

Table 1. List of Included Primary Studies

ID	Year	Title	Venue	Reference
1	2020	Evaluating representation learning of code changes for predicting patch correctness in program repair	ASE	[127]
2	2021	Applying CodeBERT for Automated Program Repair of Java Simple Bugs	MSR	[93]
3	2021	CURE Code-Aware Neural Machine Translation for Automatic Program Repair	ICSE	[56]
4	2021	Generating Bug-Fixes Using Pretrained Transformers	PLDI	[19]
5	2021	Is this Change the Answer to that Problem? Correlating Descriptions of Bug and Code Changes for Evaluating Patch Correctness	ASE	[130]
6	2021	TFix-Learning to Fix Coding Errors with a Text-to-Text Transformer	PMLR	[7]
7	2022	An Analysis of the Automatic Bug Fixing Performance of ChatGPT	APR	[123]
8	2022	An empirical study of deep transfer learning-based program repair for Kotlin projects	FSE/ESEC	[63]
9	2022	Can OpenAI's codex fix bugs?: an evaluation on QuixBugs	APR	[113]
10	2022	CIRCLE: Continual Repair across Programming Languages	ISSTA	[167]
11	2022	DEAR A Novel Deep Learning-based Approach for Automated Program Repair	ICSE	[76]
12	2022	DeepDev-PERF: A Deep Learning-Based Approach for Improving Software Performance	FSE/ESEC	[33]
13	2022	Fix Bugs with Transformer through a Neural-Symbolic Edit Grammar	ICLR	[48]
14	2022	Framing Program Repair as Code Completion	APR	[115]
15	2022	Less training, more repairing please: revisiting automated program repair via zero-shot learning	FSE/ESEC	[150]
16	2022	Patch Generation with Language Models: Feasibility and Scaling Behavior	ICLR	[64]
17	2022	SYNShINE: improved fixing of Syntax Errors	TSE	[2]
18	2022	Towards JavaScript program repair with Generative Pre-trained Transformer (GPT-2)	APR	[70]
19	2022	VulRepair: A T5-Based Automated Software Vulnerability Repair	FSE/ESEC	[29]
20	2023	A Chain of AI-based Solutions for Resolving FQNs and Fixing Syntax Errors in Partial Code	arxiv	[53]
21	2023	A critical review of large language model on software engineering: An example from chatgpt and automated program repair	arxiv	[176]
22	2023	Agentcoder: Multi-agent-based code generation with iterative testing and optimisation	arxiv	[49]
23	2023	An Empirical Study of Adoption of ChatGPT for Bug Fixing among Professional Developers	ITA	[35]
24	2023	An Empirical Study on Fine-Tuning Large Language Models of Code for Automated Program Repair	ASE	[50]
25	2023	An Evaluation of the Effectiveness of OpenAI's ChatGPT for Automated Python Program Bug Fixing using QuixBugs	iSEMANTIC	[146]
26	2023	An Extensive Study on Model Architecture and Program Representation in the Domain of Learning-based Automated Program Repair	APR	[44]
27	2023	Automated Code Editing with Search-Generate-Modify	TSE	[80]
28	2023	Automated Program Repair in the Era of Large Pre-trained Language Models	ICSE	[149]
29	2023	Automated Program Repair Using Generative Models for Code Infilling	AIED	[68]
30	2023	Automated Repair of Programs from Large Language Models	ICSE	[24]
31	2023	Baldur: Whole-Proof Generation and Repair with Large Language Models	FSE/ESEC	[27]
32	2023	Can LLMs Patch Security Issues	arxiv	[4]
33	2023	Coffee: Boost Your Code LLMs by Fixing Bugs with Feedback	arxiv	[96]

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ID	Year	Title	Venue	Reference
34	2023	Copiloting the Copilots: Fusing Large Language Models with Completion Engines for Automated Program Repair	FSE/ESEC	[141]
35	2023	Enhancing Automated Program Repair through Fine-tuning and Prompt Engineering	arxiv	[110]
36	2023	Enhancing Code Language Models for Program Repair by Curricular Fine-tuning Framework	ICSME	[41]
37	2023	Evaluating ChatGPT for Smart Contracts Vulnerability Correction	COMPSAC	[98]
38	2023	Evaluating Pre-trained Language Models for Repairing API Misuses	arxiv	[177]
39	2023	Examining zero-shot vulnerability repair with large language models	S&P	[111]
40	2023	Exploring the Limits of ChatGPT in Software Security Applications	arxiv	[143]
41	2023	FixEval: Execution-based Evaluation of Program Fixes for Programming Problems	APR	[42]
42	2023	Fully Autonomous Programming with Large Language Models	GECCO	[87]
43	2023	Gamma: Revisiting Template-Based Automated Program Repair Via Mask Prediction	ASE	[175]
44	2023	GPT-3-Powered Type Error Debugging: Investigating the Use of Large Language Models for Code Repair	SLE	[116]
45	2023	How Effective Are Neural Networks for Fixing Security Vulnerabilities	ISSTA	[144]
46	2023	Impact of Code Language Models on Automated Program Repair	ICSE	[55]
47	2023	Improving Automated Program Repair with Domain Adaptation	TOSEM	[189]
48	2023	InferFix: End-to-End Program Repair with LLMs over Retrieval-Augmented Prompts	FSE/ESEC	[59]
49	2023	Invalidator: Automated Patch Correctness Assessment via Semantic and Syntactic Reasoning	TSE	[72]
50	2023	Is ChatGPT the Ultimate Programming Assistant—How far is it?	arxiv	[129]
51	2023	Is Self-Repair a Silver Bullet for Code Generation?	ICLR	[102]
52	2023	LLM4SeCHW: Leveraging domain-specific large language model for hardware debugging	AsianHOST	[30]
53	2023	Neural Program Repair with Program Dependence Analysis and Effective Filter Mechanism	arxiv	[179]
54	2023	PATCH: Empowering Large Language Model with Programmer-Intent Guidance and Collaborative-Behavior Simulation for Automatic Bug Fixing	TOSEM	[178]
55	2023	Pre-trained Model-based Automated Software Vulnerability Repair: How Far are We?	TDSC	[174]
56	2023	RAP-Gen: Retrieval-Augmented Patch Generation with CodeT5 for Automatic Program Repair	FSE/ESEC	[138]
57	2023	Refining ChatGPT-Generated Code: Characterizing and Mitigating Code Quality Issues	TOSEM	[86]
58	2023	Repair Is Nearly Generation: Multilingual Program Repair with LLMs	AAAI	[60]
59	2023	Resolving Crash Bugs via Large Language Models: An Empirical Study	arxiv	[20]
60	2023	Retrieval-based prompt selection for code-related few-shot learning	ICSE	[99]
61	2023	Self-Edit: Fault-Aware Code Editor for Code Generation	ACL	[171]
62	2023	SelfEvolve: A Code Evolution Framework via Large Language Models	arxiv	[57]
63	2023	Self-Refine: Iterative Refinement with Self-Feedback	NeurIPS	[92]
64	2023	SkipAnalyzer: An Embodied Agent for Code Analysis with Large Language Models	arxiv	[95]
65	2023	The Best of Both Worlds: Combining Learned Embeddings with Engineered Features for Accurate Prediction of Correct Patches	TOSEM	[128]
66	2023	The Plastic Surgery Hypothesis in the Era of Large Language Models	ASE	[148]
67	2023	The Right Prompts for the Job: Repair Code-Review Defects with Large Language Model	arxiv	[184]
68	2023	Towards Generating Functionally Correct Code Edits from Natural Language Issue Descriptions	ICSE	[23]

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ID	Year	Title	Venue	Reference
69	2023	Training Language Models for Programming Feedback Using Automated Repair Tools	AIED	[67]
70	2023	Vision Transformer-Inspired Automated Vulnerability Repair	TOSEM	[28]
71	2023	What makes good in-context demonstrations for code intelligence tasks with llms?	ASE	[32]
72	2023	ZeroLeak: Using LLMs for Scalable and Cost Effective Side-Channel Patching	ESORICS	[132]
73	2024	A Case Study of LLM for Automated Vulnerability Repair: Assessing Impact of Reasoning and Patch Validation Feedback	AIware	[69]
74	2024	A Deep Dive into Large Language Models for Automated Bug Localization and Repair	FSE/ESEC	[45]
75	2024	A Study of Vulnerability Repair in JavaScript Programs with Large Language Models	WWW	[71]
76	2024	An Empirical Evaluation of Pre-trained Large Language Models for Repairing Declarative Formal Specifications	EMSE	[3]
77	2024	APPT Boosting Automated Patch Correctness Prediction via Pre-trained Language Model	TSE	[173]
78	2024	Assessing the Latent Automated Program Repair Capabilities of Large Language Models using Round-Trip Translation	TOSEM	[117]
79	2024	AutoCodeRover: Autonomous Program Improvement	ISSTA	[180]
80	2024	Automated Program Repair for Introductory Programming Assignments	TLT	[136]
81	2024	Automated Program Repair via Conversation: Fixing 162 out of 337 bugs for \$0.42 each using chatgpt	ISSTA	[151]
82	2024	Automated Test Case Repair Using Language Models	TSE	[119]
83	2024	Benchmarking Automated Program Repair: An Extensive Study on Both Real-World and Artificial Bugs	ISSTA	[107]
84	2024	Chain-of-Thought Prompting of Large Language Models for Discovering and Fixing Software Vulnerabilities	arxiv	[100]
85	2024	CigaR: Cost-efficient Program Repair with LLMs	arxiv	[43]
86	2024	Code repair with llms gives an exploration-exploitation tradeoff	NeurIPS	[125]
87	2024	CodeEditorBench: Evaluating Code Editing Capability of Large Language Models	ICLR	[37]
88	2024	CodeR: Issue Resolving with Multi-Agent and Task Graphs	arxiv	[12]
89	2024	CodeScope: An Execution-based Multilingual Multitask Multidimensional Benchmark for Evaluating LLMs on Code Understanding and Generation	ACL	[156]
90	2024	ConDefects: A New Dataset to Address the Data Leakage Concern for LLM-based Fault Localization and Program Repair	FSE/ESEC	[145]
91	2024	CORE: Resolving Code Quality Issues using LLMs	FSE/ESEC	[135]
92	2024	CraftRTL: High-quality Synthetic Data Generation for Verilog Code Models with Correct-by-Construction Non-Textual Representations and Targeted Code Repair	ICLR	[83]
93	2024	CREF: An LLM-based Conversational Software Repair Framework for Programming Tutors	ISSTA	[158]
94	2024	CYCLE: Learning to Self-Refine the Code Generation	OOPSLA	[18]
95	2024	DebugBench: Evaluating Debugging Capability of Large Language Models	ACL	[131]
96	2024	Divide-and-Conquer: Automating Code Revisions via Localization-and-Revision	TOSEM	[137]
97	2024	Domain Knowledge Matters: Improving Prompts with Fix Templates for Repairing Python Type Errors	ICSE	[112]
98	2024	DrPlanner: Diagnosis and Repair of Motion Planners Using Large Language Models	RAL	[78]
99	2024	Enhancing Automated Program Repair with Solution Design	ASE	[181]

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ID	Year	Title	Venue	Reference
100	2024	Exploring and Lifting the Robustness of LLM-powered Automated Program Repair with Metamorphic Testing	arxiv	[155]
101	2024	Exploring ChatGPT's Capabilities on Vulnerability Management	USENIX Security	[84]
102	2024	Exploring Experiences with Automated Program Repair in Practice	ICSE	[94]
103	2024	Exploring Parameter-Efficient Fine-Tuning of Large Language Model on Automated Program Repair	ASE	[75]
104	2024	Exploring the Potential of ChatGPT in Automated Code Refinement: An Empirical Study	ICSE	[39]
105	2024	FastFixer: An Efficient and Effective Approach for Repairing Programming Assignments	ASE	[81]
106	2024	FlakyFix: Using Large Language Models for Predicting Flaky Test Fix Categories and Test Code Repair	TSE	[25]
107	2024	From Code to Correctness: Closing the Last Mile of Code Generation with Hierarchical Debugging	arxiv	[120]
108	2024	Frustrated with Code Quality Issues? LLMs can Help!	FSE/ESEC	[134]
109	2024	GitBug-Java: A Reproducible Benchmark of Recent Java Bugs	MSR	[122]
110	2024	HDLdebugger: Streamlining HDL debugging with Large Language Models	TODAES	[162]
111	2024	How Far Can We Go with Practical Function-Level Program Repair?	arxiv	[152]
112	2024	Improved Program Repair Methods using Refactoring with GPT Models	SIGCSE TS	[54]
113	2024	Investigating Large Language Models Capabilities for Automatic Code Repair in Python	Cluster Computing	[103]
114	2024	LDB: A Large Language Model Debugger via Verifying Runtime Execution Step by Step	ACL	[186]
115	2024	Leveraging Large Language Model for Automatic Patch Correctness Assessment	TSE	[188]
116	2024	Leveraging Print Debugging to Improve Code Generation in Large Language Models	arxiv	[47]
117	2024	Lost in Translation: A Study of Bugs Introduced by Large Language Models while Translating Code	ICSE	[108]
118	2024	MarsCode Agent: AI-native Automated Bug Fixing	arxiv	[85]
119	2024	MASAI: Modular Architecture for Software-engineering AI Agents	NeurIPS	[6]
120	2024	On Hardware Security Bug Code Fixes By Prompting Large Language Models	TIFS	[1]
121	2024	One Size Does Not Fit All: Multi-granularity Patch Generation for Better Automated Program Repair	ISSTA	[77]
122	2024	OpenCodeInterpreter: Integrating Code Generation with Execution and Refinement	ACL	[185]
123	2024	Out of Context: How important is Local Context in Neural Program Repair?	ICSE	[114]
124	2024	Out of Sight, Out of Mind: Better Automatic Vulnerability Repair by Broadening Input Ranges and Sources	ICSE	[187]
125	2024	Peer-aided Repairer: Empowering Large Language Models to Repair Advanced Student Assignments	arxiv	[182]
126	2024	PyDex: Repairing Bugs in Introductory Python Assignments using LLMs	OOPSLA	[168]
127	2024	PyTy: Repairing Static Type Errors in Python	ICSE	[15]
128	2024	ReRepair: Automated Program Repair with Process-based Feedback	ACL	[183]
129	2024	Retyper: Integrated Retrieval-based Automatic Program Repair for Python Type Errors	ICSME	[40]
130	2024	Revisiting Unnaturalness for Automated Program Repair in the Era of Large Language Models	arxiv	[157]
131	2024	RTLFixer: Automatically Fixing RTL Syntax Errors with Large Language Models	DAC	[133]

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ID	Year	Title	Venue	Reference
132	2024	SWE-agent: Agent-Computer Interfaces Enable Automated Software Engineering	NeurIPS	[160]
133	2024	SWE-bench: Can Language Models Resolve Real-World GitHub Issues?	ICLR	[58]
134	2024	T5APR: Empowering Automated Program Repair across Languages through Checkpoint Ensemble	JSS	[36]
135	2024	Teaching Large Language Models to Self-Debug	ICLR	[13]
136	2024	Thinkrepair: Self-directed automated program repair	ISSTA	[164]
137	2024	VulAdvisor: Natural Language Suggestion Generation for Software Vulnerability Repair	ASE	[170]
138	2024	When Large Language Models Confront Repository-Level Automatic Program Repair: How Well They Done?	ICSE	[14]
139	2025	A New Era in Software Security: Towards Self-Healing Software via Large Language Models and Formal Verification	AST	[11]
140	2025	A study on Prompt Design, Advantages and Limitations of ChatGPT for Deep Learning Program Repair	AUSE	[10]
141	2025	ACFIX: Guiding LLMs with Mined Common RBAC Practices for Context-Aware Repair of Access Control Vulnerabilities in Smart Contracts	TSE	[172]
142	2025	Adversarial Reasoning for Repair Based on Inferred Program Intent	ISSTA	[163]
143	2025	Alibaba LingmaAgent: Improving Automated Issue Resolution via Comprehensive Repository Exploration	FSE-Companion	[90]
144	2025	Aligning the Objective of LLM-based Program Repair	ICSE	[153]
145	2025	APPATCH: Automated Adaptive Prompting Large Language Models for Real-World Software Vulnerability Patching	USENIX Security	[101]
146	2025	APRMCTS: Improving LLM-based Automated Program Repair with Iterative Tree Search	ASE	[46]
147	2025	Closing the Gap: A User Study on the Real-world Usefulness of AI-powered Vulnerability Detection & Repair in the IDESecurityArtifact-FunctionalArtifact-AvailableArtifact-Reusable	ICSE	[124]
148	2025	Combining Logic and Large Language Models for Assisted Debugging and Repair of ASP Programs	ICST	[9]
149	2025	ContrastRepair: Enhancing Conversation-Based Automated Program Repair via Contrastive Test Case Pairs	TOSEM	[65]
150	2025	Counterexample Guided Program Repair Using Zero-Shot Learning and MaxSAT-based Fault Localization	AAAI	[104]
151	2025	Demystifying LLM-based Software Engineering Agents	FSE/ESEC	[147]
152	2025	Demystifying Memorization in LLM-based Program Repair via a General Hypothesis Testing Framework	FSE/ESEC	[66]
153	2025	DesignRepair: Dual-Stream Design Guideline-Aware Frontend Repair with Large Language Models	ICSE	[166]
154	2025	Error Delayed Is Not Error Handled: Understanding and Fixing Propagated Error-Handling Bugs	FSE/ESEC	[82]
155	2025	Explainable Automated Debugging via Large Language Model-driven Scientific Debugging	EMSE	[61]
156	2025	FixAgent: Hierarchical Multi-Agent Framework for Unified Software Debugging	arxiv	[73]
157	2025	Guiding ChatGPT to Fix Web UI Tests via Explanation-Consistency Checking	ICST	[154]
158	2025	HapRepair: Learn to Repair OpenHarmony Apps	FSE/ESEC	[79]
159	2025	Hierarchical Knowledge Injection for Improving LLM-based Program Repair	ASE	[21]
160	2025	Hybrid Automated Program Repair by Combining Large Language Models and Program Analy	TOSEM	[74]

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ID	Year	Title	Venue	Reference
161	2025	Integrating Various Software Artifacts for Better LLM-based Bug Localization and Program Repair	TOSEM	[26]
162	2025	Investigating the Transferability of Code Repair for Low-Resource Programming Languages	NAACL	[142]
163	2025	Knowledge-Enhanced Program Repair for Data Science Code	ICSE	[106]
164	2025	Less is More: Adaptive Program Repair with Bug Localization and Preference Learning	AAAI	[16]
165	2025	MAGIS: LLM-Based Multi-Agent Framework for GitHub Issue Resolution	NeurIPS	[126]
166	2025	MORRepair: Teaching LLMs to Repair Code via Multi-Objective Fine-tuning	TOSEM	[159]
167	2025	NIODebugger: A Novel Approach to Repair Non-Idempotent-Outcome Tests with LLM-Based Agent	ICSE	[62]
168	2025	OmmiGIRL: A Multilingual and Multimodal Benchmark for GitHub Issue Resolution	ISSTA	[38]
169	2025	OpenHands: An Open Platform for AI Software Developers as Generalist Agents	ICLR	[139]
170	2025	PATCHAGENT: A Practical Program Repair Agent Mimicking Human Expertise	USENIX Security	[165]
171	2025	RAPGen: An Approach for Fixing Code Inefficiencies in Zero-Shot	ICSE	[34]
172	2025	Repair Ingredients Are All You Need: Improving Large Language Model-Based Program Repair viaRepair Ingredients Search	ICSE	[169]
173	2025	RepairAgent: An Autonomous, LLM-Based Agent for Program Repair	ICSE	[8]
174	2025	RepairLLaMA: Efficient Representations and Fine-Tuned Adapters for Program Repair	TSE	[121]
175	2025	RepoGraph: Enhancing AI Software Engineering with Repository-level Code Graph	ICLR	[105]
176	2025	RustAssistant: Using LLMs to Fix Compilation Errors in Rust Code	ICSE	[17]
177	2025	Seeing is Fixing: Cross-Modal Reasoning with Multimodal LLMs for Visual Software Issue Fixing	ASE	[52]
178	2025	SWE-bench Multimodal: Do AI Systems Generalize to Visual Software Domains?	ICLR	[161]
179	2025	SWE-GPT: A Process-Centric Language Model for Automated Software Improvement	ISSTA	[89]
180	2025	SWE-RL: Advancing LLM Reasoning via Reinforcement Learning on Open Software Evolution	NeurIPS	[140]
181	2025	SWE-Search: Enhancing Software Agents with Monte Carlo Tree Search and Iterative Refinement	ICLR	[5]
182	2025	SWT-Bench: Testing and Validating Real-World Bug-Fixes with Code Agents	NeurIPS	[97]
183	2025	Teaching AI the ‘Why’ and ‘How’ of Software Vulnerability Fixes	FSE/ESEC	[31]
184	2025	Template-Guided Program Repair in the Era of Large Language Models	ICSE	[51]
185	2025	The Art of Repair: Optimizing Iterative Program Repair with Instruction-Tuned Models	EASE	[118]
186	2025	The Fact Selection Problem in LLM-Based Program Repair	ICSE	[109]
187	2025	The Impact of Fine-tuning Large Language Models on Automated Program Repair	ICSME	[91]
188	2025	Towards Detecting Prompt Knowledge Gaps for Improved LLM-guided Issue Resolution	MSR	[22]
189	2025	When Fine-Tuning LLMs Meets Data Privacy: An Empirical Study of Federated Learning in LLM-Based Program Repair	TOSEM	[88]

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