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(57) Abstract :
The present invention relates to a machine learning based device for automation of testing of software development. The proposed invention belonging to the field of software development and validation. The device autonomously generates and executes test scenarios by analyzing source code, runtime behaviors, and historical test data through a hybrid convolutional and recurrent neural network. It comprises an Input Processing Unit, Data Analysis Module, Machine Learning Core, Test Case Generator, Test Execution Engine, Feedback Loop Module, and Control Unit, interconnected to ensure seamless operation. The technical advancement lies in its dynamic adaptation to software changes, comprehensive test coverage, and reduced manual intervention compared to static analysis-based prior art. The principal use is to enhance the efficiency and accuracy of software testing in agile development environments. Figure 1 illustrates the device's schematic structure (101-107).

No. of Pages : 15 No. of Claims : 4

FORM 2

THE PATENT ACT 1970

(39 OF 1970)

AND

The patent rules, 2003

COMPLETE SPECIFICATION

(See section 10: rule 13)

TITLE OF INVENTION

A MACHINE LEARNING BASED DEVICE FOR AUTOMATION OF TESTING OF SOFTWARE DEVELOPMENT

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PREAMBLE TO THE DESCRIPTION

COMPLETE

Following specification particularly describes the invention and the manner in which it is to be performed.

DESCRIPTION

TECHNICAL FIELD OF INVENTION

The present invention pertains to the technical field of software development and testing, specifically focusing on the automation of software testing processes through the application of machine learning technologies. The invention relates to a device that leverages machine learning algorithms to enhance the efficiency, accuracy, and adaptability of software testing, ensuring robust validation of software applications across diverse platforms and environments.

BACKGROUND OF THE INVENTION

The background information herein below relates to the present disclosure but is not necessarily prior art.

Software testing is a critical phase in the software development lifecycle, aimed at ensuring that applications function as intended, are free of defects, and meet specified requirements. Traditional software testing methods, including manual testing and scripted automation, often face challenges such as high time consumption, human error, and limited adaptability to complex or evolving software systems. These methods rely heavily on predefined test cases, which may not adequately cover all possible scenarios, particularly in dynamic applications involving large datasets or intricate user interactions.

The advent of complex software systems, such as those incorporating artificial intelligence, Internet of Things (IoT), and real-time data processing, has exacerbated these challenges. Existing testing frameworks often struggle to keep pace with rapid development cycles and frequent updates, leading to undetected bugs or performance issues.

For instance, a prior art disclosed in US8924938B2 describes a system for software testing using machine learning to generate test cases based on static analysis and hypotheses about program execution paths. However, this approach primarily focuses on static analysis and may not dynamically adapt to runtime behaviors or diverse software environments, limiting its effectiveness in modern agile development settings.

Another relevant prior art from the Indian Patent Office (Patent No. 311620) illustrates a method for allocating communication resources to wireless devices using historical data and machine learning to optimize throughput. While this demonstrates the application of machine learning in resource allocation, it does not address the specific needs of software testing, such as identifying edge cases or adapting to new software features without extensive reprogramming. Additionally, existing solutions often require significant manual intervention to update test scripts or require predefined rules, which can be inadequate for applications with non-deterministic behaviors or frequent updates.

The inefficiencies of these existing solutions underscore the need for a testing mechanism that can autonomously learn from software behavior, adapt to changes, and generate comprehensive test scenarios with minimal human intervention. The inability of conventional methods to efficiently handle large-scale, dynamic software systems results in increased development costs, delayed releases, and compromised software quality, creating a pressing demand for an innovative approach to automate and optimize the testing process.

There are various drawbacks prior art/existing technology. Hence there was a long felt need in the art.

OBJECTIVE OF THE INVENTION

The primary objective of the present invention is to provide a machine learning based device for automation of testing of software development.

To develop a device that dynamically adapts to software changes by learning from runtime behaviours and historical test data, thereby reducing manual intervention.

To enhance the efficiency and accuracy of software testing by leveraging machine learning to identify edge cases and optimize test coverage across diverse software environments.

These and other objects and characteristics of the present invention will become apparent from the further disclosure to be made in the detailed description given below.

SUMMARY OF THE INVENTION

Accordingly, the following invention provides a machine learning based device for automation of testing of software development. The invention comprises a device that integrates machine learning algorithms to autonomously generate, execute, and optimize test scenarios for software applications. The device analyzes source code, runtime behaviors, and historical test data to create adaptive test cases, ensuring comprehensive coverage and early detection of defects. By employing a neural network-based architecture, the device dynamically learns from software updates and user interactions, reducing manual effort and improving testing efficiency. The main advantages include enhanced test coverage, reduced testing time, and the ability to adapt to complex and evolving software systems, thereby overcoming limitations of prior art such as static test case generation and lack of runtime adaptability.

BRIEF DESCRIPTION OF DRAWING

This invention is described by way of example with reference to the following drawing where,

Figure 1 of sheet 1 the depicts a schematic block diagram.

DETAILED DESCRIPTION OF THE INVENTION

As used in the description herein and throughout the claims that follow, the meaning of “a,” “an,” and “the” includes plural reference unless the context clearly dictates otherwise. Also, as used in the description herein, the meaning of “in” includes “in” and “on” unless the context clearly dictates otherwise.

The present invention is related to a machine learning based device for automation of testing of software development.

The invention introduces a novel device designed to automate software testing using machine learning, addressing the inefficiencies of traditional testing methods. The device autonomously generates and executes test scenarios, adapts to software changes, and optimizes test coverage, ensuring robust validation of software applications across diverse environments. Unlike prior art, such as US8924938B2, which relies on static analysis and predefined hypotheses, this invention leverages dynamic learning to adapt to runtime behaviors, offering a non-obvious improvement in testing efficiency and adaptability.

The device comprises several interconnected components, each designed to perform specific functions within the testing ecosystem. The Input Processing Unit (101) receives and preprocesses software data, including source code, runtime logs, and historical test results. The Data Analysis Module (102) processes this data to extract features such as code complexity, execution paths, and user interaction patterns. The Machine Learning Core (103), based on a convolutional neural network (CNN) and recurrent neural network (RNN) hybrid, analyzes these features to identify patterns and predict potential defects. The Test Case Generator (104) creates adaptive test scenarios based on the machine learning outputs, while the Test Execution Engine (105) runs these scenarios and collects results. The Feedback Loop Module (106) feeds test outcomes back to the Machine Learning Core (103) for continuous learning. These components are interconnected via a central Control Unit (107), which coordinates data flow and ensures seamless operation.

The configuration ensures that the Input Processing Unit (101) communicates processed data to the Data Analysis Module (102), which in turn feeds feature sets to the Machine Learning Core (103). The Test Case Generator (104) receives predictive models from the Machine Learning Core (103), and the Test Execution Engine (105) interfaces with the Feedback Loop Module (106) to refine future test cycles.

The process begins with the Input Processing Unit (101) collecting software data, which is normalized and segmented for analysis. The Data Analysis Module (102) employs statistical and pattern recognition techniques to extract relevant features, such as code dependencies and execution bottlenecks. The Machine Learning Core (103) processes these features using a hybrid CNN-RNN model, where the CNN extracts spatial patterns in code structure, and the RNN captures temporal dependencies in runtime behavior. The Test Case Generator (104) uses these insights to create test cases that cover edge cases, stress conditions, and typical user

scenarios. The Test Execution Engine (105) executes these test cases in a controlled environment, simulating real-world conditions. The Feedback Loop Module (106) analyzes test outcomes, identifying defects and updating the Machine Learning Core (103) to refine future predictions. For example, in testing a web application, the device might identify a rare user input sequence causing a crash, generate a test case to replicate it, and verify the fix in subsequent iterations.

The technical advantages of this invention over prior art are significant. Unlike static analysis-based systems, the device dynamically adapts to software changes, reducing the need for manual script updates. The hybrid CNN-RNN model enables deep learning of complex software behaviors, surpassing rule-based or heuristic methods. The autonomous generation of test cases ensures comprehensive coverage, including edge cases often missed by traditional methods. Additionally, the feedback loop enhances long-term accuracy, making the device suitable for agile and continuous integration environments.

I/We Claim:

1. A machine learning-based device for automation of testing of software development, comprising:

a) an Input Processing Unit (101) configured to receive and preprocess software data, including source code, runtime logs, and historical test results;

b) a Data Analysis Module (102) communicatively coupled to the Input Processing Unit (101), configured to extract features such as code complexity, execution paths, and user interaction patterns;

c) a Machine Learning Core (103) connected to the Data Analysis Module (102), employing a hybrid convolutional neural network (CNN) and recurrent neural network (RNN) to analyze features and predict potential defects;

d) a Test Case Generator (104) linked to the Machine Learning Core (103), configured to generate adaptive test scenarios based on predictive models;

e) a Test Execution Engine (105) interfaced with the Test Case Generator (104), configured to execute test scenarios and collect results;

f) a Feedback Loop Module (106) connected to the Test Execution Engine (105) and Machine Learning Core (103), configured to analyze test outcomes and refine predictive models;

g) a Control Unit (107) interconnecting all components, configured to coordinate data flow and ensure seamless operation.

2. The device of claim 1, wherein the Machine Learning Core (103) uses a hybrid CNN-RNN model to process spatial and temporal features of software data.

3. The device of claim 1, wherein the Test Case Generator (104) creates test cases covering edge cases, stress conditions, and typical user scenarios.

4. The device of claim 1, wherein the Feedback Loop Module (106) updates the Machine Learning Core (103) based on test outcomes to enhance prediction accuracy.

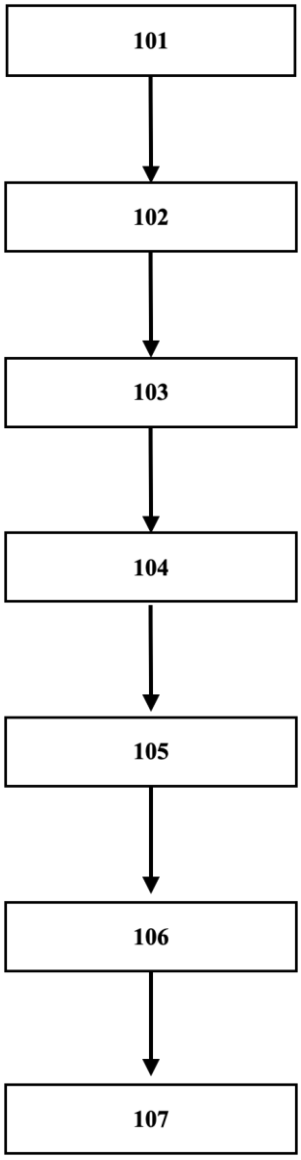

Figure 1

ABSTRACT

A MACHINE LEARNING BASED DEVICE FOR AUTOMATION OF TESTING OF SOFTWARE DEVELOPMENT

The present invention relates to a machine learning based device for automation of testing of software development. The proposed invention belonging to the field of software development and validation. The device autonomously generates and executes test scenarios by analyzing source code, runtime behaviors, and historical test data through a hybrid convolutional and recurrent neural network. It comprises an Input Processing Unit, Data Analysis Module, Machine Learning Core, Test Case Generator, Test Execution Engine, Feedback Loop Module, and Control Unit, interconnected to ensure seamless operation. The technical advancement lies in its dynamic adaptation to software changes, comprehensive test coverage, and reduced manual intervention compared to static analysis-based prior art. The principal use is to enhance the efficiency and accuracy of software testing in agile development environments. Figure 1 illustrates the device's schematic structure (101-107).

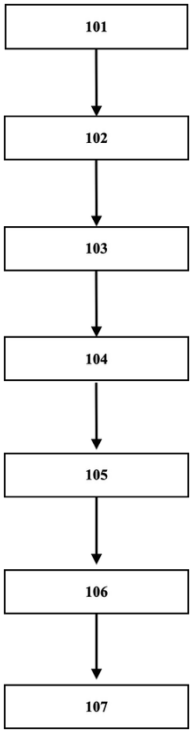

Figure 1

FORM 9

THE PATENT ACT, 1970
(39 of 1970)
&
THE PATENTS RULES, 2003

REQUEST FOR PUBLICATION

[See section 11A (2) rule 24A]

I/We **Gundala Swarnalatha,Sariya Jabeen Duriya,Dr. Koneti Krishnaiah,PEDDABOMMA ARCHANA,MADUGULA SRAVANTHI,KATHAYAT KALPANA,Dr.A.Manikandan,Akurathi Lakshmi Pathi Rao** hereby request for early publication of my/our [Patent Application No.] TEMP/E-1/78703/2025-CHE

Dated **24/07/2025 00:00:00** under section 11A(2) of the Act.

Dated this(Final Payment Date):----------
Signature
Name of the signatory

To,
The Controller of Patents,
The Patent Office,
At Chennai

This form is electronically generated.

FORM 1
THE PATENTS ACT, 1970
(39 of 1970)
&
THE PATENTS RULES, 2003
APPLICATION FOR GRANT OF PATENT
[See sections 7,54 & 135 and rule 20(1)]

(FOR OFFICE USE ONLY)

Application No.: .....
Filing Date: .....
Amount of Fee Paid: .....
CBR No.: .....
Signature: .....

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3. TITLE OF THE INVENTION: A MACHINE LEARNING BASED DEVICE FOR AUTOMATION OF TESTING OF SOFTWARE DEVELOPMENT

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Sr.No.	Country	Application Number	Filing Date	Name of the Applicant	Tilte of the Invention

6. PARTICULARS FOR FILING PATENT COOPERATION TREATY (PCT) NATIONAL PHASE APPLICATION:

International Application Number	International Filing Date as Allotted by the Receiving Office
PCT//	

7. PARTICULARS FOR FILING DIVISIONAL APPLICATION

Original (first) Application Number	Date of Filing of Original (first) Application

8. PARTICULARS FOR FILING PATENT OF ADDITION:

Main Application / Patent Number:	Date of Filing of Main Application

9. DECLARATIONS:

(i) Declaration by the inventor(s)

I/We ,Gundala Swarnalatha,Sariya Jabeen Duriya,Dr. Koneti Krishnaiah,PEDDABOMMA ARCHANA,MADUGULA SRAVANTHI,KATHAYAT KALPANA,Dr.A.Manikandan,Akurathi Lakshmi Pathi Rao, is/are the true & first inventor(s) for this invention and declare that the applicant(s) herein is/are my/our assignee or legal representative.

(a) Date: -----

(b) Signature(s) of the inventor(s): .....

(c) Name(s): Gundala Swarnalatha,Sariya Jabeen Duriya,Dr. Koneti Krishnaiah,PEDDABOMMA ARCHANA,MADUGULA SRAVANTHI,KATHAYAT KALPANA,Dr.A.Manikandan,Akurathi Lakshmi Pathi Rao

(ii) Declaration by the applicant(s) in the convention country

I/We, the applicant(s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.

(a) Date: -----

(b) Signature(s) : .....

(c) Name(s) of the singnatory: Gundala Swarnalatha,Sariya Jabeen Duriya,Dr. Koneti Krishnaiah,PEDDABOMMA ARCHANA,MADUGULA SRAVANTHI,KATHAYAT KALPANA,Dr.A.Manikandan,Akurathi Lakshmi Pathi Rao

(iii) Declaration by the applicant(s)

- **The Complete specification relating to the invention is filed with this application.**
- **I am/We are, in possession of the above mentioned invention.**
- **There is no lawful ground of objection to the grant of the Patent to me/us.**

10. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION:

Sr.	Document Description	FileName

I/We hereby declare that to the best of my/our knowledge, information and belief the fact and matters stated hering are correct and I/We request that a patent may be granted to me/us for the said invention.

Dated this(Final Payment Date): ----------

Signature: .....