Market Guide for AI-Augmented Software-Testing Tools

Published 28 November 2022 - ID G00763841 - 30 min read

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The AI-augmented software-testing market continues to rapidly evolve in terms of vendors and capabilities. To maximize the impact of these tools on testing efficacy, software engineering leaders must evaluate vendor offerings based on each tool's AI capabilities in specific software-testing areas.

Overview

Key Findings

- Artificial-intelligence-augmented software-testing tools use algorithmic approaches to enhance the productivity of testers. AI can dramatically increase the efficacy of test automation tools, enabling software engineering teams to improve software quality and reduce testing cycle times.
- Several new vendors have entered the AI-augmented, software-testing market, and vendor acquisitions were prevalent in 2022. Software engineering leaders find it difficult to navigate this constantly evolving market, where many vendors offer a wide range of varied testing capabilities.
- Software engineering leaders face a shortage of experienced testers, especially people with the skills required to programatically create tests.

Recommendations

Software engineering leaders responsible for software quality and testing should:

- Maximize the value of AI by identifying areas of software testing in their organizations, where AI will be most applicable and impactful, such as in visual testing.
- Use this research to evaluate vendors that offer AI-augmented, software-testing tools by requesting evidence for how they can improve efficacy in each specific area of software testing.
- Modernize their teams' testing capabilities by establishing a community of practice to share information and budgeting for training.

Strategic Planning Assumption

By 2027, 80% of enterprises will have integrated artificial intelligence (AI)-augmented testing tools into their software engineering toolchain, which is a significant increase from 10% in 2022.

Market Definition

AI-augmented, software-testing tools provide capabilities for advanced, self-optimizing and adaptive automated testing through the use of AI technologies, such as machine learning (ML), self-healing heuristics or computer vision. They assist humans in their testing efforts and reduce the need for human intervention in the following areas:

- Test case and test data generation
- Test suite optimization and coverage detection

- Test efficacy and robustness
- Test analysis and defect prediction
- Test effort estimation and decision making

AI-augmented testing tools streamline, accelerate and improve the test workflow, as models can be retrained based on the data collected from the activities they perform — thereby enhancing human productivity.

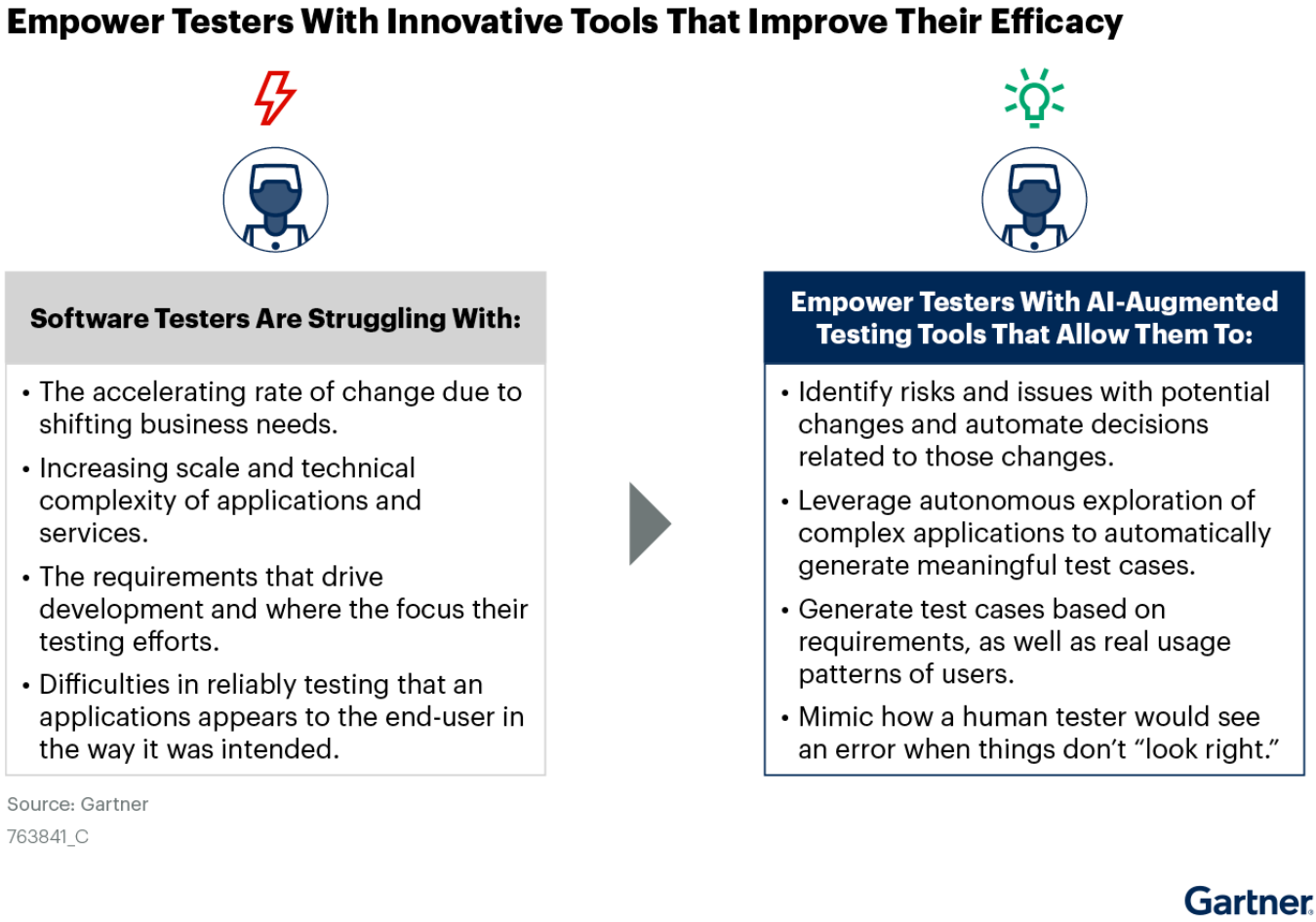
Market Description

When compared with traditional software-testing tools, AI-augmented software-testing tools provide software engineering teams with a clear advantage in accelerating testing cycle times and improving software quality. AI/ML-based technologies assist software engineering teams in creating, maintaining and executing a diverse set of tests, analyzing test results and governing testing activities.

AI-augmented software-testing tools improve software quality and reduce cycle times by optimizing test efforts, providing early feedback about the quality of release candidates and improving consistency.

AI-augmented software-testing tools offer a wide range of capabilities across different areas of the test workflow. This research explores the dynamics of this market and highlights vendors that provide innovative tools to help software testers improve their efficacy (see Figure 1).

Figure 1: Empower Testers With Innovative Tools That Improve Their Efficacy



To maximize the benefits of AI-augmented testing, software engineering leaders must evaluate the five areas for applying AI to software testing (see Quick Answer: How Can AI Provide Benefits for Software Testing?), which are shown in the sections that follow.

Test Planning and Prioritization

Testing is always a risk-based activity. Although testers cannot test everything or eliminate all risk, they can use AI to measure risk and aid with test coverage, test selection and implementation of compliance measures, and reduce the cognitive load of the testers. AI can also feed insights into value stream management platforms (VSMPs) and observability platforms to improve the monitoring of software value streams.

Test Creation and Maintenance

Test creation and maintenance is the most-fertile ground for AI augmentation. Most vendors have focused their efforts on these tasks.

AI-augmented test creation can occur in many different ways. Examples include the use of models or domain-specific languages to define application functionality and the associated tests in a way that enables these tests to be automatically generated. Testers can apply AI to analyze log files, to monitor user activity, or to use bots or crawlers that learn the applications' paths and types of data inputs. AI can then create tests automatically based on these insights.

For test maintenance, AI aids testers by building a better model of the application under test, enabling clearer and more-concise testing. If a test fails at runtime, AI-augmented tools can explore alternative ways to find the faulty component or information, then fix the broken test with the updated information (often referred to as self-healing capability).

Test Data Generation

Testers are increasingly applying AI to generate synthetic data for development and test (see Innovation Insight for Synthetic Data). Synthetic data addresses data privacy issues and enables data to reflect the test cases that have been identified. AI-augmented test data generation is primarily model-based; however, tools can also learn from log files — especially when developing input data for the tests being run.

Visual Testing

Although an application may technically function, it may not render correctly in all instances. Thus, testers need the ability to rapidly perform accurate visual tests across a wide range of OS versions, browsers and devices, especially for consumer-grade applications. AI can augment visual testing by using a variety of image recognition techniques that replicate a human looking at screens and comparing them. Unlike traditional testing tools, AI-augmented visual testing does not require testers to define specific assertions for objects on a user interface (UI), such as information displayed in a text field. For a well-designed system, these tools can provide "free" assertions for the entire page/application. Leading visual tools can also aid with testing for compliance accessibility standards (see Market Guide for Digital Accessibility).

Test and Defect Analysis

When testing large applications and codebases, tools may find many issues in a single run. In these cases, a person must determine what is really a bug, whether the test is "flaky" and how to reproduce the steps of the test. AI can assist in determining flaky tests and flag them for review. Another way to assist testers is by applying AI for static analysis and security testing. Vendors are also beginning to create tools that learn from test runs, and understand code changes and their impact. These tools can aid in assessing which tests should be changed or dropped and which defects to focus on.

Market Direction

The testing tool market (excluding mainframe testing) segment is $2,319.7 million, which is expected to increase at a 7.5% compound annual growth rate (CAGR) in constant currency through 2026. [4] There is strong interest in the AI-augmented testing tools market from investors — the vendors in this research have received private investments of more than $300 million since 2020.

This rapid growth and aggressive investment in the AI-augmented testing market is driving new entrants and numerous acquisitions. A few notable acquisitions since the beginning of 2021 that were focused on AI-augmented testing capabilities are:

- Tricentis' acquisition of Testim
- BrowserStack's acquisition of Percy
- Worksoft's acquisition of eureQa
- Copado's acquisition of Qentinel
- Perforce's acquisition of 21 Labs
- Sauce Labs's acquisition of AutonomIQ

Respondents from the 2021 Gartner Software Engineering Leaders Survey stated that their second-most-rewarding activity is delighting customers beyond their expectations, whereas their second-most-frustrating activity is ensuring production incidents are resolved quickly. [1] Both of these can be improved with better testing investment. In the 2020 Gartner Achieve Business Agility With Automation, Continuous Quality and DevOps Survey, 84% of recipients responded that AI/ML features are more important than other features in testing tools selection. [2]

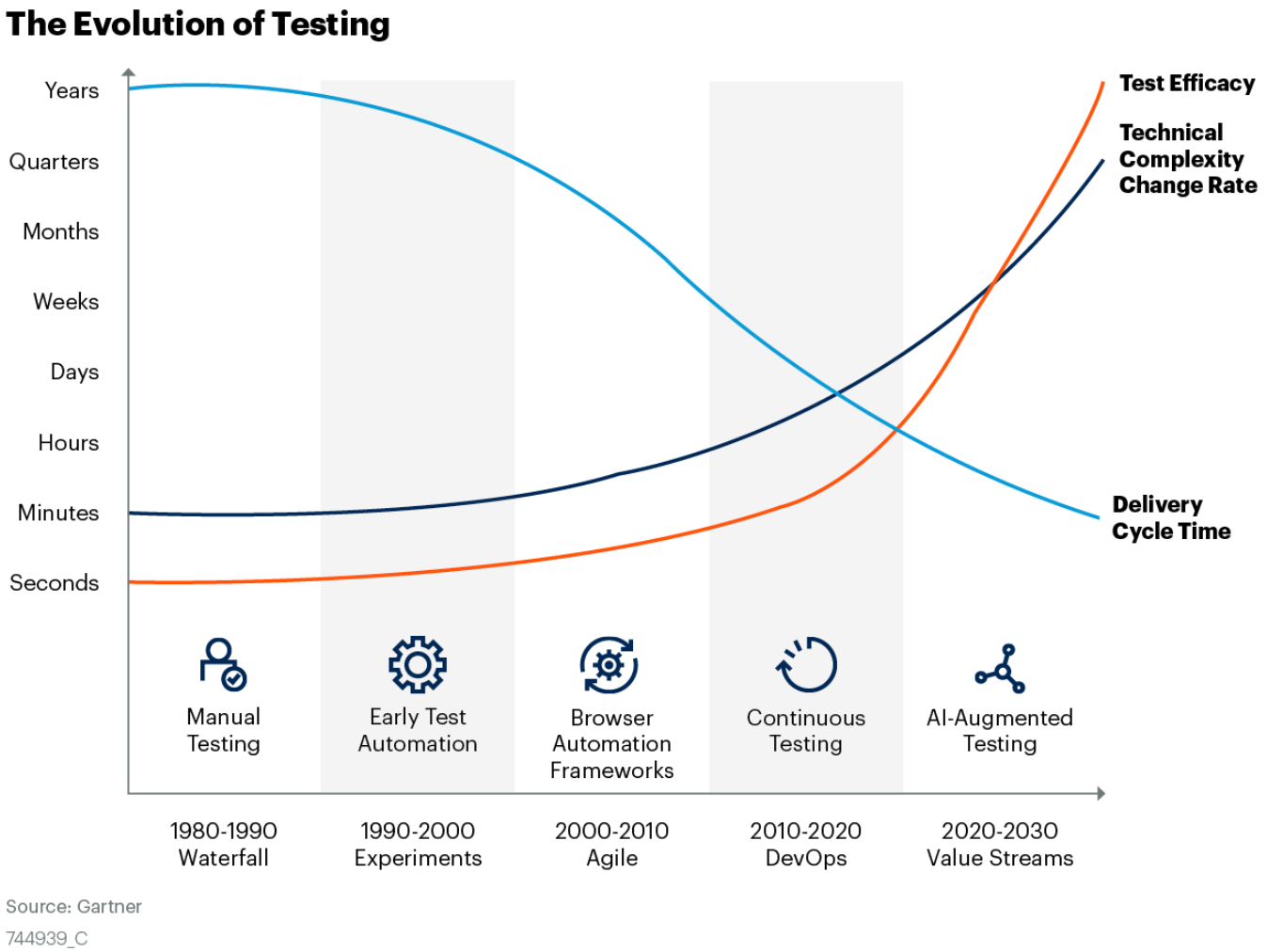
Several trends will drive the rapid adoption of AI-augmented software-testing tools in the next two to three years, including:

- The increasing complexity of applications, including microservices, and support for multiple clients
- Increased adoption of agile and DevOps, which demands faster development and delivery cadences
- A growing backlog of work to replace manual tests with automated tests that support continuous integration
- A shortage of skilled automation engineers to close this backlog
- Cognitive overload of product teams as they struggle to identify the most important areas for testing of complex applications
- The need to reduce maintenance costs associated with traditional tools and open-source system (OSS) solutions
- The need to deliver consumer-grade user experience (UX), based on insights about release success and user satisfaction
- The need for maintainability: the World Quality Report 2022-23 found that maintainability is the most important factor in determining test automation approaches [3]

All these factors will continue to drive an increasing need for AI and ML to increase the speed of test creation, reduce the cost of test maintenance and drive efficient test loops.

AI augmentation is the next step in the evolution of software testing. It is also a crucial element for a strategy to reduce significant business continuity risks when critical applications and services are severely compromised or stop working altogether (see Improve Software Quality by Building Digital Immunity). A digital immune system combines practices and technologies from AI-augmented testing, chaos engineering, observability, autoremediation, site reliability engineering (SRE) and software supply chain security. This is designed to increase the resilience of products, services and systems against failure, and is more relevant than ever (see Top Strategic Technology Trends for 2023: Digital Immune System). Software engineering leaders should invest in AI-augmented tools that support smarter testing and improve testing efficacy (see Figure 2).

Figure 2: The Evolution of Testing



Market Analysis

Many organizations continue to rely heavily on manual testing and aging technology, but market conditions demand a shift to automation, as well as more intelligent testing that is context-aware. Vendors are innovating rapidly and expanding their capabilities; however, their ability to support testing use cases still varies a great deal. Each vendor typically focuses on AI augmentation for a few testing scenarios, but no single vendor supports the complete testing life cycle with AI. Most vendors are small, and their ability to support global enterprises may be limited.

However, software engineering leaders should not necessarily dismiss newer, smaller vendors in favor of larger, more established ones. Small vendors may offer tools that can deliver quick ROI, and larger vendors face the challenge of continuing to innovate on top of legacy codebases that are typically focused on specific markets and scenarios. We expect vendors of all sizes to continue evolving and expanding their capabilities through acquisitions or third-party integrations, while remaining focused on their core value propositions.

Most organizations that transition from manual testing and start to invest in test automation tools initially focus on testing through the UI layer. Consequently, many vendors focus on leveraging AI technologies to make it cheaper and faster to produce and maintain UI-driven functional tests. However, this is only the first step.

We expect vendors will reach beyond the more established areas, such as basic test automation and test management, to deliver automated test design, test generation and advanced test result analytics. These expanded capabilities will help to make testing accessible to a wider range of user personas, including those that do not have deep test automation expertise.

Software engineering leaders must tactically select AI-augmented software-testing solutions to address use cases across the full life cycle of testing activities. AI-augmented software-testing tools will improve the process, amplify testing capacity and help to eliminate steps that can be performed more efficiently by intelligent technologies. As the

market evolves, the degree to which AI-augmented software-testing tools will automatically build, maintain, execute, monitor and analyze tests will continually increase.

Representative Vendors

The vendors listed in this Market Guide do not imply an exhaustive list. This section is intended to provide more understanding of the market and its offerings.

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Market Introduction

AI-augmented software-testing vendors are rapidly expanding and developing their capabilities to support more testing use cases across different contexts — cloud-native, mobile, edge, packaged applications and regulatory environments.

Table 1 provides a representative sample of AI-augmented software-testing vendors (also see Note 1). Table 2, Table 3 and Table 4 provide more details about the delivery options, tool categories and types of tests that each vendor supports.

Table 1: Representative Vendors in AI-Augmented Software Testing

Vendor	Product Name(s)	HQ
ACCELQ	Automate WebAutomate API Automate Mobile ACCELQ Manual ACCELQ Unified	San Francisco, California, U.S.
Applitools	Applitools Eyes Applitools Ultrafast Grid Applitools Native Mobile Grid	San Mateo, California, U.S.
Appvance.ai	Appvance.ai IQ	Santa Clara, California, U.S.
Avo Automation	Avo Assure	Cincinnati, Ohio, U.S.
bqurious	bqurious	Noida, India
Functionize	Functionize	Walnut Creek, California, U.S.
Katalon	Katalon	Atlanta, Georgia, U.S.
Keysight	Digital Automation Intelligence	Santa Rosa, California, U.S.
Leapwork	Leapwork	Copenhagen, Denmark

Vendor	Product Name(s)	HQ
mabl	mabl	Boston, Massachusetts, U.S.
Micro Focus	UFT Family (UFT One, UFT Developer, UFT Mobile)	Newbury, Berkshire, U.K.
Opkey	Opkey	Dublin, California, U.S.
Parasoft	Parasoft Selenic Parasoft SOAtest	Monrovia, California, U.S.
ProdPerfect	ProdPerfect	San Francisco, California, U.S.
Sauce Labs	Virtual Cloud Real Device Cloud	San Francisco, California, U.S.
testRigor	testRigor	San Francisco, California, U.S.
Testsigma	Testsigma Cloud Testsigma Enterprise Edition	Palo Alto, California, U.S.
Tricentis	Tricentis Tosca Testim	Austin, Texas, U.S.
Worksoft	Worksoft Certify	Addison, Texas, U.S.

Source: Gartner (November 2022)

Table 2: Product Delivery Options

Vendor	Cloud/SaaS	On-Premises
ACCELQ	■	■
Applitools	■	

Vendor	*Cloud/SaaS*	*On-Premises*
Appvance.ai	■	■
Avo Automation	■	
bqurious	■	
Functionize	■	■
Katalon	■	■
Keysight	■	■
Leapwork		■
mabl	■	
Micro Focus	■	■
Opkey	■	
Parasoft	■	■
ProdPerfect	■	
Sauce Labs	■	
testRigor	■	■
Testsigma	■	■

Vendor	Cloud/SaaS	On-Premises
Tricentis	■	■
Worksoft	■	■

Source: Gartner (November 2022)

Table 3: Product Testing Capabilities

Vendor	UI Test Automation	API Test Automation	Test Management	Test Data	Test Lab/Device Management	T S D
ACCELQ	■	■	■	■	■	■
Applitools	■		■		■	
Appvance .ai	■	■		■	■	■
Avo Automation	■	■	■	■	■	■
bqurious	■	■	■			
Functionize	■	■	■	■	■	■
Katalon	■	■	■	■	■	■
Keysight	■	■	■	■	■	■
Leapwork	■	■	■	■		■

Vendor	UI Test Automation	API Test Automation	Test Management	Test Data	Test Lab/Device Management	T S D
mabl	■	■	■	■		
Micro Focus	■	■		■	■	■
Opkey	■	■			■	■
Parasoft	■	■	■	■		■
ProdPerfect	■					■
Sauce Labs	■	■			■	
testRigor	■	■				
Testsigma	■	■	■			■
Tricentis	■	■	■	■		■
Worksoft	■	■	■	■		■

Source: Gartner (November 2022)

Table 4: Types of Applications That Can Be Tested

Vendor	Web Apps	Native Mobile Apps	Desktop Applications	APIs	SAP, Salesforce, Oracle
ACCELQ	■	■	■	■	SAP, Salesforce, Oracle
Applitools	■	■	■		
Appvance.ai	■	■		■	
Avo Automation	■	■	■	■	SAP, Salesforce, Oracle
bqurious	■	■		■	SAP, Salesforce
Functionize	■			■	Salesforce
Katalon	■	■	■	■	Salesforce
Keysight	■	■	■	■	
Leapwork	■	■	■	■	SAP, Salesforce, Oracle
mabl	■			■	Salesforce
Micro Focus	■	■	■	■	SAP, Salesforce, Oracle
Opkey	■	■	■	■	SAP, Salesforce, Oracle
Parasoft	■			■	Salesforce

Vendor	Web Apps	Native Mobile Apps	Desktop Applications	APIs	SAP, Salesforce, Oracle
ProdPerfect	■				
Sauce Labs	■				Salesforce, Oracle
testRigor	■	■	■	■	Salesforce
Testsigma	■	■		■	
Tricentis	■	■	■	■	SAP, Salesforce, Oracle
Worksoft	■	■	■	■	SAP, Salesforce, Oracle

Source: Gartner (November 2022)

Vendor Profiles

ACCELQ

ACCELQ offers AI-powered codeless test automation, as well as AI-based test management. The product is offered as cloud/software as a service (SaaS) or as an on-premises deployment. ACCELQ can test common web, mobile and desktop UIs, as well as API and back ends.

ACCELQ augments test automation engineers, quality and test managers and manual testers by providing the following capabilities:

- Test scenario design through ACCELQ's App Universe visual model, which represents the relationships between applications, their business rules and the end-to-end (E2E) flow. Universe uses smart dependency analyzer and K-nearest neighbors algorithms to create a nonoverlapping graph of dependencies and navigation handoffs.
- Natural language autonomous test authoring.
- Self-healing test automation through dynamic updates to object selectors by multiple indicators such as location or anchor points, optical character recognition (OCR), semantic analysis and document object model (DOM) attributes.
- Visual assertions using computer vision to detect changes from baselined UI elements to post-commit updates.
- Test selection to minimize a test suite runtime and to focus test execution on areas of greatest risk.
- Test selection to remove duplicate tests or unnecessary code files/features sets from a test suite.
- Improved test result analytics to deduplicate error findings and remove noise from test reporting.

Applitools

Applitools offers software testing and quality capabilities supporting UI automation, test lab/device management and test management. The product is offered as a SaaS deployment. It can test web, mobile and desktop applications, as well as chatbots, smart TVs and kiosks.

Applitools primarily targets software development engineers in test (SDETs), developers and test automation engineers by providing the following capabilities:

- Functional and visual testing based on visual AI. Instead of using specific assertions, Applitools Eyes replicates a human tester by evaluating every step on the screen versus a baseline.
- Self-healing test automation through dynamic updates to object selectors by multiple indicators such as location or anchor points, OCR, semantic analysis, DOM attributes, among others. Visual AI based locators can be helpful for UI elements that are difficult/impossible to locate with traditional locators (canvas, floating/dynamic objects, specific mobile technologies, etc.).
- The Applitools Ultrafast Grid cloud testing platform for parallel functional and visual, cross-browser testing at scale.
- The Applitools Native Mobile Grid cloud-testing platform for mobile app testing on iOS and Android.

Appvance.ai

Appvance.ai supports AI-generated autonomous testing and codeless test creation for functional, performance and security testing in one, unified test platform. The product is offered as cloud/SaaS, on-premises or as a hybrid deployment. It can test web, native mobile apps or apps built on platforms (such as Salesforce, SAP or ServiceNow), and API testing for microservices and the Internet of Things (IoT).

Appvance.ai primarily targets SDETs, test automation engineers and manual testers through these capabilities:

- Test Designer — a visual script writer that enables test engineers to create codeless test scripts that are resilient to UI changes, adapt at run time to eliminate false negatives and can “self-heal” when needed.
- AI Test Generation — uses ML and cognitive generation to automatically produce thousands of unique tests, based on a thorough mapping of the application, as well as an analysis of actual user activity through log file analysis.
- A write-once capability allows a single script to drive tests across functional, performance, load, and application penetration and distributed denial of service (DDoS) testing.
- Test selection to remove unneeded tests from a test suite, based on duplicated coverage or the removal of code files/feature sets.

Avo Automation

Avo Automation offers capabilities for UI Test Automation, Test Data Management, and Process Discovery as part of its product portfolio. The Avo Assure product is a SaaS offering and has AI-augmented testing capabilities for testing web, mobile and desktop applications. It also supports testing of APIs; ERP applications, including SAP, Oracle and Salesforce; and mainframe applications via emulations.

Avo Automation supports different user roles, including test automation engineers, quality and test managers, and business analysts by providing the following capabilities:

- Smart recorder using its Avo Genius feature to automatically capture E2E test scenarios as a user navigates through the application under test.
- Self-healing capabilities using a matrix of identifiers across anchors, OCR, semantic analysis and DOM elements.

- Visual assertions for healing the automation scripts by automatically detecting changes from baselined UI elements to postcommit update using the update analyzer feature for frequently upgraded applications.
- Test selection to minimize a test suite runtime and to focus test execution on areas of greatest risk.
- Augmented defect triaging through workflows that engage developers with test artifacts, code file identification, evidence of defect capture, and potential root causes analysis.

bqurious

bqurious offers E2E, AI-based functional testing and support, UI and API test automation and test management. The product is offered as SaaS and has AI-augmented testing capabilities for web and mobile native apps, APIs, and enterprise apps, such as SAP, Oracle, Salesforce, IBM Maximo and Tenemos.

bqurious augments test automation engineers, quality and test managers, and manual testers by providing the following capabilities:

- A self-healing augmentation method that focuses on optimizing dynamic updates to object selectors by multiple indicators, such as location or anchor points, OCR, semantic analysis and DOM attributes
- Visual comparing of application UIs with past versions or mock-ups to ensure a match with expectations
- AI and natural language processing (NLP)-based BQ-Genie for scanning elements and capturing element properties
- Workflow classification of automated defect detection that engages testers with test artifacts, code file identification and evidence of captured defects

Functionize

Functionize supports E2E testing scenarios by offering UI and API test automation, test management, and a live test cloud. The product is available as cloud/SaaS and on-premises. Its suite of web-based tools enables clients to test web apps and APIs.

Functionize augments SDETs, test automation engineers, quality and test managers and manual testers by providing the following capabilities:

- Functionize Architect learns as a website evolves by collecting many data points each time a test executes and uses ML to understand the intent behind each test.
- Quick-start solutions include NLP to automate existing manual tests in bulk or migrating existing test cases directly into the product.
- Self-healing test automation is performed through dynamic updates to page elements by multiple indicators such as location or anchor points, OCR, semantic analysis and DOM attributes.
- Visual assertions using computer vision detect changes from baselined UI elements to postcommit updates.
- Functionize Test Cloud uses ML algorithms to distribute tests and provision virtual machines (VMs) intelligently in the cloud to enable large numbers of tests to run in parallel.
- Live Debug interacts with and modifies a live running test in the cloud.

Katalon

Katalon offers a platform with capabilities for UI and API test automation, test management, distributed testing in the cloud and AI-driven visual testing. The product is offered as SaaS or desktop deployment. AI-augmented testing capabilities support testing of desktop, web and mobile applications, APIs, and enterprise SaaS, such as Salesforce.

Katalon augments manual testers, test automation engineers, and test and quality managers through these capabilities:

- Visual assertions using computer vision to detect changes from baselined UI elements to postcommit updates
- Self-healing test automation through dynamic updates to object selectors by multiple indicators, such as location or anchor points, OCR, semantic analysis, and DOM attributes
- Test maintenance with test flakiness, test staleness and test slowness analysis
- Improved test result analytics to deduplicate error findings and remove noise from test reporting
- Test failure analysis by finding similar failures from previous execution results

Keysight

Keysight offers capabilities for UI and API test automation, test management, test data and test lab/device management, performance testing and embedded device testing as part of its product portfolio. The product is offered as SaaS or desktop deployment. It supports testing for web, mobile and desktop apps and APIs. It also supports the testing of embedded devices, smart TVs, and connected car and gaming platforms.

Keysight augments test automation engineers, quality and test managers, and DevOps engineers through these capabilities:

- User-journey-based autonomous test authoring through log file analysis or agent/library injection into codebases
- Self-healing test automation through dynamic updates to object selectors
- Visual testing using computer vision and OCR
- Model-based testing that create a digital twin model for testing complex systems, workflows or user journeys across platforms
- E2E testing for the contract testing of API chains and associated versioning

Leapwork

Leapwork offers tools with capabilities for UI and API automation, test design and management. The product is delivered as a desktop solution, with a SaaS-based offering, which is planned for release in 1Q23. It supports the testing of web, mobile, and desktop apps, as well as virtual desktop and enterprise applications, such as SAP, Microsoft Dynamics 365, Oracle, Salesforce, ServiceNow and Citrix.

Leapwork augments test automation engineers, manual testers and business analysts/small-to-midsize enterprises (SMEs) through these capabilities:

- A universal, visual automation language to automate tests and processes; intelligent building blocks handle logic and give a graphic overview of every step
- Self-healing of tests through the use of OCR ML, regression and convolutional neural networks (CNN) for locator generation to remediate changes in selectors
- Visual assertions using computer vision to detect changes from baselined UI elements to postcommit updates
- Automated/augmented defect triaging through workflows that engage developers with test artifacts, evidence of defect capture and potential root causes analysis

mabl

mabl offers a low code test automation tool with capabilities for functional API and UI test automation and further support for accessibility automation, and test management. The product is offered as a SaaS deployment with a desktop client application. AI-augmented test automation is supported for testing web apps, mobile web apps, and APIs.

mabl augments SDETs, manual testers, test automation engineers and manual testers through these capabilities:

- User-journey-based autonomous test authoring
- App page modeling for maximizing effective test coverage, app performance and app accessibility
- Self-healing test automation through dynamic updates to object selectors by multiple indicators, such as location or anchor points, OCR, semantic analysis, and DOM attributes
- Visual assertions using computer vision to detect changes from baselined UI elements to postcommit updates
- Identification of app performance regressions by capturing data from functional test executions and applying statistical anomaly detection to detect performance changes

Micro Focus

Micro Focus offers capabilities for test automation, test management, test lab/device management, test data and performance testing as part of its ADM portfolio. UFT One, Micro Focus's AI-powered functional test automation tool is part of the UFT family of products (which also includes UFT Developer and UFT Mobile). It works across desktop, web, mobile, mainframe, composite, and enterprise applications, such as SAP, Oracle, and Salesforce. The product is offered as a desktop implementation.

Micro Focus augments test automation engineers, quality and test managers and manual testers through these capabilities:

- AI Mockup Identification enables the learning of AI objects on application mockups and prepares AI-based tests before an application is completely developed
- AI Transformation Assistant enables the running of existing tests with this feature, which receives suggestions for transforming technology-based test steps to AI-based testing steps
- UFT One Remote AI Service is installed on one central, powerful computer to provide faster and more-efficient AI capabilities to less powerful UFT One machines
- Visual assertions using computer vision

Opkey

Opkey offers tools supporting UI and API test automation and test scenario design. The product is delivered as SaaS and supports testing of web, mobile, desktop, as well as enterprise applications, such as SAP, Salesforce, Oracle, Workday and Microsoft Dynamics 365.

Opkey augments SDETs, manual testers and business analysts/SMEs through these capabilities:

- Self-healing test automation through dynamic updates to object selectors by multiple indicators, such as location or anchor points, OCR, semantic analysis, DOM attributes, among others
- Visual assertions using computer vision to detect changes from baselined UI elements to postcommit updates
- Prebuilt accelerators for packaged applications that include automated features, such as test discovery
- Smart keyword suggestion to accelerate test creation

- Natural language test creation — the company uses a variety of AI algorithms and ML to speed up the creation of tests; this enables creation via log file analysis or use of a bot to navigate the UI

Parasoft

Parasoft provides capabilities for API and UI test automation and also supports unit test automation, static code analysis, load and security testing as part of their product portfolio. The products are offered as SaaS and desktop deployments, and support testing for web apps, APIs, as well as the IoT and embedded applications.

Parasoft augments developers, test automation engineers and quality and test managers through these capabilities:

- Parasoft Selenic provides recommendations and self-healing of Selenium tests for web testing.
- Parasoft SOAtest's SOAtest Smart API Test Generator leverages AI and ML to convert UI tests into complete, automated API test scenarios and to add specific assertions based on user behavior.
- Parasoft SOAtest and Virtualize leverage AI to develop data models from the service interactions, then applies ML, using those models to learn the data scenarios in real time, as it monitors different usage patterns.
- Smart test execution using AI-augmented test impact analysis to optimize manual testing efforts.

ProdPerfect

ProdPerfect creates AI-augmented testing technology for UI test automation of web applications. The product is offered as a SaaS deployment. ProdPerfect supports testing of web applications by analyzing real user interactions to autonomously build and develop E2E regression test cases.

ProdPerfect accelerates deployment and mitigates significant risk of exposure by providing prioritized regression test suites that replicate real-world user scenarios. ProdPerfect augments developers, quality, and test managers through these capabilities:

- Collection of personally identifiable information (PII)-free clickstream metadata from the production environment and generation of test environment-specified scripts, which replicates the users' most trafficked paths through the application
- Self-healing capabilities based on consistent reanalysis of data to determine new or more stable locators
- Continuous reprioritization of tests by analyzing the application's ongoing traffic to factually determine what end-user behaviors represent test cases that are most critical for testing. This allows for continuous testing, ensuring that test suites always run lean and efficiently to give instant feedback to every developer on every deployment
- Execution platform that enables consistent collaboration between development and quality engineering teams

Sauce Labs

Sauce Labs offers capabilities for UI and API test automation, test data management and detecting failure patterns in testing. The product is available via SaaS deployment and supports testing of web applications, including Salesforce and Oracle SaaS applications. It also offers cross-browser testing, mobile app testing, a real device cloud, API testing and visual testing.

Sauce Labs augments SDETs, test automation engineers and manual testers through these capabilities:

- Natural language autonomous test authoring supported by a NLP engine that can understand the complex English sentences used in conversational flows.
- Self-healing test automation through dynamic updates to object selectors by multiple indicators such as location or anchor points, OCR, semantic analysis and DOM attributes.

- Test scenario generation and management supported by an intelligent, application-aware platform that continuously learns application objects.
- Improved test result analytics to deduplicate error findings and remove noise from test reporting.

testRigor

testRigor creates AI-augmented testing technology for E2E UI test automation. Although API testing is not the primary focus of testRigor, it provides basic support for API testing and mocking APIs. The product is offered in SaaS and on-premises deployments. testRigor supports the testing of web, native and hybrid mobile and desktop applications, and APIs.

testRigor augments business analysts/SMEs, manual testers and test and quality managers through these capabilities:

- Natural-language, autonomous test authoring through the use of plain English to allow anyone to build/understand tests purely from the end user's point of view
- Easy test creation via a record-and-playback plugin that produces human readable and executable test output
- User-journey-based autonomous test creation based on real user activity and identification of interaction patterns
- Selenium plug-in for self-healing test automation through dynamic updates to object selectors and matching of elements on the page, even if the UI framework and markup are completely different

Testsigma

Testsigma provides capabilities for UI and API test automation and test scenario design. The product is offered as a SaaS deployment. It supports web application testing, as well as the testing of mobile apps and APIs.

Testsigma augments SDETs, test automation engineers, and quality and test managers by providing the following capabilities:

- NLP-based test authoring feature that automatically converts simple English statements to actions
- Self-healing test automation through dynamic updates to object selectors by multiple indicators, such as location or anchor points, OCR, semantic analysis and DOM attributes
- AI-based test failure analysis to identify other tests that may have been affected; Testsigma also tries to auto correct the tests to some extent
- AI-based suggestion feature for the identification of tests that are affected or relevant and should be executed based on changes in the application
- Identification of all relevant test cases to be included as part of a test run to avoid test failures that are likely to occur later

Tricentis

Tricentis offers capabilities for UI and API test automation, test management, data integrity and performance testing, as well as smart impact analysis for SAP updates as part of their product portfolio. Tosca, Tricentis' AI-powered functional test automation tool, supports the testing of web, mobile and desktop applications; APIs; and enterprise applications, such as SAP, Salesforce, ServiceNow, Oracle, Workday and Microsoft Dynamics 365.

The product is offered as a desktop implementation. For agile development teams, Tricentis Testim provides an AI-based recorder and smart locators to support fast and stable UI automation of modern web applications.

Tricentis augments test automation engineers, quality and test managers, and business analysts/SMEs through these capabilities:

- The Vision AI solution, which can create automation based on visual clues, such as a simple mock-up or UI description, before any code is written; this is independent of underlying platform or technology
- Self-healing test automation through dynamic updates to object selectors by multiple indicators, such as location or anchor points, OCR, semantic analysis, or DOM attributes
- Risk AI-driven automation that leverages the knowledge of the AI networks to optimize regression testing by analyzing the impact of code changes and data objects

Worksoft

Worksoft offers capabilities for UI and API test automation, test management, and test scenario design as part of their product portfolio. The company expanded its AI footprint in 2022 with the acquisition of eureQA. Worksoft Certify, Worksoft's test automation solution, is available as desktop or SaaS deployment.

Certify supports testing of web, mobile and desktop apps, and APIs, as well as enterprise ERP, CRM and HR packaged applications. Worksoft augments test automation engineers, quality and test managers, and business analysts/SMEs by providing the following capabilities:

- Self-healing automation through a variety of algorithms for object identification
- Process discovery to capture user scenarios based on behavior
- AI Search for saving time in finding existing, reusable automation and preventing duplicate test creation with AI-based fuzzy matching and comparison
- eureQa's cloud-native cross-platform solution, which uses AI/ML techniques to support self-healing tests and autonomous troubleshooting for websites to reduce risk for new implementations, business process change or compliance needs

Market Recommendations

Software engineering leaders should:

- Maximize the value of AI by identifying areas of software testing in their organizations, where AI will be most applicable and impactful.
- Use this research to evaluate vendors that offer AI-augmented software-testing tools by requesting evidence for how they can improve efficacy in each specific area of software testing.
- Modernize their teams' testing capabilities by establishing a community of practice to share information and lessons and budgeting for training.

Evidence

[1] The **2021 Gartner Software Engineering Leaders Survey** was conducted to understand the challenges and responsibilities of software engineering leaders. The research was conducted online from April through June 2021 among 314 respondents from North America (n = 155), Western Europe (n = 103) and the Asia/Pacific (APAC) region (n = 56). Respondents were screened as responsible for at least one team of software engineers at organizations with more than $20 million in worldwide revenue across organizations from all industries. This does not include construction, natural resources, energy, some manufacturing subindustries, local or regional government, and wholesale. The survey was developed collaboratively by a team of Gartner analysts and Gartner's Research Data, Analytics and Tools team.

Disclaimer: The results of this survey do not represent global findings or the market as a whole; rather, they reflect the sentiments of the respondents and companies surveyed.

[2] The **2020 Gartner Achieve Business Agility With Automation, Continuous Quality and DevOps Survey** was conducted online from June 2020 through August 2020. There were 205 respondents working for service providers, cloud

providers and end-user organizations in North America and Western Europe that have deployed or are using DevOps.

Qualified organizations had at least $500 million in annual revenue and were required to operate primarily in the banking and financial services, government, insurance, healthcare, and retail industries. Respondents were required to work in their organizations' IT function, have a job title less senior than C-level, and be two or more layers away from the most senior executive in their organization.

The respondent's role had to be primarily focused on application development, I&O, or business intelligence and information management. In these focus areas, they were also required to perform relevant roles/activities.

Disclaimer: The results of this study do not represent global findings or the market as a whole; rather, they reflect the sentiments of the respondents and companies surveyed.

[3] World Quality Report 2022/23, Capgemini.

[4] Forecast Analysis: IT Spending, Worldwide, 3Q22 Update.

Note 1: Representative Vendor Selection

The vendors listed in this research are a representative sample, not an exhaustive view, of the total market. Our focus in this edition of the market guide is on use of AI augmentation in automated functional testing. Some of the vendors in this document may also support AI for other use cases. Their products are typically sold in ways that emphasize how they use AI to improve software testing. In addition, the listed vendors have achieved some degree of global visibility and traction in this market.