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PROSPECTS OF INTELLIGENT AUTOMATION IN SOFTWARE TESTING PROCESS

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Abstract. *This paper provides an overview of using Artificial intelligence (AI) for building test automation frameworks in a way with less human interventions. The analytical framework of the article is built on new modern enterprise prototypes.*

This article deals with opportunities as well as ideas to drive process of incorporation of AI in software testing process. The article provides analysis of areas to be augmented by use of Machine learning methods in testing tools (frameworks) from integrated reports as well as from own experience.

This article refers to improvement of software quality validation, discovering

potentiality and challenges of AI in terms of testing activities.

Schema of integrated process with use of AI technology and traditional testing techniques is presented. By engaging with presented ideas, the article contributes to creation of open-source automated tool with power of AI. The main contribution of this study is to identify hands-on perspectives of AI to test software.

Keywords: *artificial intelligence, automation testing, deep neural networks, testing, deep learning, DNN, AI, machine learning.*

I. INTRODUCTION

Artificial intelligence (AI) software is used in almost all industries, including healthcare, social media, and advertisements, fintech, autonomous cars, planning of smart cities' infrastructure.

AI becomes omnipresent and it is important to ensure reliability of AI-based and conventional software which mostly play safety-crucial contexts.

Companies have already started extending CI with incorporation of AI-assisted tools to their software development lifecycle (SDLC) pipeline. Introduction of AI will make regression testing quicker as well as decrease routine monotonous tasks being done by manual testers and thereby free up time for more creative work. As the result, focus will be shifted to scalability and security of incorporated AI, adopting more product-focused approach. There are already exist some scenarios that leverage power of AI, but they do not fulfill all technical aspects such as generating test scenarios based on user experience by reading production logs or relevant adaptation to changes in software, identification of critical areas in the code.

It is obvious that building automation framework with versatile functionality requires consideration bunch of criteria that are going to be covered in this paper.

Therefore, to stay in optimal condition and provide trustworthy software to the market quickly requires keeping track of innovative approaches, which main aspects are considered in this paper.

II. LITERATURE ANALYSIS

Generally, the main goal of AI is to mimic cognitive functions of humans, and one of the powerful techniques for this is Machine Learning. Consequently, ML could be realized by using one of well-known methods, for example, deep neural networks. As AI devices continuously learn from human input, testing process is persistently improving as well. Development of AI is still in its early-stage despite of appearance number of innovative tools, such as Applitools, Sauce Labs, Testim, TestCraft etc. AI is supposed to change established testing process with use of Machine Learning methods (pattern-recognition technology), Deep Learning.

To gain basic overview of enterprise tools that use AI, it worth to mention at least a couple tools, particularly TestCraft and Testim. On the market exists codeless Selenium test automation platform with revolutionary AI which provides auto-fixing 97, 4 % of flaky tests, namely TestCraft. This tool is designed for functional UI testing. On the one hand, this product has a great range of advantages: building tests with flow builder on the fly, Selenium-based, has integrations with management and CI/CD

tools, etc. But on the other hand, drag and drop function to build flows is not easy-to-use and it is not open source [1].

Unlike TestCraft, Testim is more robust because allows create codeless, coded or partially coded/codeless tests. Testim uses AI to speed-up the authoring, execution, and maintenance of automated tests [2]. Since Testim has more integrations, such as Jira Service Management, TestRail, CircleCI it makes good test management tool.

One of the most critical part in testing process is time for analysis of automated test results, visualization of reports and providing analytics. Solution is provided in open-sourced reporting management tool Report Portal, which among other features gives smart analysis of tests cases based on Machine Learning [3]. Report Portal uses AI in the next features: auto-analysis based on historical data of the test execution; direct submission of issues from the execution result; flagging of tests results after automatic root cause analysis. All features of this tool reduce the time for re-analysis, as well as eliminate the need to create a custom tool for reporting for almost any of software-under-test.

III. OBJECT, SUBJECT, AND METHODS OF RESEARCH

The research object is automated software testing tools.

The research subject is process of automation software testing.

As a research method, this paper uses literature review to synthesize findings and to uncover possible undertaken collection of studies that have capacity to engender new ideas for use of AI in testing.

IV. RESULTS

Stiff competition in the market requires from businesses to deliver software as soon as possible to stay on radar. Consequently, time for testing activities should be reduced. It is well-known problem with lack of time when regression testing is coming [4]. Every time after run execution automation testers spend time to analyze tests failures, to do manual defect triage. As it turned out, AI can reduce the direct involvement of test engineers within reports execution analysis.

With AI, coverage of code by unit tests also could be tracked in the following way: creation of test suites, detection of uncovered code by written test suites, finding out of parameters needed to the test method and creation of test. This approach helps with maintenance unit tests and ascertain testers that features testing is done on unit level.

Apart from that, AI has great potential in generation of API test cases. Recognition of patterns shifts to analysis of users' network traffic. Then based on obtained patterns model is being created, that will be used for generation of test suites that cover limitless user steps.

Validation of UI components already uses ML algorithms to adapt of simple Selenium tests to self-fixing common problems such as dynamic locators.

Gathering of logs from production or from staging environments as a data-source of learning can help with identification of unique test cases that need manual

and automated testing and generate a comprehensive suite of testing scripts that are missing in regression suite, as well as detection and elimination of redundant, unnecessary test cases. Examination concept of AI exposed that forecasting of end-2-end user scenarios can group and identify application areas that require more focus.

Moreover, from business side AI can ensure coverage of testing acceptance criteria by using some ML algorithms for extracting keywords from the Requirements Traceability Matrix. Business risks even outnumber some technical aspects, and it is hypothesized that analytics of defects will be among the most prioritized areas with trial of AI use.

In paper [5], proposed and evaluated testing tool for automation testing of DNN-driven vehicles that can potentially lead to fatal crashes. As it is mentioned, this tool systematically generates test inputs that maximize the numbers of activated neurons by leveraging real-world changes and using domain-specific metamorphic relations.

The focus of present article shifts to development Deep Neural Network [6] for test suites optimization that already have integrations with any test management tool, for example TestRail. Model of network is supposed to be used for optimization of test cases on long-term projects.

Learning of neural network is trained with the supervised learning algorithm that take a set of training data (to learn a desired function) and test data (to validate learning algorithm). The result of this process should be model. As criteria for definition of deviation MSE [6] is supposed to be used. It should be noted that training and testing data is modified from cases in original project.

Block diagram is illustrated in Fig.1

Use of such approach eliminates the need of deep knowledge of project domain specifics to navigate and search for some test cases, not just extending volume of database with new ones.

V. CONCLUSIONS

AI is constantly bringing a new dimension to our lives, and software testing is no exception. AI can improve tests stability and validation, generate end-to-end tests from production user journeys and use them in production to monitor critical parts of systems. Even if users are not aware of AI pervasiveness, application of AI to large volumes data is already used in high-value cases, such as customer engagement [5]. While the benefits of AI in software testing are still in the early development, progress in this direction is natural in the race to fast SDLCs. Number of changes related to growing hybrid cloud use emerging requires AI as never before. Further study of the issue would of interest. Software testing, backed with AI and ML, will only get better with time.

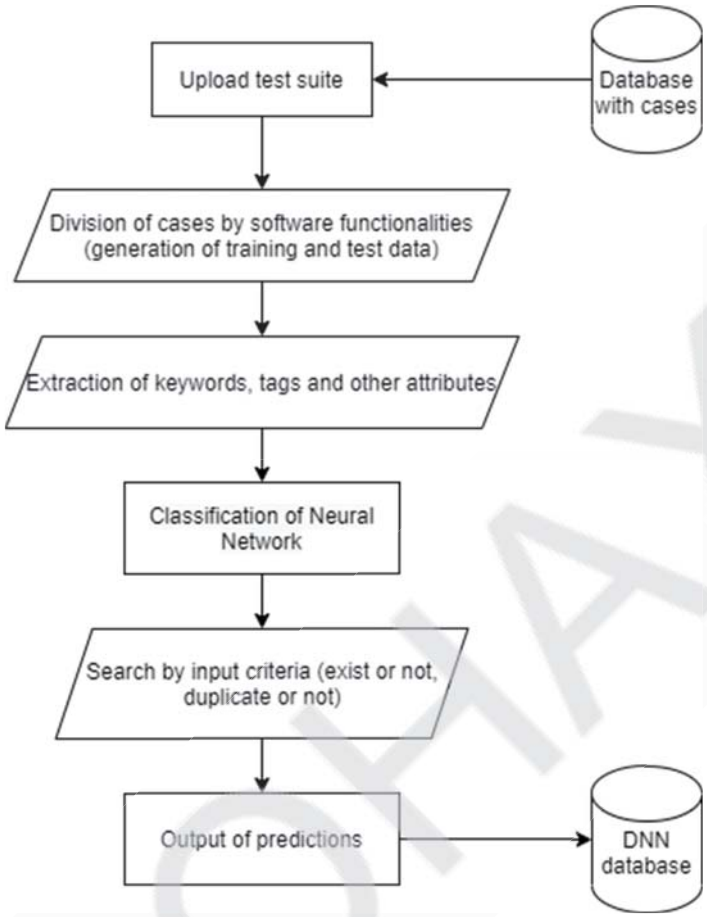

Fig. 1. Diagram of DNN learning process

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The collection includes student works of the participants of the competition, which were not included in the number of prize-winners. The texts of the competitive works are published in the form in which they were submitted by the authors. The authors of the articles are responsible for the content and form of submission of the material.

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