noting	RQ1, RQ3	case study

	Computing Technology, INTECH 2016, Institute of Electrical and Electronics Engineers Inc., pp. 502–506. Available at: https://doi.org/10.1109/INTECH.2016.7845105 .	semantic, discourse, and negation issues. Used Stanford dependency parser for text translation.		
126	Iftikhar, E., Iftikhar, A. and Mehmood, M.K. (2017) ‘Identification of textual entailments in business rules’, in Int. Conf. Innov. Comput. Technol., INTECH. 2016 6th International Conference on Innovative Computing Technology, INTECH 2016, Institute of Electrical and Electronics Engineers Inc., pp. 706–711. Available at: https://doi.org/10.1109/INTECH.2016.7845104 .	Introduced an approach for automated recognition of textual entailments in business rules using NLP, aiming to reduce misinterpretation and improve software design precision.	RQ2	empirical research
127	Ilieva, M.G. and Ormandjieva, O. (2005) ‘Automatic transition of natural language software requirements specification into formal presentation’, in Lect. Notes Comput. Sci. Lecture Notes in Computer Science, Springer Verlag, pp. 392–397. Available at: https://doi.org/10.1007/11428817_45 .	Proposed a methodology for processing textual descriptions of requirements into an object-oriented analysis model, addressing the challenges of ambiguity and large information volume in natural language requirements.	RQ2	empirical research
128	Imam, A.T., Alhroob, A. and Alzyadat, W.J. (2021) ‘SVM Machine Learning Classifier to Automate the Extraction of SRS Elements’, International Journal of Advanced Computer Science and Applications, 12(3), pp. 174–185. Available at: https://doi.org/10.14569/IJACSA.2021.0120322 .	A new NER method using SVM was developed to extract system, actor, and use case entities from software requirements	RQ2	empirical research
129	Jackson, D. (1996) ‘Requirements need form, maybe formality’, IEEE Software, 13(2), pp. 21–22.	Advocates for the need for formality in requirements analysis to ensure software quality and successful maintenance, emphasizing cooperation among developers and analysts.	RQ2	empirical research

130	Jafari, S.M. et al. (2023) ‘Anaphoric Ambiguity Resolution in Software Requirement Texts’, in He J. et al. (eds) Proc. - IEEE Int. Conf. Big Data, BigData. Proceedings - 2023 IEEE International Conference on Big Data, BigData 2023, Institute of Electrical and Electronics Engineers Inc., pp. 4722–4730. Available at: https://doi.org/10.1109/BigData59044.2023.10386192 .	Investigated methods for resolving anaphoric ambiguity in requirements engineering	RQ2	empirical research
131	Jain, C. et al. (2023) ‘A Transformer-based Approach for Abstractive Summarization of Requirements from Obligations in Software Engineering Contracts’, in Schneider K., Dalpiaz F., and Horkoff J. (eds) Proc. Int. Conf. Requir. Eng. Proceedings of the IEEE International Conference on Requirements Engineering, IEEE Computer Society, pp. 169–179. Available at: https://doi.org/10.1109/RE57278.2023.00025 .	Used NLG models to summarize high-level requirements from legal contracts	RQ2, RQ4	case study
132	Jain, R., Ghaisas, S. and Sureka, A. (2014) ‘SANAYOJAN: A framework for traceability link recovery between use-cases in software requirement specification and regulatory documents’, in Int. Workshop Realiz. Artif. Intell. Synerg. Softw. Eng., RAISE - Proc. 3rd International Workshop on Realizing Artificial Intelligence Synergies in Software Engineering, RAISE 2014 - Proceedings, Association for Computing Machinery, Inc, pp. 12–18. Available at: https://doi.org/10.1145/2593801.2593804 .	Developed a framework to extract system use-cases from URS and link them with regulations in the regulatory documents.	RQ2	empirical research
133	Jaiwai, M. and Sammapun, U. (2017) ‘Extracting UML class diagrams from software requirements in Thai using NLP’, in Chantamunee S., Doung-in S., and Thanathamath P. (eds) Proc. Int. Jt. Conf. Comput. Sci. Softw. Eng., JCSSE. Proceedings of the 2017 14th International Joint Conference on Computer Science and Software Engineering, JCSSE 2017, Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.1109/JCSSE.2017.8025938 .	Proposed a method to transform Thai language requirements into UML class diagrams, evaluated for precision and recall against human-created truth values.	RQ1, RQ2	tool or prototype development
134	Javed, M. and Lin, Y. (2021) ‘iMER: Iterative process of entity relationship and business process model extraction from the requirements’, In: Information and Software Technology, 135. Available at: https://doi.org/10.1016/j.infsof.2021.106558 .	an automated and iterative approach to extract detailed business and entity relationship models from varying formats of software requirements using NLP	RQ1, RQ2	empirical research tool or prototype development

135	Jebril, E.M., Imam, A.T. and Al-Fayuomi, M. (2018) 'An Algorithmic Approach to Extract Actions and Actors (AAEAA)', in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery, pp. 13–17. Available at: https://doi.org/10.1145/3220228.3220247 .	Defined a new algorithmic approach using thematic role technique to extract actors and actions from functional requirements, potentially aiding in I-CASE tool development.	RQ1, RQ2	empirical research
136	Johnson, W.L., Feather, M.S. and Harris, D.R. (1991) 'The KBSA requirements/specification facet: ARIES', in Proc. - Annu. Knowl.-Based Softw. Eng. Conf., KBSE. Proceedings - 6th Annual Knowledge-Based Software Engineering Conference, KBSE 1991, Institute of Electrical and Electronics Engineers Inc., pp. 48–56. Available at: https://doi.org/10.1109/KBSE.1991.638020 .	Discusses a transformation-based software environment for acquiring and validating software requirements, highlighting the ability to translate requirements into natural language and graphical diagrams for better validation.	RQ4	empirical research
137	Jp, S. et al. (2022) 'A Non-Exclusive Multi-Class Convolutional Neural Network for the Classification of Functional Requirements in AUTOSAR Software Requirement Specification Text', IEEE Access, 10, pp. 117707–117714. Available at: https://doi.org/10.1109/ACCESS.2022.3217752 .	Utilized CNN with Word2Vec and FastText for classifying functional requirements in AUTOSAR SRS texts, comparing the effectiveness of different embeddings.	RQ3, RQ4	empirical research
138	Jubair, M.A. et al. (2022) 'A multi-agent K-means with case-based reasoning for an automated quality assessment of software requirement specification', IET Communications [Preprint]. Available at: https://doi.org/10.1049/cmu2.12555 .	Combines NLP with multi-agent systems and K-means for automating quality assessment of software requirements, showing high agreement with expert assessments.	RQ1, RQ3, RQ4	empirical research
139	Karagöz, S. and Tosun, A. (2022) 'An Automated Approach for Mapping Between Software Requirements and Design Items: An Industrial Case from Turkey', in Lecture. Notes. Data Eng. Commun. Tech. Springer Science and Business Media Deutschland GmbH, pp. 175–186. Available at: https://doi.org/10.1007/978-3-031-08017-3_16 .	Developed an automated feature mapping tool using NLP and machine learning, improving precision in linking software requirements to design items.	RQ2, RQ3	case study

140	Kersting, J., Ahmed, M. and Geierhos, M. (2022) ‘Chatbot-Enhanced Requirements Resolution for Automated Service Compositions’, in Stephanidis C., Antona M., and Ntoa S. (eds) Commun. Comput. Info. Sci. Communications in Computer and Information Science, Springer Science and Business Media Deutschland GmbH, pp. 419–426. Available at: https://doi.org/10.1007/978-3-031-06417-3_56 .	Developed a chatbot with NLP capabilities to assist in the automated resolution of software requirements, improving user interaction and error identification.	RQ2, RQ4	tool or prototype development
141	Khelifa, A., Haoues, M. and Sellami, A. (2018) ‘Towards a software requirements change classification using support vector machine’, in Mechtai S., Belguith L.H., and Ellouze M. (eds) CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85059822763&partnerID=40&md5=aa0b4508d3111ceae2ba24f1fa16946a .	Explored using NLP and SVM for classifying software requirement changes into functional and technical categories.	RQ1, RQ3	empirical research
142	Kim, H.Y. and Sheldon, F.T. (2004) ‘Testing software requirements with Z and statecharts applied to an embedded control system’, Software Quality Journal, 12(3), pp. 231–264. Available at: https://doi.org/10.1023/B:SQJO.0000034710.86897.16 .	Describes the use of formalisms (Z and Statecharts) to model, test, and evaluate a natural language SRS, emphasizing strategies to avoid design defects and system failures.	RQ3	empirical research
143	King, J., Pandita, R. and Williams, L. (2015) ‘Enabling forensics by proposing heuristics to identify mandatory log events’, in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery. Available at: https://doi.org/10.1145/2746194.2746200 .	Proposed heuristics to identify mandatory log events in software systems through the systematic analysis of verb-object pairs in natural language software artifacts, improving the accuracy of logging for enhancing forensics and user accountability.	RQ2	empirical research
144	Kocerka, J., Krześlak, M. and Gałuszka, A. (2022) ‘Ontology Extraction from Software Requirements Using Named-Entity Recognition’, Advances in Science and Technology Research Journal, 16(3), pp. 207–212. Available at: https://doi.org/10.12913/22998624/149941 .	A model was created that detects domain-specific terms in software requirements with 87% precision	RQ1, RQ2	empirical research

145	Kochbati, T., Gérard, S., et al. (2021) 'From word embeddings to text similarities for improved semantic clustering of functional requirements', in Proc. Int. Conf. Softw. Eng. Knowl. Eng., SEKE. Proceedings of the International Conference on Software Engineering and Knowledge Engineering, SEKE, Knowledge Systems Institute Graduate School, pp. 285–290. Available at: https://doi.org/10.18293/SEKE2021-056 .	Introduced a method using word2vec and hierarchical clustering to automatically cluster functional requirements based on semantic similarity, improving cluster identification results in software projects compared to existing methods.	RQ2, RQ4	empirical research
146	Kochbati, T., Li, S., et al. (2021a) 'From User Stories to Models: A Machine Learning Empowered Automation', in Seidewitz E., Ferreira Pires L., and Hammoudi S. (eds) Int. Conf. Model. Driven. Eng. Softw. Dev. International Conference on Model-Driven Engineering and Software Development, Science and Technology Publications, Lda, pp. 20–40. Available at: https://doi.org/10.5220/0010197800280040 .	Proposed a machine learning approach for decomposing systems into sub-systems and generating architecture models from user stories, demonstrating effectiveness with case studies.	RQ1, RQ3, RQ4	case study
147	Kochbati, T., Li, S., et al. (2021b) 'From user stories to models: A machine learning empowered automation', in Hammoudi S. et al. (eds) MODELSWARD 2021 - Proceedings of the 9th International Conference on Model-Driven Engineering and Software Development, SciTePress, pp. 28–40. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85103060290&partnerID=40&md5=b21f0a1129728bdf6c7d8a8be5e5d99b .	Proposed a machine learning approach for decomposing systems into sub-systems and generating architecture models from user stories, demonstrating effectiveness with case studies.	RQ1, RQ3, RQ5	case study
148	Kostanyan, A.V. and Shekhovtsov, V.A. (2007) 'Towards Entropy-Based Requirements Elicitation', in Mayr H.C. and Karagiannis D. (eds) Lect. Notes Informatics (LNI), Proc. - Series Ges. Inform. (GI). Lecture Notes in Informatics (LNI), Proceedings - Series of the Gesellschaft fur Informatik (GI), Gesellschaft fur Informatik (GI), pp. 105–116. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85134506601&partnerID=40&md5=93bc4bd97f75a7e6d728f78fd0bc156e .	Proposed a universal parsing technique for software requirements texts, aiming for language-independent processing. The technique uses entropy minimization to identify the most organized state of system elements (words),	RQ2	empirical research

		aiming to improve requirements elicitation.		
149	Kuchta, J. and Padhiyar, P. (2018) 'Extracting concepts from the software requirements specification using natural language processing', in Kaczmarek M., Bujnowski A., and Ruminski J. (eds) Proc. - Int. Conf. Hum. Syst. Interact., HSI. Proceedings - 2018 11th International Conference on Human System Interaction, HSI 2018, Institute of Electrical and Electronics Engineers Inc., pp. 443–448. Available at: https://doi.org/10.1109/HSI.2018.8431221 .	Developed a method to extract concepts from requirements without needing a domain-specific ontology, using grammatical analysis and the WordNet dictionary.	RQ1, RQ2	empirical research
150	Kumar, D.D. and Sanyal, R. (2008) 'Static UML Model Generator from Analysis of Requirements (SUGAR)', in Proc. Adv. Softw. Eng. Appl., ASE. Proceedings of the 2008 Advanced Software Engineering and its Applications, ASE 2008, pp. 77–84. Available at: https://doi.org/10.1109/ASE.2008.25 .	Proposed SUGAR, a tool that generates UML models from natural language requirements by integrating requirement analysis and design phases, helping even non-experts to generate detailed design models.	RQ2	empirical research
151	Kumar, S. and Yadav, D. (2023) 'Natural Language Processing based Automatic Making of Use Case Diagram', in Proc. Int. Conf. Inventive Res. Comput. Appl., ICIRCA. Proceedings of the 5th International Conference on Inventive Research in Computing Applications, ICIRCA 2023, Institute of Electrical and Electronics Engineers Inc., pp. 1026–1032. Available at: https://doi.org/10.1109/ICIRCA57980.2023.10220849 .	Introduces an NLP-based automated method for creating use case diagrams from textual requirements, demonstrating improvements over traditional methods.	RQ1, RQ4	case study
152	Kummler, P. and Fromm, H. (2019) 'A closer look on the difficulties to determine the quality of software requirements', in Konersmann M. et al. (eds) CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS, pp. 53–60. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85061771449&partnerID=40&md5=d082e933de3243384a3f54047cb3d9eb .	Analyzed quality determination challenges in software requirements, focusing on improving quality assessment practices.	RQ1, RQ4	empirical research
153	Ladeinde, A. et al. (2023) 'Extracting Queryable Knowledge Graphs from User Stories: An Empirical Evaluation', in Kaindl H. et al. (eds) International Conference on Evaluation of Novel Approaches to Software Engineering, ENASE - Proceedings. International Conference on	Used NLP to extract and model user story data into queryable graphs	RQ1, RQ2	empirical research

	Evaluation of Novel Approaches to Software Engineering, ENASE - Proceedings, Science and Technology Publications, Lda, pp. 684–692. Available at: https://doi.org/10.5220/0011994400003464 .			
154	Lafi, M., Hawashin, B. and AlZu'bi, S. (2021) 'Eliciting requirements from Stakeholders' responses using natural language processing', CMES - Computer Modeling in Engineering and Sciences, 127(1), pp. 99–116. Available at: https://doi.org/10.32604/cmes.2021.013026 .	Proposes a method to efficiently collect requirements from stakeholders using NLP, reducing time and improving accuracy.	RQ2, RQ4	empirical research
155	Lami, G. (2009) 'Analytic effectiveness evaluation of techniques for natural language software requirements testability', Computer Systems Science and Engineering, 24(2), pp. 103–114.	Analyzed and evaluated different NLP-based techniques to enhance the testability of software requirements, providing criteria for assessing the effectiveness of these techniques.	RQ2	empirical research
156	Lee, J., Kuo, J.-Y. and Xue, N.-L. (2001) 'A note on current approaches to extending fuzzy logic to object-oriented modeling', International Journal of Intelligent Systems, 16(7), pp. 807–820. Available at: https://doi.org/10.1002/int.1036 .	Developed a system that uses NLP for automatically constructing use case diagrams from software requirements.	RQ2	empirical research
157	Lee, S.W. (2002) 'Proxy viewpoints model-based requirements engineering', in Proc ACM Symp Appl Computing. Proceedings of the ACM Symposium on Applied Computing, Association for Computing Machinery (ACM), pp. 1004–1008. Available at: https://doi.org/10.1145/508979.508986 .	Introduces a methodology to construct proxy viewpoints models from legacy status requirements to address missing requirements from multiple viewpoints and improve SRS adaptation efficiency.	RQ4	empirical research
158	Lee, S.-W. et al. (2006) 'Building decision support problem domain ontology from natural language requirements for software assurance', International Journal of Software Engineering and Knowledge Engineering, 16(6), pp. 851–884. Available at: https://doi.org/10.1142/S0218194006003051 .	Defined a methodology using RE and knowledge engineering techniques to structure problem domain concepts based on C&A requirements, aiming to facilitate effective decision-making in the C&A	RQ2	empirical research

		process by creating a decision support domain ontology.		
159	Lee, W.J. (1998) 'Integration and analysis of use cases using modular petri nets in requirements engineering', IEEE Transactions on Software Engineering, 24(12), pp. 1115–1130. Available at: https://doi.org/10.1109/32.738342 .	Introduces a method for formalizing use cases with Constraints-based Modular Petri Nets (CMPNs) to address their inherent informality and improve system behavior analysis for completeness and consistency.	RQ3	empirical research
160	Li, C. et al. (2018) 'Automatically classifying user requests in crowdsourcing requirements engineering', Journal of Systems and Software, 138, pp. 108–123. Available at: https://doi.org/10.1016/j.jss.2017.12.028 .	Proposed a method using machine learning and NLP to classify user requests from crowdsourced platforms, enhancing the structuring of informal requirements into defined classes.	RQ1, RQ4	empirical research
161	Limaylla-Lunarejo, M.-I., Condori-Fernandez, N. and Luaces, M.R. (2023) 'Requirements Classification Using FastText and BETO in Spanish Documents', in Ferrari A. and Penzenstadler B. (eds) Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Science and Business Media Deutschland GmbH, pp. 159–176. Available at: https://doi.org/10.1007/978-3-031-29786-1_11 .	Examines the use of AI and machine learning technologies alongside NLP in SRE	RQ2, RQ4	empirical research
162	Limaylla-Lunarejo, M.-I., Condori-Fernandez, N. and Luaces, M.R. (2022) 'Towards an automatic requirements classification in a new Spanish dataset', in Knauss E. et al. (eds) Proc. Int. Conf. Requir. Eng. Proceedings of the IEEE International Conference on Requirements Engineering, IEEE Computer Society, pp. 270–271. Available at: https://doi.org/10.1109/RE54965.2022.00039 .	Examines ML techniques for classifying software requirements in Spanish, highlighting the effectiveness of SVM with TF-IDF.	RQ3, RQ4	empirical research
163	Liu, C. et al. (2021) 'Automated conditional statements checking for complete natural language requirements specification', Applied Sciences (Switzerland), 11(17). Available at: https://doi.org/10.3390/app11177892 .	Developed a method to detect incompleteness in requirements specification due to	RQ1, RQ2	empirical research

		conditional statements using sentence embedding and antonym-based analysis		
164	Liu, H. et al. (2022) ‘Deep Learning Based Program Generation From Requirements Text: Are We There Yet?’, IEEE Transactions on Software Engineering, 48(4), pp. 1268–1289. Available at: https://doi.org/10.1109/TSE.2020.3018481 .	Evaluated deep learning-based approaches for generating source code from requirements. Found that these approaches performed poorly on diverse datasets and suggested significant improvements are needed.	RQ3	empirical research
165	Liu, K., Reddivari, S. and Reddivari, K. (2022) ‘Artificial Intelligence in Software Requirements Engineering: State-of-the-Art’, in Proc. - IEEE Int. Conf. Inf. Reuse Integr. Data Sci., IRI. Proceedings - 2022 IEEE 23rd International Conference on Information Reuse and Integration for Data Science, IRI 2022, Institute of Electrical and Electronics Engineers Inc., pp. 106–111. Available at: https://doi.org/10.1109/IRI54793.2022.00034 .	Reviews the application of AI, particularly NLP and ML, in RE, summarizing current uses and future potential for improving requirement processes.	RQ1, RQ2, RQ3, RQ4	literature review/survey
166	Luo, X. et al. (2022) ‘PRCBERT: Prompt Learning for Requirement Classification using BERT-based Pretrained Language Models’, in Aehnel M. and Kirste T. (eds) ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery. Available at: https://doi.org/10.1145/3551349.3560417 .	Introduced prompt learning with BERT for requirement classification, showing improved performance over traditional models.	RQ1, RQ3	tool or prototype development
167	Luqman Fanani, M.Z., Tahir, Z. and Suyuti, A. (2023) ‘Development of Software Cost Estimation and Resource Allocation Using Natural Language Processing, Cosine Similarity and Function Point’, in Int. Conf. Digit. Appl., Transform. Econ., ICDATE. 2023 International Conference on Digital Applications, Transformation and Economy, ICDATE 2023, Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.1109/ICDATE58146.2023.10248788 .	Combined multiple methods to develop a new model for software cost estimation	RQ4	case study
168	Lyu, J., Hu, J. and Wang, L. (2022) ‘Platform of Formal Modeling and Analysis for Airborne Software Requirements’, in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for	Develops a formal modeling and analysis platform for airborne software requirements, ensuring compliance with	RQ1, RQ4	tool or prototype development

	Computing Machinery, pp. 1221–1234. Available at: https://doi.org/10.1145/3573428.3573646 .	safety standards via automated tools.		
169	Maatuk, A.M. and Abdelnabi, E.A. (2021) ‘Generating UML use case and activity diagrams using NLP techniques and heuristics rules’, in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery, pp. 271–277. Available at: https://doi.org/10.1145/3460620.3460768 .	Demonstrated an approach to generate UML diagrams from natural language using NLP techniques and heuristics	RQ1, RQ2	case study
170	Magableh, A.A. and Rababah, R. (2022) ‘CROSSCUTTING CONCERNS (ASPECTS) IDENTIFICATION IN THE EARLY STAGE OF ASPECT-ORIENTED SOFTWARE DEVELOPMENT’, Journal of Theoretical and Applied Information Technology, 100(7), pp. 1864–1874.	Discusses an NLP method for early identification of cross-cutting concerns in aspect-oriented development, particularly in Arabic language requirements.	RQ1, RQ2, RQ3	empirical research
171	Mahalakshmi, K. et al. (2021) ‘A timeline optimization approach of green requirement engineering framework for efficient categorized natural language documents in non-functional requirements’, International Journal of Business Analytics, 8(1), pp. 21–37. Available at: https://doi.org/10.4018/IJBAN.2021010102 .	Introduced a green requirements engineering framework to optimize the classification of non-functional requirements from natural language documents, improving accuracy and efficiency.	RQ1, RQ2	empirical research
172	Malhotra, R. et al. (2016) ‘Analyzing and evaluating security features in software requirements’, in Kumar B. et al. (eds) Int. Conf. Innov. Chall. Cyber Secur., ICICCS. 2016 1st International Conference on Innovation and Challenges in Cyber Security, ICICCS 2016, Institute of Electrical and Electronics Engineers Inc., pp. 26–30. Available at: https://doi.org/10.1109/ICICCS.2016.7542334 .	Proposed a semi-automatic methodology using NLP and ML to evaluate security features in software requirements.	RQ3	empirical research
173	Malik, M.I. et al. (2021) ‘Automating test oracles from restricted natural language agile requirements’, Expert Systems, 38(1). Available at: https://doi.org/10.1111/exsy.12608 .	Introduced ReNaLART to automate test oracle creation from modified user stories, enhancing testing efficiency and effectiveness.	RQ1, RQ4	tool or prototype development
174	Manrique-Losada, B., Zapata-Jaramillo, C.M. and Burgos, D.A. (2016) ‘Re-expressing business processes information from corporate	Proposed a multi-level methodology to convert business	RQ2	empirical research

	documents into controlled language', in Métais E. et al. (eds) Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Verlag, pp. 376–383. Available at: https://doi.org/10.1007/978-3-319-41754-7_37 .	process information from corporate documents into controlled language, enhancing software requirements elicitation. This method uses rhetorical analysis, event analysis, and parsing techniques.		
175	Masuda, S., Matsuodani, T. and Tsuda, K. (2021) 'Syntax-tree similarity for test-case derivability in software requirements', in Proc. - IEEE Int. Conf. Softw. Test., Verif. Valid. Workshops, ICSTW. Proceedings - 2021 IEEE 14th International Conference on Software Testing, Verification and Validation Workshops, ICSTW 2021, Institute of Electrical and Electronics Engineers Inc., pp. 162–172. Available at: https://doi.org/10.1109/ICSTW52544.2021.00037 .	Introduced a syntax-tree similarity method for deriving test cases, improving accuracy in pre-processing and condition/action determination.	RQ1, RQ4	empirical research
176	Masuda, S., Matsuodani, T. and Tsuda, K. (2016a) 'Detecting logical inconsistencies by clustering technique in natural language requirements', IEICE Transactions on Information and Systems, E99D(9), pp. 2210–2218. Available at: https://doi.org/10.1587/transinf.2015KBP0005 .	Introduced a method using clustering techniques to detect logical inconsistencies in natural language requirements. This approach involves semantic role labeling and logical formula derivation to evaluate inconsistencies, enhancing the quality and cost-effectiveness of system development.	RQ2	empirical research
177	Masuda, Satoshi, Matsuodani, T. and Tsuda, K. (2016) 'Syntactic Rules of Extracting Test Cases from Software Requirements', in Proceedings of the 2016 8th International Conference on Information Management and Engineering. ICIME 2016: 2016 8th International Conference on Information Management and Engineering, Istanbul Turkey: ACM, pp. 12–17. Available at: https://doi.org/10.1145/3012258.3012262 .	Discussed the development of syntactic rules for extracting conditions and actions from software requirements to generate test cases, enhancing the decision table testing approach.	RQ2	empirical research

178	Matsuo, Y., Ogasawara, K. and Ohnishi, A. (2010) ‘Automatic transformation of organization of software requirements specifications’, in Int. Conf. Res. Challenges Info. Sci. - Proc., RCIS. 2010 4th International Conference on Research Challenges in Information Science - Proceedings, RCIS 2010, IEEE Computer Society, pp. 269–278. Available at: https://doi.org/10.1109/rcis.2010.5507386 .	Proposed a method to automatically transform software requirements specifications organized in one way to another form using NLP techniques.	RQ2	empirical research
179	Matsuoka, J. and Lepage, Y. (2011) ‘Ambiguity spotting using WordNet semantic similarity in support to recommended practice for software requirements specifications’, in NLP-KE - Proc. Int. Conf. Nat. Lang. Process. Knowl. Eng. NLP-KE 2011 - Proceedings of the 7th International Conference on Natural Language Processing and Knowledge Engineering, pp. 479–484. Available at: https://doi.org/10.1109/NLPKE.2011.6138247 .	Proposed a method to spot ambiguities in software requirements specifications using WordNet semantic similarity.	RQ2	empirical research
180	McZara, J. et al. (2015) ‘Software requirements prioritization and selection using linguistic tools and constraint solvers—a controlled experiment’, Empirical Software Engineering, 20(6), pp. 1721–1761. Available at: https://doi.org/10.1007/s10664-014-9334-8 .	Introduced a method combining linguistic tools and constraint solvers for efficient and accurate prioritization of software requirements.	RQ2	empirical research
181	Memon, K.A. and Xiaoling, X. (2019) ‘Deciphering and analyzing software requirements employing the techniques of Natural Language processing’, in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery, pp. 153–156. Available at: https://doi.org/10.1145/3325730.3325757 .	Discusses NLP techniques for extracting precise requirements from clients’ natural language descriptions, aiming to minimize bugs and improve software quality.	RQ1, RQ2	empirical research
182	Mihany, F.A. et al. (2016) ‘An automated system for measuring similarity between software requirements’, in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery, pp. 46–51. Available at: https://doi.org/10.1145/2944165.2944173 .	Developed an interactive system to measure lexical similarity between new projects and existing ones to identify reusable components, thereby linking text similarity to software reusability.	RQ2	empirical research
183	Mishra, S. and Sharma, A. (2019) ‘On the use of word embeddings for identifying domain specific ambiguities in requirements’, in Proc. - IEEE	Applied word embeddings to detect domain-specific	RQ1, RQ2	empirical research

	Int. Requir. Eng. Conf. Workshops, REW. Proceedings - 2019 IEEE 27th International Requirements Engineering Conference Workshops, REW 2019, Institute of Electrical and Electronics Engineers Inc., pp. 234–240. Available at: https://doi.org/10.1109/REW.2019.00048 .	ambiguous words in requirements, showing effectiveness across various engineering subdomains.		
184	Mishra, S. and Sharma, A. (2020) ‘Automatic Word Embeddings-Based Glossary Term Extraction from Large-Sized Software Requirements’, in Madhavji N. and Pasquale L. (eds) Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer, pp. 203–218. Available at: https://doi.org/10.1007/978-3-030-44429-7_15 .	Proposes a new approach for automated glossary term extraction from large-sized requirements documents using word embeddings and semantic filtering.	RQ1, RQ3	tool or prototype development
185	Miskell, C. et al. (2023) ‘Automated Framework to Extract Software Requirements from Source Code’, in Proceedings of the 2023 7th International Conference on Natural Language Processing and Information Retrieval. NLPPIR 2023: 2023 7th International Conference on Natural Language Processing and Information Retrieval, Seoul Republic of Korea: ACM, pp. 130–134. Available at: https://doi.org/10.1145/3639233.3639242 .	Developed an automated framework using AI to extract and validate software requirements from source code, improving documentation and comprehension for developers.	RQ1, RQ3	empirical research
186	Mohanani, M. and Samuel, P. (2016) ‘Software requirement elicitation using natural language processing’, in Abraham A. et al. (eds) Adv. Intell. Sys. Comput. Advances in Intelligent Systems and Computing, Springer Verlag, pp. 197–208. Available at: https://doi.org/10.1007/978-3-319-28031-8_17 .	Presented a method using NLP to transform natural language SRS into object-oriented models, enhancing the extraction of classes, objects, attributes, and relationships from SRS documents, thereby improving the clarity and usability of software requirements.	RQ2	empirical research
187	Moharil, A. and Sharma, A. (2022) ‘Identification of Intra-Domain Ambiguity using Transformer-based Machine Learning’, in Proc. - Int. Workshop Nat. Lang.-Based Softw. Eng., NLBSE. Proceedings - 1st International Workshop on Natural Language-Based Software Engineering, NLBSE 2022, Institute of Electrical and Electronics Engineers Inc., pp. 51–58. Available at: https://doi.org/10.1145/3528588.3528651 .	Utilizes BERT and clustering to effectively identify intra-domain ambiguities, enhancing clarity in software requirements documentation.	RQ2, RQ3	empirical research

188	<p>Moore, T.T. and Champion, R.E.M. (1994) ‘Software quality through the traceability of requirements specifications’, in Int Conf Software Testing Reliab Qual Assur STRQA. International Conference on Software Testing, Reliability and Quality Assurance, STRQA, IEEE, pp. 100–104. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-0028683242&partnerID=40&md5=4cef52f51141d71a6e3c981e9b11e256.</p>	<p>Argues for the importance of maintaining traceability from customer requirements to SRS for quality assurance and highlights methods for tracing requirements through different development stages.</p>	RQ2	empirical research
189	<p>Mornie, M.N. et al. (2023) ‘Visualisation of User Stories in UML Models: A Systematic Literature Review’, Acta Informatica Pragensia, 12(2), pp. 419–438. Available at: https://doi.org/10.18267/j.airy.212.</p>	<p>Systematic review discusses the integration of NLP in generating UML models from user stories, highlighting challenges and effectiveness.</p>	RQ2, RQ4	literature review/survey
190	<p>Mosquera, D. et al. (2023) ‘Ontology-Based Automatic Reasoning and NLP for Tracing Software Requirements into Models with the Onto-Trace Tool’, in Ferrari A. and Penzenstadler B. (eds) Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Science and Business Media Deutschland GmbH, pp. 140–158. Available at: https://doi.org/10.1007/978-3-031-29786-1_10.</p>	<p>OntoTraceV2.0 improves trace generation efficiency and satisfaction without depending on historical data, using ontology-based reasoning and NLP for adaptability and trace discovery.</p>	RQ1, RQ2, RQ4	tool or prototype development
191	<p>Mu, Y., Wang, Y. and Guo, J. (2009) ‘Extracting software functional requirements from free text documents’, in Int. Conf. Inf. Multimedia Technol., ICIMT. 2009 International Conference on Information and Multimedia Technology, ICIMT 2009, pp. 194–198. Available at: https://doi.org/10.1109/ICIMT.2009.47.</p>	<p>Proposed a method to extract functional requirements by analyzing text-based SRSs using extended functional requirements framework and NLP, demonstrating high accuracy and efficiency in managing functional requirements variability in software product lines.</p>	RQ2	empirical research
192	<p>Muhamad, F.N.J. et al. (2023) ‘Fault-Prone Software Requirements Specification Detection Using Ensemble Learning for Edge/Cloud Applications’, Applied Sciences (Switzerland), 13(14). Available at: https://doi.org/10.3390/app13148368.</p>	<p>Developed FPDM and ACM models using deep learning and Boosting ensemble learning for detecting fault-prone</p>	RQ1, RQ3	case study

		requirements in edge/cloud applications		
193	Muruges, S. and Jaya, A. (2018) 'Exploiting ontology to map requirements derived from informal descriptions', <i>International Journal of Reasoning-based Intelligent Systems</i> , 10(3–4), pp. 169–173. Available at: https://doi.org/10.1504/IJRIS.2018.096195 .	Uses ontology to map and validate requirements derived from informal descriptions in the ATM operations domain, enhancing requirement feasibility analysis.	RQ1, RQ2	tool or prototype development
194	Mustafa, A., Wan Kadir, W.M.N. and Ibrahim, N. (2017) 'Automated Natural Language Requirements Analysis using General Architecture for Text Engineering (GATE) Framework', <i>Journal of Telecommunication, Electronic and Computer Engineering</i> , 9(3-4 Special Issue), pp. 97–101.	Proposes using the GATE framework to automate the analysis of natural language requirements against boilerplates to minimize ambiguity and inconsistencies.	RQ1, RQ4	tool or prototype development
195	Müter, L. et al. (2019) 'Refinement of User Stories into Backlog Items: Linguistic Structure and Action Verbs: Research Preview', in Knauss E. and Goedicke M. (eds) <i>Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)</i> , Springer Verlag, pp. 109–116. Available at: https://doi.org/10.1007/978-3-030-15538-4_7 .	Identified seven elementary action verbs and a template for task labels, providing a structured approach to decompose user stories into tasks.	RQ4	empirical research
196	Naeem, A., Aslam, Z. and Shah, M.A. (2019) 'Analyzing quality of software requirements; A comparison study on NLP tools', in Yu H. (ed.) <i>ICAC - IEEE Int. Conf. Autom. Comput. ICAC 2019 - 2019 25th IEEE International Conference on Automation and Computing</i> , Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.23919/ICoAC.2019.8895182 .	Evaluated different tools for analyzing the quality of software requirements, proposing a new tool, RAT, that showed high accuracy.	RQ1, RQ2	case study
197	Narouei, M., Khanpour, H. and Takabi, H. (2017) 'Identification of access control policy sentences from natural language policy documents', in Zhu S. and Livraga G. (eds) <i>Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)</i> , Springer Verlag, pp. 82–100. Available at: https://doi.org/10.1007/978-3-319-61176-1_5 .	Developed a method using NLP techniques for identifying access control policies in documents, which is effective across different domains with high accuracy.	RQ2	empirical research

198	Naufal Maulana, M.Z. and Siahaan, D. (2022) 'Use Case-Based Analytical Hierarchy Process Method for Software Requirements Prioritization', in Proceeding - Int. Conf. Inf. Technol., Inf. Syst. Electr. Eng.: Appl. Data Sci. Artif. Intell. Technol. Environ. Sustain., ICITISEE. Proceeding - 6th International Conference on Information Technology, Information Systems and Electrical Engineering: Applying Data Sciences and Artificial Intelligence Technologies for Environmental Sustainability, ICITISEE 2022, Institute of Electrical and Electronics Engineers Inc., pp. 205–210. Available at: https://doi.org/10.1109/ICITISEE57756.2022.10057944 .	Introduction of UC-Based-AHP method reduces complexity in software requirements prioritization, improving reliability compared to traditional AHP.	RQ1, RQ4	empirical research
199	Naumcheva, M. (2022) 'Object-Oriented Approach for Requirements Specification', in Fischbach J. et al. (eds) CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85128774392&partnerID=40&md5=80fc674def5d4a1a51b0bffc610406c1 .	Advocated for object-oriented techniques to enhance unambiguity and traceability in software requirements specification.	RQ3, RQ4	empirical research
200	Navarro-Almanza, R., Juarez-Ramirez, R. and Licea, G. (2017) 'Towards Supporting Software Engineering Using Deep Learning: A Case of Software Requirements Classification', in Proc. - Int. Conf. in Softw. Eng. Res. Innov., CONISOFT. Proceedings - 2017 5th International Conference in Software Engineering Research and Innovation, CONISOFT 2017, Institute of Electrical and Electronics Engineers Inc., pp. 116–120. Available at: https://doi.org/10.1109/CONISOFT.2017.00021 .	Proposed using deep learning, specifically CNN, to classify software requirements without manual feature engineering, showing promising results in functional and non-functional requirements classification.	RQ1, RQ3	case study
201	Nayak, A. et al. (2022) 'Req2Spec: Transforming Software Requirements into Formal Specifications Using Natural Language Processing', in Gervasi V. and Vogelsang A. (eds) Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Science and Business Media Deutschland GmbH, pp. 87–95. Available at: https://doi.org/10.1007/978-3-030-98464-9_8 .	Developed Req2Spec, a pipeline that transforms natural language requirements into formal specifications, improving integration with existing tools like HANFOR.	RQ1, RQ4	tool or prototype development
202	Nazir, F. et al. (2017) 'The applications of natural language processing (NLP) for software requirement engineering - A systematic literature review', in Kim K. and Joukov N. (eds) Lect. Notes Electr. Eng. Lecture	Systematically reviewed the use of NLP in SRE, identifying key techniques and tools used in the field.	RQ1	empirical research

	Notes in Electrical Engineering, Springer Verlag, pp. 485–493. Available at: https://doi.org/10.1007/978-981-10-4154-9_56 .			
203	Olajubu, O. et al. (2017) ‘Automated test case generation from high-level logic requirements using model transformation techniques’, in Comput. Sci. Electron. Eng. Conf., CEEC - Proc. 2017 9th Computer Science and Electronic Engineering Conference, CEEC 2017 - Proceedings, Institute of Electrical and Electronics Engineers Inc., pp. 178–182. Available at: https://doi.org/10.1109/CEEC.2017.8101621 .	Applied model-based techniques to generate test cases from high-level logic requirements in the aviation industry, improving productivity.	RQ1, RQ3	tool or prototype development
204	Omar, N., Razali, N.A.M. and Darus, S. (2009) ‘Automated grammar checking of tenses for ESL writing’, in Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), pp. 475–482. Available at: https://doi.org/10.1007/978-3-642-02962-2_60 .	Developed a heuristic-based approach for grammar checking in ESL writing, which can be integrated into CBEM systems.	RQ2	empirical research
205	Ong, E.T. et al. (2008) ‘A multilingual programming model for coupled systems’, International Journal for Multiscale Computational Engineering, 6(1), pp. 39–51. Available at: https://doi.org/10.1615/IntJMultCompEng.v6.i1.40 .	Developed a multilingual programming model to address language interoperability issues in coupled systems, particularly in computational science, enhancing the integration of different programming languages within a single framework.	RQ2	empirical research
206	Ormandjieva, O., Hussain, I. and Kosseim, L. (2007) ‘Toward a text classification system for the quality assessment of software requirements written in natural language’, in. SOQUA’07: Fourth International Workshop on Software Quality Assurance - In conjunction with the 6th ESEC/FSE Joint Meeting, pp. 39–45. Available at: https://doi.org/10.1145/1295074.1295082 .	Proposed a text classification system using NLP to automatically assess the quality of software requirements, focusing on identifying ambiguities and improving the accuracy of requirements documentation.	RQ4	empirical research
207	Osama, M. et al. (2020) ‘Score-Based Automatic Detection and Resolution of Syntactic Ambiguity in Natural Language Requirements’, in Proc. - IEEE Int. Conf. Softw. Maint. Evol., ICSME. Proceedings - 2020 IEEE International Conference on Software Maintenance and Evolution,	Developed a technique to automatically detect and resolve syntactic ambiguity in NL requirements using Stanford	RQ1, RQ2	tool or prototype development

	ICSME 2020, Institute of Electrical and Electronics Engineers Inc., pp. 651–661. Available at: https://doi.org/10.1109/ICSME46990.2020.00067 .	CoreNLP and filtering pipelines.		
208	Osborne, M. and MacNish, C.K. (1996) ‘Processing natural language software requirement specifications’, in Proc Int Conf Requir Eng. Proceedings of the IEEE International Conference on Requirements Engineering, IEEE, pp. 229–236. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-0029722537&partnerID=40&md5=e66d2e84f6f10e33ecce8b48d55ed9c8 .	Discusses using NLP techniques to aid the development of formal descriptions from requirements expressed in controlled natural language to detect and resolve ambiguities.	RQ4	empirical research
209	Ossoukine, K.-Z.B. and Hadrich, L.B. (2020) ‘AR2B: Formalization of Arabic texts with event-B’, Jordanian Journal of Computers and Information Technology, 6(2), pp. 148–164. Available at: https://doi.org/10.5455/jcit.71-1570002057 .	Developed a platform to transform Arabic software requirements into formal specifications with 70% accuracy.	RQ1, RQ2	tool or prototype development
210	Oztekin, G.C. and Menekse Dalveren, G.G. (2023) ‘Structured SRS for e-Government Services With Boilerplate Design and Interface’, IEEE Access, 11, pp. 62906–62917. Available at: https://doi.org/10.1109/ACCESS.2023.3287882 .	Proposed a quality model for SRS in Turkish for e-Government applications, using boilerplate design to standardize requirements documentation.	RQ1, RQ4	empirical research
211	Panthum, T. and Senivongse, T. (2021) ‘Generating functional requirements based on classification of mobile application user reviews’, in IEEE/ACIS Int. Conf. Softw. Eng. Res., Manag. Appl., SERA. 2021 IEEE/ACIS 19th International Conference on Software Engineering Research, Management and Applications, SERA 2021, Institute of Electrical and Electronics Engineers Inc., pp. 15–20. Available at: https://doi.org/10.1109/SERA51205.2021.9509277 .	Automated the generation of functional requirements from user reviews using machine learning and NLP, enhancing the maintenance process for mobile apps.	RQ2, RQ4	empirical research
212	Patel, G.A. and Priya, A.S. (2014) ‘Resolve the uncertainty in requirement specification to generate the UML diagram’, in Int. Conf. Adv. Eng. Technol., ICAET. 2014 International Conference on Advances in Engineering and Technology, ICAET 2014, Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.1109/ICAET.2014.7105213 .	Proposed a method to resolve ambiguities in natural language software requirements and generate precise UML diagrams, utilizing graphical notations of UML to reduce ambiguities significantly.	RQ2	empirical research

213	Perez-Gonzalez, H.G. et al. (2008) 'GOOAL automatic design tool: A role posets based tool to produce object models from problem descriptions', in ICISOFT - Int. Conf. Softw. Data Technol., Proc. ICISOFT 2008 - Proceedings of the 3rd International Conference on Software and Data Technologies, pp. 200–205. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-57649217890&partnerID=40&md5=a3c6cb731c9b920b87a42001338ac95a .	Introduced GOOAL, a tool that automatically produces simple object models (UML diagrams) from problem description statements processed through an intermediate semi-natural language, aiding in the visualization of design decisions and supporting learning in Object Oriented analysis and design courses.	RQ2	empirical research
214	Perez-Verdejo, J.M., Sanchez-Garcia, A.J. and Ocharan-Hernandez, J.O. (2020) 'A systematic literature review on machine learning for automated requirements classification', in Juarez-Ramirez R. et al. (eds) Proc. - Ed. Int. Conf. Softw. Eng. Res. Innov., CONISOFT. Proceedings - 2020 8th Edition of the International Conference in Software Engineering Research and Innovation, CONISOFT 2020, Institute of Electrical and Electronics Engineers Inc., pp. 21–28. Available at: https://doi.org/10.1109/CONISOFT50191.2020.00014 .	Identified ML techniques like Naive Bayes and Decision Trees commonly used in automated requirements classification, highlighting their use with academic databases and user reviews.	RQ1, RQ4	literature review/survey
215	Polpinij, J. and Namee, K. (2021) 'Automatically Retrieving of Software Specification Requirements Related to Each Actor', in Meesad P. et al. (eds) Lect. Notes Networks Syst. Lecture Notes in Networks and Systems, Springer Science and Business Media Deutschland GmbH, pp. 117–126. Available at: https://doi.org/10.1007/978-3-030-79757-7_12 .	Developed a method using NLP to extract and visualize software system requirements, focusing on actors and their actions	RQ2	empirical research
216	Priyadi, Y., Djunaidy, A. and Siahaan, D. (2019) 'Requirements Dependency Graph Modeling on Software Requirements Specification Using Text Analysis', in Int. Conf. Cybern. Intell. Syst., ICORIS. 2019 1st International Conference on Cybernetics and Intelligent System, ICORIS 2019, Institute of Electrical and Electronics Engineers Inc., pp. 221–226. Available at: https://doi.org/10.1109/ICORIS.2019.8874920 .	Proposed a method to model the dependency graph of software requirements using text analysis and semantic similarity measurements, enhancing understanding of requirement interdependencies.	RQ1, RQ4	empirical research
217	Provenzano, L. and Hänninen, K. (2017) 'Specifying software requirements for safety-critical railway systems: An experience report', in Perini	Described the introduction of a safety-compliant method for	RQ2	empirical research

	A. and Grünbacher P. (eds) Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Verlag, pp. 363–369. Available at: https://doi.org/10.1007/978-3-319-54045-0_25 .	writing software safety requirements in railway projects to comply with the EN 50128 standard, focusing on transforming natural language requirements into more structured forms like scenarios and diagrams.		
218	Pudlitz, F., Vogelsang, A. and Brokhausen, F. (2019) ‘A Lightweight Multilevel Markup Language for Connecting Software Requirements and Simulations’, in Goedicke M. and Knauss E. (eds) Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Verlag, pp. 151–166. Available at: https://doi.org/10.1007/978-3-030-15538-4_11 .	Introduced a markup language to annotate natural language requirements for better integration with simulation runs, enhancing the feedback loop between requirements and simulation.	RQ1, RQ2	case study
219	R, L.A.L., L, J.A.G. and A, S.A.G. (2015) ‘Extraction of goals and their classification in the kaos model using natural language processing’, In: <i>ingeniare</i> , 23(1), pp. 59–66. Available at: https://doi.org/10.4067/s0718-33052015000100007 .	Presented a method for extracting and classifying goals from Spanish textual requirements into the KAOS model, using morphosyntactic structures and verb classifications to enhance goal modeling in requirements engineering.	RQ2	empirical research
220	Rago, A., Marcos, C. and Diaz-Pace, J.A. (2018) ‘Using semantic roles to improve text classification in the requirements domain’, <i>Language Resources and Evaluation</i> , 52(3), pp. 801–837. Available at: https://doi.org/10.1007/s10579-017-9406-7 .	Explored the use of semantic roles to enhance text classification in software requirements, achieving improvements in precision and recall.	RQ2, RQ4	case study
221	Raharjana, I.K., Siahaan, D. and Fatichah, C. (2019) ‘User Story Extraction from Online News for Software Requirements Elicitation: A Conceptual Model’, in <i>JCSSE - Int. Jt. Conf. Comput. Sci. Softw. Eng.: Knowl. Evol. Towar. Singul. Man-Machine Intell. JCSSE 2019 - 16th International Joint Conference on Computer Science and Software Engineering</i> :	Proposed a conceptual model to extract user stories from online news, enhancing domain knowledge	RQ1, RQ4	case study

	Knowledge Evolution Towards Singularity of Man-Machine Intelligence, Institute of Electrical and Electronics Engineers Inc., pp. 342–347. Available at: https://doi.org/10.1109/JCSSE.2019.8864199 .	understanding without extensive stakeholder involvement.		
222	Rahman, K. et al. (2023) ‘Pre-Trained Model-Based NFR Classification: Overcoming Limited Data Challenges’, IEEE Access, 11, pp. 81787–81802. Available at: https://doi.org/10.1109/ACCESS.2023.3301725 .	Employed pre-trained models with neural network architectures to classify NFRs, achieving high accuracy and addressing data scarcity challenges.	RQ3, RQ4	empirical research
223	Ramesh, M.R.R. and Reddy, C.S. (2021) ‘Metrics for software requirements specification quality quantification’, Computers and Electrical Engineering, 96. Available at: https://doi.org/10.1016/j.compeleceng.2021.107445 .	Redefined IEEE standard metrics for SRS quality, emphasizing the importance of accurate quality quantification	RQ4	empirical research
224	Riaz, M.Q., Butt, W.H. and Rehman, S. (2019) ‘Automatic Detection of Ambiguous Software Requirements: An Insight’, in Int. Conf. Inf. Manag., ICIM. 5th International Conference on Information Management, ICIM 2019, Institute of Electrical and Electronics Engineers Inc., pp. 1–6. Available at: https://doi.org/10.1109/INFOMAN.2019.8714682 .	Reviewed tools and techniques for automatic detection of ambiguities in software requirements, highlighting the differences and popularity among them.	RQ1, RQ2	empirical research
225	Robeer, M. et al. (2016) ‘Automated Extraction of Conceptual Models from User Stories via NLP’, in Proc. - IEEE Int. Requir. Eng. Conf., RE. Proceedings - 2016 IEEE 24th International Requirements Engineering Conference, RE 2016, Institute of Electrical and Electronics Engineers Inc., pp. 196–205. Available at: https://doi.org/10.1109/RE.2016.40 .	Proposed an NLP-based method to derive conceptual models from user stories, achieving high accuracy in identifying key concepts and relationships, enhancing model visibility and project communication.	RQ4	empirical research
226	Rodriguez, G. et al. (2022) ‘Deriving Architectural Responsibilities from Textual Requirements’, in Misra S. et al. (eds) Commun. Comput. Info. Sci. Communications in Computer and Information Science, Springer Science and Business Media Deutschland GmbH, pp. 297–310. Available at: https://doi.org/10.1007/978-3-030-95630-1_21 .	Proposed an AI-based approach to derive high-level architectural descriptions from textual requirements using NLP and data mining	RQ1, RQ2	empirical research

227	Rojas, A.B. and Sliesarieva, G.B. (2010) ‘Automated Detection of Language Issues Affecting Accuracy, Ambiguity and Verifiability in Software Requirements Written in Natural Language’, in Solorio T. and Pedersen T. (eds) Young Investig. Workshop Comput. Approaches Lang. Americas, Proc. Young Investigators Workshop on Computational Approaches to Languages of the Americas, Proceedings, Association for Computational Linguistics (ACL), pp. 100–108. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84965103654&partnerID=40&md5=9ba83be933711280c3c3c346b5fe4f54 .	Proposed a method to automatically analyze software requirements to assess quality properties like accuracy, non-ambiguity, and verifiability using NLP techniques and specialized dictionaries, showing effective identification of critical issues.	RQ2	empirical research
228	Rossanez, A. and Carvalho, A.M.B.R. (2016) ‘Semi-automatic checklist quality assessment of natural language requirements for space applications’, in Proc. - Latin-Am. Symp. Dependable Comput., LADC. Proceedings - 7th Latin-American Symposium on Dependable Computing, LADC 2016, Institute of Electrical and Electronics Engineers Inc., pp. 123–126. Available at: https://doi.org/10.1109/LADC.2016.26 .	Proposed a semi-automatic NLP tool to assist in the quality assessment of software requirements for space applications, reducing manual effort and potential errors in quality evaluation.	RQ2	case study
229	Sabir, M., Chrysoulas, C. and Banissi, E. (2020) ‘Multi-label Classifier to Deal with Misclassification in Non-functional Requirements’, in Rocha A. et al. (eds) Adv. Intell. Sys. Comput. Advances in Intelligent Systems and Computing, Springer, pp. 486–493. Available at: https://doi.org/10.1007/978-3-030-45688-7_49 .	Proposed a CNN-based multi-label classifier to minimize misclassification of NFRs, enhancing early consideration of NFRs in development.	RQ1, RQ2	tool or prototype development
230	Sajjad, R. and Sarwar, N. (2017) ‘NLP based verification of a UML class model’, in Int. Conf. Innov. Comput. Technol., INTECH. 2016 6th International Conference on Innovative Computing Technology, INTECH 2016, Institute of Electrical and Electronics Engineers Inc., pp. 30–35. Available at: https://doi.org/10.1109/INTECH.2016.7845070 .	Discussed the challenges and approaches in verifying UML models generated from natural language requirements using NLP, highlighting the need for model verification to ensure accuracy and completeness.	RQ1, RQ2	empirical research
231	Sanyal, R. and Ghoshal, B. (2018) ‘Automatic Extraction of Structural Model from Semi Structured Software Requirement Specification’, in Xiong W. et al. (eds) Proc. - IEEE/ACIS Int. Conf. Comput. Inf. Sci., ICIS. Proceedings - 17th IEEE/ACIS International Conference on Computer	Presented an automated extraction method of the structure from semi-structured elicitation	RQ2	empirical research

	and Information Science, ICIS 2018, Institute of Electrical and Electronics Engineers Inc., pp. 543–548. Available at: https://doi.org/10.1109/ICIS.2018.8466406 .			
232	Sanyal, R. and Ghoshal, B. (2021) ‘Automated class diagram elicitation using intermediate use case template’, IET Software, 15(1), pp. 25–42. Available at: https://doi.org/10.1049/sfw2.12010 .	Presented automated class diagram generation	RQ4	tool or prototype development
233	Saphira, M. and Rusli, A. (2019) ‘Towards a gamified support tool for requirements gathering in Bahasa Indonesia’, in Proc. Int. Conf. New Media Stud., CONMEDIA. Proceedings of 2019 5th International Conference on New Media Studies, CONMEDIA 2019, Institute of Electrical and Electronics Engineers Inc., pp. 201–206. Available at: https://doi.org/10.1109/CONMEDIA46929.2019.8981828 .	Developed a gamified tool to enhance stakeholder participation in requirements gathering, showing high user engagement and potential for further development.	RQ1, RQ4	case study
234	Saratha, P., Uma, G.V. and Santhosh, B. (2017) ‘Formal specification for online food ordering system using z language’, in Deborah L.J. and Vijayakumar P. (eds) Proc. - Int. Conf. Recent Trends Chall. Comput. Model., ICRTCCM. Proceedings - 2017 2nd International Conference on Recent Trends and Challenges in Computational Models, ICRTCCM 2017, Institute of Electrical and Electronics Engineers Inc., pp. 343–348. Available at: https://doi.org/10.1109/ICRTCCM.2017.59 .	Addressed ambiguity in SRS using Z language and formal methods, improving the accuracy and efficiency of order details.	RQ1, RQ2	tool or prototype development
235	Sarmiento, E., Do Prado Leite, J.C.S. and Almentero, E. (2014) ‘C&L: Generating model based test cases from natural language requirements descriptions’, in IEEE Int. Workshop Requir. Eng. Test., RET - Proc. 2014 IEEE 1st International Workshop on Requirements Engineering and Testing, RET 2014 - Proceedings, Institute of Electrical and Electronics Engineers Inc., pp. 32–38. Available at: https://doi.org/10.1109/RET.2014.6908677 .	Presented the C&L tool, which translates natural language requirements into behavioral models for automated testing, aiming to decrease the time and effort required for test case generation.	RQ2	empirical research
236	Sarmiento, E., Leite, J.C.S.D.P. and Almentero, E. (2015) ‘Analysis of Scenarios with Petri-Net Models’, in Proc. - Braz. Symp. Softw. Eng., SBES. Proceedings - 29th Brazilian Symposium on Software Engineering, SBES 2015, Institute of Electrical and Electronics Engineers Inc., pp. 90–99. Available at: https://doi.org/10.1109/SBES.2015.13 .	Proposed a Petri-Net based method for translating natural language scenarios into Petri-Nets to automatically analyze software requirements for correctness, consistency, and completeness.	RQ2	empirical research

237	Sateli, B., Angius, E. and Witte, R. (2013) 'The ReqWiki approach for collaborative software requirements engineering with integrated text analysis support', in Proc Int Comput Software Appl Conf. Proceedings - International Computer Software and Applications Conference, IEEE Computer Society, pp. 405–414. Available at: https://doi.org/10.1109/COMPSAC.2013.68 .	Presented ReqWiki, a semantic wiki-based approach that includes NLP assistants to collaboratively work with humans on requirements specification documents, improving the quality of requirements specifications.	RQ2	empirical research
238	Sateli, B. et al. (2012) 'ReqWiki: A semantic system for collaborative software requirements engineering', in WikiSym Conf. Proc. - Annu. Int. Symp. Wikis Open Collab. WikiSym 2012 Conference Proceedings - 8th Annual International Symposium on Wikis and Open Collaboration. Available at: https://doi.org/10.1145/2462932.2462966 .	Introduced ReqWiki, a semantic wiki with NLP assistants for collaborative requirements engineering, aiming to enhance the specification process especially for small to mid-size enterprises.	RQ4	empirical research
239	Sateli, B. and Witte, R. (2012) 'Supporting wiki users with natural language processing', in WikiSym Conf. Proc. - Annu. Int. Symp. Wikis Open Collab. WikiSym 2012 Conference Proceedings - 8th Annual International Symposium on Wikis and Open Collaboration. Available at: https://doi.org/10.1145/2462932.2462976 .	Introduced a "self-aware" wiki system that uses NLP and Semantic Computing to enhance MediaWiki for applications like biomedical literature curation and software requirements engineering, significantly improving content development and organization.	RQ2	empirical research
240	Sawada, K. et al. (2023) 'Intelligent requirement-to-test-case traceability system via Natural Language Processing and Machine Learning', in Proc. - IEEE Int. Conf. Space Mission Challenges Inf. Technol., SMC-IT. Proceedings - 2023 IEEE 9th International Conference on Space Mission Challenges for Information Technology, SMC-IT 2023, Institute of Electrical and Electronics Engineers Inc., pp. 78–83. Available at: https://doi.org/10.1109/SMC-IT56444.2023.00017 .	Proposed a method combining NLP and ML to automate software requirement-to-test mapping	RQ3	empirical research
241	Sawant, K.P. et al. (2014) 'Enforcing structure on textual use cases via annotation models', in ACM Int. Conf. Proc. Ser. ACM International	Presented a method for processing textual use cases to	RQ2	empirical research

	Conference Proceeding Series, Association for Computing Machinery. Available at: https://doi.org/10.1145/2590748.2590766 .	extract a structured model using NLP, which can be used to generate various UML and business process models, thereby enhancing the structuring of requirements documentation.		
242	Seresht, S.M. and Ormandjieva, O. (2008) 'Automated assistance for use cases elicitation from user requirements text', in Workshop Requir. Eng., WER - Proc. 11th Workshop on Requirements Engineering, WER 2008 - Proceedings, pp. 128–139. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-77952702195&partnerID=40&md5=0d901e6a90f3eeef463254b1bd7f9b20 .	Proposed a methodology to automatically extract high-level system services and actors from user requirements texts, supporting use-case model development and helping analysts to better understand the requirements.	RQ2	empirical research
243	Sharma, R. and Biswas, K.K. (2014) 'Automated generation of test cases from logical specification of software requirements', in ENASE - Proc. Int. Conf. Eval. Novel Approaches Softw. Eng. ENASE 2014 - Proceedings of the 9th International Conference on Evaluation of Novel Approaches to Software Engineering, SciTePress, pp. 241–248. Available at: https://doi.org/10.5220/0004972902410248 .	Presented an approach to automatically generate test cases from logical specifications of requirements using courteous logic, aiming to integrate testing early in the development process.	RQ4	empirical research
244	Sharma, R., Gulia, S. and Biswas, K.K. (2014) 'Automated generation of activity and sequence diagrams from natural language requirements', in ENASE - Proc. Int. Conf. Eval. Novel Approaches Softw. Eng. ENASE 2014 - Proceedings of the 9th International Conference on Evaluation of Novel Approaches to Software Engineering, SciTePress, pp. 69–77. Available at: https://doi.org/10.5220/0004893600690077 .	Presented an approach to automatically generate behavioral UML models from natural language requirements by transforming requirements statements into structured representations using NLP, thus facilitating the automated generation of activity and sequence diagrams.	RQ2	empirical research

245	Shehadeh, K., Arman, N. and Khamayseh, F. (2021) 'Semi-Automated Classification of Arabic User Requirements into Functional and Non-Functional Requirements using NLP Tools', in Int. Conf. Inf. Technol., ICIT - Proc. 2021 International Conference on Information Technology, ICIT 2021 - Proceedings, Institute of Electrical and Electronics Engineers Inc., pp. 527–532. Available at: https://doi.org/10.1109/ICIT52682.2021.9491698 .	NLP reduces time and cost in classifying functional and non-functional requirements.	RQ2, RQ4	empirical research
246	Sheldon, F.T. and Kim, H.Y. (2002) 'Validation of guidance control software requirements specification for reliability and fault-tolerance', Proceedings of the Annual Reliability and Maintainability Symposium, pp. 312–318. Available at: https://doi.org/10.1109/RAMS.2002.981660 .	Validates a guidance control software's SRS for reliability and fault tolerance using Z and Statecharts, demonstrating the benefits of formal specification for avoiding design defects and system failures.	RQ3	empirical research
247	Sholiq, S., Sarno, R. and Astuti, E.S. (2022) 'Generating BPMN diagram from textual requirements', Journal of King Saud University - Computer and Information Sciences, 34(10), pp. 10079–10093. Available at: https://doi.org/10.1016/j.jksuci.2022.10.007 .	Developed a method for converting textual requirements to BPMN diagrams, improving on existing methods by handling complex sentence structures.	RQ1, RQ2	empirical research
248	Shreda, Q.A. and Hanani, A.A. (2021) 'Identifying Non-functional Requirements from Unconstrained Documents using Natural Language Processing and Machine Learning Approaches', IEEE Access [Preprint]. Available at: https://doi.org/10.1109/ACCESS.2021.3052921 .	Proposed an automatic method to identify and classify non-functional requirements from unconstrained documents using a combination of semantic and syntactic analysis with machine learning, achieving high classification accuracy.	RQ2	empirical research
249	Shweta, Sanyal, R. and Ghoshal, B. (2021) 'Automated class diagram elicitation using intermediate use case template', IET Software, 15(1), pp. 25–42. Available at: https://doi.org/10.1049/sfw2.12010 .	Proposed an intermediate template to reduce complexity and increase accuracy in	RQ2, RQ3	empirical research

		automated class diagram elicitation from use cases		
250	Shweta, Sanyal, R. and Ghoshal, B. (2021) 'Automated class diagram elicitation using intermediate use case template', IET Software, 15(1), pp. 25–42. Available at: https://doi.org/10.1049/sfw2.12010 .	Improved rule-based methods for extracting class diagrams from semi-structured SRS documents, achieving high precision and recall.	RQ1, RQ2	tool or prototype development
251	Siahaan, D., Raharjana, I.K. and Fatichah, C. (2023) 'User story extraction from natural language for requirements elicitation: Identify software-related information from online news', Information and Software Technology, 158. Available at: https://doi.org/10.1016/j.infsof.2023.107195 .	Utilized a rule-based NLP approach to extract user stories from online news, enhancing the elicitation process by improving stakeholder and needs identification.	RQ1, RQ2	case study
252	Silva, G.R.S. and Canedo, E.D. (2023) 'Unveiling Quality in Chatbot Conversations: Quantitative Analysis of Chatbot Requirements', in ACM Int. Conf. Proc. Ser. ACM International Conference Proceeding Series, Association for Computing Machinery, pp. 148–157. Available at: https://doi.org/10.1145/3629479.3629481 .	Analyzed chatbot development requirements, highlighting the significance of structured documentation and conversation flow for quality	RQ1, RQ4	case study
253	Singh, M. and Walia, G.S. (2020) 'Using Semantic Analysis and Graph Mining Approaches to Support Software Fault Fixation', in Vieira M. et al. (eds) Proc. - IEEE Int. Symp. Softw. Reliab. Eng. Workshops, ISSREW. Proceedings - 2020 IEEE 31st International Symposium on Software Reliability Engineering Workshops, ISSREW 2020, Institute of Electrical and Electronics Engineers Inc., pp. 43–48. Available at: https://doi.org/10.1109/ISSREW51248.2020.00035 .	Proposed a method using semantic analysis and graph mining to support change impact analysis (CIA) in software requirement specifications.	RQ1, RQ3	empirical research
254	Singh, M., Walia, G.S. and Goswami, A. (2017) 'Validation of Inspection Reviews over Variable Features Set Threshold', in Proc. - Int. Conf. Mach. Learn. Data Sci., MLDS. Proceedings - 2017 International Conference on Machine Learning and Data Science, MLDS 2017, Institute of Electrical and Electronics Engineers Inc., pp. 128–135. Available at: https://doi.org/10.1109/MLDS.2017.16 .	Evaluated a mining approach to automate the validation of requirement reviews, using POS tagging against different trained models.	RQ1, RQ4	empirical research

255	Sinkie, M. et al. (2023) 'Joint Impact of Agents and Services in Enhancing Software Requirements Engineering', Electronics (Switzerland), 12(18). Available at: https://doi.org/10.3390/electronics12183955 .	agent-oriented and service-oriented approaches with social media, enhances the effectiveness of software requirement engineering processes	RQ3, RQ4	empirical research
256	Slob, G.-J. et al. (2018) 'The interactive narrator tool: Effective requirements exploration and discussion through visualization', in Dalpiaz F. et al. (eds) CEUR Workshop Proc. CEUR Workshop Proceedings, CEUR-WS. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045417653&partnerID=40&md5=38b4c289ac0d9a8e7b2518058e56d39a .	Introduced a tool that uses NLP to create interactive visualizations of software requirements, facilitating better understanding and discussion among stakeholders.	RQ1, RQ4	tool or prototype development
257	Soares, H.A. and Moura, R.S. (2015) 'A methodology to guide writing Software Requirements Specification document', in 2015 Latin American Computing Conference (CLEI). 2015 XLI Latin American Computing Conference (CLEI), Arequipa, Peru: IEEE, pp. 1–11. Available at: https://doi.org/10.1109/CLEI.2015.7360001 .	Proposed a methodology supported by ERS-EDITOR tool using NLP for guiding the creation of consistent, unambiguous SRS documents, with preliminary results showing promise.	RQ4	empirical research
258	Sonbol, R., Rebdawi, G. and Ghneim, N. (2022) 'Learning software requirements syntax: An unsupervised approach to recognize templates', Knowledge-Based Systems, 248. Available at: https://doi.org/10.1016/j.knosys.2022.108933 .	Proposed an unsupervised approach to detect templates from requirements	RQ2	empirical research
259	Sonbol, R., Rebdawi, G. and Ghneim, N. (2020) 'Towards a Semantic Representation for Functional Software Requirements', in Proc. - Int. Workshop Artif. Intell. Requir. Eng., AIRE. Proceedings - 7th International Workshop on Artificial Intelligence and Requirements Engineering, AIRE 2020, Institute of Electrical and Electronics Engineers Inc., pp. 1–8. Available at: https://doi.org/10.1109/AIRE51212.2020.00007 .	Introduced ReqVec, a semantic representation for functional requirements, demonstrating high efficiency in detecting related requirements and categorizing them using NLP.	RQ1, RQ2, RQ4	tool or prototype development
260	de Souza Filho, J.C. et al. (2021) 'Towards a Data-Driven Requirements Elicitation Tool through the Lens of Design Thinking', in Filipe J. et al. (eds) International Conference on Enterprise Information Systems, ICEIS - Proceedings. International Conference on Enterprise Information	used design thinking to elicitate requirements	RQ4	tool or prototype development

	Systems, ICEIS - Proceedings, Science and Technology Publications, Lda, pp. 283–290. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85137964843&partnerID=40&md5=f8eee5eca91cc47e918a2eb4d0763fd7 .			
261	Stålthane, T. and Wien, T. (2014) ‘The DODT tool applied to sub-sea software’, in IEEE Int. Requir. Eng. Conf., RE - Proc. 2014 IEEE 22nd International Requirements Engineering Conference, RE 2014 - Proceedings, Institute of Electrical and Electronics Engineers Inc., pp. 420–427. Available at: https://doi.org/10.1109/RE.2014.6912293 .	Described the use of natural language requirements with tool support using boilerplates and domain ontologies to improve requirement quality by reducing ambiguities and incompleteness, demonstrated through a case study on a safety-critical control system.	RQ2	tool or prototype development
262	Subha, R. and Palaniswami, S. (2013) ‘Quality factor assessment and text summarization of unambiguous natural language requirements’, in Commun. Comput. Info. Sci. Communications in Computer and Information Science, Springer Verlag, pp. 131–146. Available at: https://doi.org/10.1007/978-3-642-36321-4_12 .	Proposed a framework for automatic analysis of ambiguities in requirements documents, summarization of these documents, and quality assessment based on a decision-tree based text classifier.	RQ2	empirical research
263	Syu, Y., Tsao, Y.-J. and Wang, C.-M. (2022) ‘Rule-Based Extraction of Tuple-Based Service Demand from Natural Language-Based Software Requirement for Automated Service Composition’, in Katangur A. and Zhang L. (eds) Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer Science and Business Media Deutschland GmbH, pp. 1–17. Available at: https://doi.org/10.1007/978-3-030-96566-2_1 .	Proposes a rule-based NLP approach to bridge the gap between natural language requirements and tuple-based service demands, enhancing ASC accessibility.	RQ1, RQ2	empirical research
264	Tahvili, S. et al. (2018) ‘Functional Dependency Detection for Integration Test Cases’, in Proc. - IEEE Int. Conf. Softw. Qual., Reliab., Secur. Companion, QRS-C. Proceedings - 2018 IEEE 18th International Conference on Software Quality, Reliability, and Security Companion, QRS-C 2018,	Presented an NLP approach to detect dependencies between integration test cases in the railway domain, aiding test	RQ1, RQ3	empirical research

	Institute of Electrical and Electronics Engineers Inc., pp. 207–214. Available at: https://doi.org/10.1109/QRS-C.2018.00047 .	case prioritization and scheduling.		
265	Tálele, P. and Phalnikar, R. (2021) ‘Classification and prioritisation of software requirements using machine learning - A systematic review’, in Proc. Conflu.: Int. Conf. Cloud Comput., Data Sci. Eng. Proceedings of the Confluence 2021: 11th International Conference on Cloud Computing, Data Science and Engineering, Institute of Electrical and Electronics Engineers Inc., pp. 912–918. Available at: https://doi.org/10.1109/Confluence51648.2021.9377190 .	Machine learning improves requirement identification and prioritization; current models face scalability and complexity issues.	RQ1, RQ3, RQ4	empirical research
266	Talele, P. et al. (2023) ‘Semi-automated Software Requirements Categorisation using Machine Learning Algorithms’, International Journal of Electrical and Computer Engineering Systems, 14(10), pp. 1107–1114. Available at: https://doi.org/10.32985/ijeces.14.10.3 .	The study showcases that TF-IDF and Machine Learning algorithms enhance the categorization of software requirements, pointing to automation potential in the field.	RQ1, RQ3, RQ4	empirical research
267	Tamai, T. and Anzai, T. (2018) ‘Quality requirements analysis with machine learning’, in Damiani E. et al. (eds) ENASE - Proc. Int. Conf. Evaluation Novel Approaches to Softw. Engineering. ENASE 2018 - Proceedings of the 13th International Conference on Evaluation of Novel Approaches to Software Engineering, SciTePress, pp. 241–248. Available at: https://doi.org/10.5220/0006694502410248 .	Utilized ML to automate the process of filtering and classifying QR statements from SRS, analyzing their distribution across documents.	RQ1, RQ2	case study
268	Tanjong, E. and Carver, D. (2021) ‘Improving Impact and Dependency Analysis through Software Categorization Methods’, in Juarez-Ramirez R. et al. (eds) Proc. - Int. Conf. Softw. Eng. Res. Innov., CONISOFT. Proceedings - 2021 9th International Conference in Software Engineering Research and Innovation, CONISOFT 2021, Institute of Electrical and Electronics Engineers Inc., pp. 142–151. Available at: https://doi.org/10.1109/CONISOFT52520.2021.00029 .	Comparison of categorization methods reveals syntactic techniques might equal or exceed semantic methods in some contexts for requirements analysis.	RQ2, RQ4	empirical research
269	Thakur, J.S. and Gupta, A. (2016) ‘Identifying domain elements from textual specifications’, in Khurshid S., Lo D., and Apel S. (eds) ASE - Proc. IEEE/ACM Int. Conf. Autom. Softw. Eng. ASE 2016 - Proceedings of the 31st IEEE/ACM International Conference on Automated Software	Proposed an automated transformation approach using Hornby's verb patterns and Type Dependencies to identify domain elements from NL	RQ4	empirical research

	Engineering, Association for Computing Machinery, Inc, pp. 566–577. Available at: https://doi.org/10.1145/2970276.2970323 .	specifications, showing significant improvements over existing methods.		
270	Thongglin, K., Cardey, S. and Greenfield, P. (2012) ‘Controlled syntax for thai software requirements specification’, in Proc. Int. Conf. Tools Artif. Intell. ICTAI. Proceedings - International Conference on Tools with Artificial Intelligence, ICTAI, pp. 964–969. Available at: https://doi.org/10.1109/ICTAI.2012.136 .	Proposed a controlled syntax approach using Backus Naur Form for Thai software requirements, significantly reducing ambiguities.	RQ2	empirical research
271	Thongglin, K., Cardey, S. and Greenfield, P. (2013) ‘Thai software requirements specification pattern’, in SoMeT - IEEE Int. Conf. Intelligent Softw. Methodol., Tools Tech., Proc. SoMeT 2013 - 12th IEEE International Conference on Intelligent Software Methodologies, Tools and Techniques, Proceedings, IEEE Computer Society, pp. 179–184. Available at: https://doi.org/10.1109/SoMeT.2013.6645650 .	Introduced a pattern using controlled syntax to assist Thai software engineers in writing clear and structured software requirements specifications, thereby reducing ambiguities and improving the clarity of requirements documentation.	RQ2	empirical research
272	Tian, J., Yin, J. and Xiao, L. (2022) ‘Software Requirements Engineer’s Ability Assessment Method Based on Empirical Software Engineering’, Wireless Communications and Mobile Computing, 2022. Available at: https://doi.org/10.1155/2022/3617140 .	Proposed a method to assess software requirements engineers’ abilities based on industry expectations and educational settings.	RQ1, RQ3	case study
273	Tichy, W.F., Landhäußer, M. and Körner, S.J. (2015) ‘nlrpBENCH: A Benchmark for Natural Language Requirements Processing’, in Assmann U. et al. (eds) Lect. Notes Informatics (LNI), Proc. - Series Ges. Inform. (GI). Lecture Notes in Informatics (LNI), Proceedings - Series of the Gesellschaft für Informatik (GI), Gesellschaft für Informatik (GI), pp. 159–164. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85134745960&partnerID=40&md5=debd9f9373d35782d844a41df48f9d89 .	Introduced nlrpBENCH, a benchmarking platform to evaluate and compare tools in natural language requirements processing, helping to standardize tool assessment in this field.	RQ2	empirical research
274	Tiwari, S. et al. (2020) ‘Identifying Use Case Elements from Textual Specification: A Preliminary Study’, in Breau T. et al. (eds) Proc. Int. Conf. Requir. Eng. Proceedings of the IEEE International Conference on	Presents an initial approach using machine learning techniques to automatically	RQ1, RQ4	empirical research

	Requirements Engineering, IEEE Computer Society, pp. 410–411. Available at: https://doi.org/10.1109/RE48521.2020.00059 .	identify use case and actor names from textual requirements specification.		
275	Tizard, J. et al. (2023) ‘A Software Requirements Ecosystem: Linking Forum, Issue Tracker, and FAQs for Requirements Management’, IEEE Transactions on Software Engineering, 49(4), pp. 2381–2393. Available at: https://doi.org/10.1109/TSE.2022.3219458 .	Developed a deep-learning model to link user feedback in forums with issue trackers and documentation	RQ1, RQ3	case study, tool or prototype development
276	Tóth, L. et al. (2020) ‘Mining Hypernyms Semantic Relations from Stack Overflow’, in Proc. - IEEE/ACM Int. Conf. Softw. Eng. Workshops, ICSEW. Proceedings - 2020 IEEE/ACM 42nd International Conference on Software Engineering Workshops, ICSEW 2020, Association for Computing Machinery, Inc, pp. 360–366. Available at: https://doi.org/10.1145/3387940.3392160 .	Created a semantic network from Stack Overflow to bridge communication gaps in software development by mapping business terminologies.	RQ2, RQ4	tool or prototype development
277	Tripathy, A. and Rath, S.K. (2014) ‘Application of natural language processing in object oriented software development’, in Int. Conf. Recent Trends Inf. Technol., ICRTIT. 2014 International Conference on Recent Trends in Information Technology, ICRTIT 2014, Institute of Electrical and Electronics Engineers Inc. Available at: https://doi.org/10.1109/ICRTIT.2014.6996121 .	Developed a methodology using NLP to identify objects, methods, and attributes from SRS documents for OO software development.	RQ2	empirical research
278	Tuz Zahra, F., Rahim, H. and Iqbal, S. (2017) ‘Sematic analysis of business rules using discourse representation theory’, in Int. Conf. Innov. Comput. Technol., INTECH. 2016 6th International Conference on Innovative Computing Technology, INTECH 2016, Institute of Electrical and Electronics Engineers Inc., pp. 210–215. Available at: https://doi.org/10.1109/INTECH.2016.7845068 .	Explored the translation of natural language business rules into formal representations, emphasizing the challenges and complexities of automation.	RQ2, RQ4	empirical research
279	Ul Hasan, S.A. and Ali Rana, Z. (2022) ‘Determining the Level of Detail of Software Requirements’, in Proc. - Int. Conf. Front. Inf. Technol., FIT. Proceedings - 2022 International Conference on Frontiers of Information Technology, FIT 2022, Institute of Electrical and Electronics Engineers Inc., pp. 13–17. Available at: https://doi.org/10.1109/FIT57066.2022.00013 .	Proposed a method using Parts of Speech to determine the level of detail of software requirements, classifying them into low, intermediate, or high-level categories	RQ1, RQ2	empirical research
280	Umber, A., Bajwa, I.S. and Asif Naeem, M. (2011) ‘NL-based automated software requirements elicitation and specification’, in Commun.	Described an automated approach for eliciting and	RQ4	empirical research

	Comput. Info. Sci. Communications in Computer and Information Science, pp. 30–39. Available at: https://doi.org/10.1007/978-3-642-22714-1_4 .	specifying software requirements using SBVR and NLP, implemented in a tool that transforms natural language into formal specifications.		
281	Verma, K., Kass, A. and Vasquez, R. (2014) ‘Using syntactic and semantic analyses to improve the quality of requirements documentation’, Semantic Web, 5(5), pp. 405–419. Available at: https://doi.org/10.3233/SW-2012-0071 .	Used syntactic and semantic methods to improve the quality of requirements documentation	RQ2	empirical research
282	Verma, R.P. and Beg, M.R. (2013b) ‘Representation of knowledge from software requirements expressed in natural language’, in Int. Conf. Emerg. Trends Eng. Technol., ICETET. International Conference on Emerging Trends in Engineering and Technology, ICETET, IEEE Computer Society, pp. 154–158. Available at: https://doi.org/10.1109/ICE-TET.2013.47 .	Demonstrated modeling of software requirements expressed in natural language into a graph-based structure using NLP techniques, which aids in the correct interpretation of requirements and early test case derivation.	RQ2	empirical research
283	Verma, R.P. and Beg, M.R. (2013a) ‘Generation of test cases from software requirements using natural language processing’, in Int. Conf. Emerg. Trends Eng. Technol., ICETET. International Conference on Emerging Trends in Engineering and Technology, ICETET, IEEE Computer Society, pp. 140–147. Available at: https://doi.org/10.1109/ICE-TET.2013.45 .	Proposed an approach to generate test cases from software requirements stated in natural language using NLP, aiming to enhance early verification of software systems and enforce quality through automated test case generation.	RQ2	empirical research
284	Vlas, R.E. and Robinson, W.N. (2012) ‘Two rule-based natural language strategies for requirements discovery and classification in open source software development projects’, in J Manage Inf Syst. Journal of Management Information Systems, pp. 11–38. Available at: https://doi.org/10.2753/MIS0742-1222280402 .	Described the use of automated natural language strategies to classify requirements in open-source projects, addressing the challenges of manual analysis in large-scale and open-source environments.	RQ2	empirical research

285	Wakabayashi, T. et al. (2020) ‘Tool supported detection of omissions by comparing words between requirements and design document’, Journal of Information Processing, 28, pp. 136–149. Available at: https://doi.org/10.2197/ipsjip.28.136 .	Proposed a tool-supported approach to detect omissions in design documents by comparing words between documents, enhancing document inspection processes.	RQ1, RQ2	tool or prototype development
286	Wang, C.-H., Chu, W.C. and Wang, F.-J. (2005) ‘Providing a behavioral and static formal model to elicit the functional software requirement’, in Proc. IEEE Int. Conf. Info. Reuse Integr. Proceedings of the 2005 IEEE International Conference on Information Reuse and Integration, IRI - 2005, pp. 44–49. Available at: https://doi.org/10.1109/IRI-05.2005.1506447 .	Proposed a formal model combining behavior and operational software models for eliciting functional software requirements.	RQ2	empirical research
287	Wang, Y. et al. (2013) ‘Automatic detection of ambiguous terminology for software requirements’, in Lect. Notes Comput. Sci. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), pp. 25–37. Available at: https://doi.org/10.1007/978-3-642-38824-8_3 .	Developed methods for automatic detection of ambiguous terminology in software requirements to prevent potential errors.	RQ2	empirical research
288	Wang, Y. and Zhang, J. (2017) ‘Experiment on automatic functional requirements analysis with the EFRFs semantic cases’, in Wang Y. and Sun Y. (eds) PIC - Proc. IEEE Int. Conf. Prog. Inf. Comput. PIC 2016 - Proceedings of the 2016 IEEE International Conference on Progress in Informatics and Computing, Institute of Electrical and Electronics Engineers Inc., pp. 636–642. Available at: https://doi.org/10.1109/PIC.2016.7949577 .	Proposed an approach for automatic functional requirements analysis, showing cross-domain extraction capabilities and robustness.	RQ1, RQ2	empirical research
289	Wang, Z. et al. (2022) ‘BiLSTM-CRF-KG: A Construction Method of Software Requirements Specification Graph’, Applied Sciences (Switzerland), 12(12). Available at: https://doi.org/10.3390/app12126016 .	Created software requirement specification graphs, demonstrating the integration of NLP and knowledge graphs for improved requirement analysis	RQ2, RQ3	empirical research
290	Wei, J. et al. (2023) ‘Zero-shot Bilingual App Reviews Mining with Large Language Models’, in Proc. Int. Conf. Tools Artif. Intell. ICTAI. Proceedings - International Conference on Tools with Artificial Intelligence, ICTAI, IEEE Computer Society, pp. 898–904. Available at: https://doi.org/10.1109/ICTAI59109.2023.00135 .	Developed Mini-BAR, a tool that uses large language models for zero-shot mining of bilingual user reviews, enhancing the efficiency and	RQ1, RQ3	empirical research tool or prototype development

		effectiveness of requirement engineering by classifying, clustering, summarizing, and ranking user review clusters.		
291	Wein, S. and Briggs, P. (2021) ‘A Fully Automated Approach to Requirement Extraction from Design Documents’, in IEEE Aerosp. Conf. Proc. IEEE Aerospace Conference Proceedings, IEEE Computer Society. Available at: https://doi.org/10.1109/AERO50100.2021.9438170 .	Demonstrates a fully automated NLP-based system for extracting and aligning requirements from design documents, enhancing accuracy and efficiency in aerospace RE.	RQ1, RQ4	empirical research, tool or prototype development
292	Wendland, M.-F., Schieferdecker, I. and Vouffo-Feudjio, A. (2011) ‘Requirements-driven testing with behavior trees’, in Proc. - IEEE Int. Conf. Softw. Test., Verif., Validation Workshops, ICSTW. Proceedings - 4th IEEE International Conference on Software Testing, Verification, and Validation Workshops, ICSTW 2011, pp. 501–510. Available at: https://doi.org/10.1109/ICSTW.2011.25 .	Extended behavior engineering methodology with testing activities to utilize requirements models for testing purposes.	RQ4	empirical research
293	Yildiz, O.T., Okutan, A. and Solak, E. (2014) ‘Bilingual software requirements tracing using vector space model’, in ICPRAM - Proc. Int. Conf. Pattern Recogn. Appl. Methods. ICPRAM 2014 - Proceedings of the 3rd International Conference on Pattern Recognition Applications and Methods, SciTePress, pp. 358–363. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84902346459&partnerID=40&md5=f1cddaf4f376321b3b4e7022d40cad34 .	Used the vector space model to trace software requirements across languages, enhancing the traceability in multilingual contexts.	RQ4	empirical research
294	Younas, M., Jawawi, D.N.A., Ghani, I., et al. (2020) ‘Extraction of non-functional requirement using semantic similarity distance’, Neural Computing and Applications, 32(11), pp. 7383–7397. Available at: https://doi.org/10.1007/s00521-019-04226-5 .	Applied semantic similarity measures using Wikipedia to extract non-functional requirements from SRS, improving NFR extraction performance.	RQ1, RQ2	empirical research
295	Younas, M., Jawawi, D.N.A., Shah, M.A., et al. (2020) ‘Elicitation of Non-functional Requirements in Agile Development Using Cloud Computing Environment’, IEEE Access, 8, pp. 209153–209162. Available at: https://doi.org/10.1109/ACCESS.2020.3014381 .	Proposed a semi-automated methodology to elicit non-functional requirements in agile development enhanced by	RQ1, RQ2	case study

		cloud computing, showing improved process efficiency.		
296	Zamani, K. (2021) 'A Prediction Model for Software Requirements Change Impact', in Proc. - IEEE/ACM Int. Conf. Autom. Softw. Eng., ASE. Proceedings - 2021 36th IEEE/ACM International Conference on Automated Software Engineering, ASE 2021, Institute of Electrical and Electronics Engineers Inc., pp. 1028–1032. Available at: https://doi.org/10.1109/ASE51524.2021.9678582 .	Developed a machine learning and NLP-based prediction model to forecast the impact of requirement changes, which supports automated change impact analysis for project managers	RQ3, RQ4	case study
297	Zhao, G. et al. (2023) 'Leveraging Conditional Statement to Generate Acceptance Tests Automatically via Traceable Sequence Generation', in IEEE Int. Conf. Softw. Qual., Reliab. Secur., QRS. IEEE International Conference on Software Quality, Reliability and Security, QRS, Institute of Electrical and Electronics Engineers Inc., pp. 394–405. Available at: https://doi.org/10.1109/QRS60937.2023.00046 .	Introduced a method to automatically generate test cases by deriving conditional statements from requirements, significantly enhancing test coverage and quality.	RQ1, RQ4	empirical research
298	Zolotas, C. et al. (2017) 'From requirements to source code: a Model-Driven Engineering approach for RESTful web services', Automated Software Engineering, 24(4), pp. 791–838. Available at: https://doi.org/10.1007/s10515-016-0206-x .	Proposed a MDE engine that semi-automatically constructs input models from multi-modal software requirements using NLP, enhancing rapid development of RESTful web services.	RQ1	empirical research
299		28th International Working Conference on Requirements Engineering: Foundation for Software Quality, REFSQ 2022	General empirical research, tool or prototype development, literature review/survey	
300		3rd EAI International Conference on Data and Information in Online Environments, DI-ONE 2022	General empirical research, tool or prototype development, literature review/survey	
301		Proceedings - 2017 5th International Conference in Software Engineering Research	General empirical research, tool or prototype development, literature review/survey	

	and Innovation, CONISOFT 2017	
302	CEUR Workshop Proceedings	General empirical research, tool or prototype development, literature review/survey
303	4th International Conference on Information and Communication Technology for Intelligent Systems, ICTIS 2020	General empirical research, tool or prototype development, literature review/survey
304	CEUR Workshop Proceedings	General empirical research, tool or prototype development, literature review/survey
305	23rd International Working Conference on Requirements Engineering - Foundation for Software Quality, REFSQ 2017	General empirical research, tool or prototype development, literature review/survey
306	23rd International Working Conference on Requirements Engineering - Foundation for Software Quality, REFSQ 2017	General empirical research, tool or prototype development, literature review/survey
307	Natural Language Processing and Information Systems - 18th International Conference on Applications of Natural Language to Information Systems, NLDB 2013, Proceedings	General empirical research, tool or prototype development, literature review/survey
308	6th International Conference on Innovations in Bio-Inspired Computing and Applications, IBICA 2015	General empirical research, tool or prototype development, literature review/survey

309	Proceedings - 2016 IEEE 24th International Requirements Engineering Conference, RE 2016	General empirical research, tool or prototype development, literature review/survey
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