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Artificial Intelligence (AI) and BOTs in Testing

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Abstract

The knowledge gathered using Artificial Intelligence (AI), coupled with the efficiency of BOTs is a boon for testing activity in the IT world. This can, not only bring down the human errors, but can also significantly speed up the whole testing process and by extension the project timeline. As part of test preparation, the AI needs be exposed to a range of different paths the product can take, so that it can learn operations and the BOTs designed to each of the possible variations in input and outcome. With detailed data gathering and careful design, AI and BOTs can effectively handle every scenario and ensure the end product meets the needs and goals of the organization. Once the BOTS are in place, they can be reused at will to actively test any enhancements or modifications that the product might have to undergo in its lifetime on the IT world. Similarly, with AI constantly observing the application, it can be used to dynamically identify the differences, both in source and the expected result for building targeted testing document and execution.

Keywords : AI, BOTs, Automated Testing, IT testing, Machine Learning, Regression testing. Application Evolution monitoring. And learning, Automated Test data gathering, Programmatic test execution

Introduction

"Artificial intelligence (AI) is a set of technologies that enable computers to perform a variety of advanced functions, including the ability to see, understand and translate spoken and written language, analyze data, make recommendations, and more."

- *Definition by Google Cloud [1]*

"A BOT is a software application that performs repetitive tasks by following instructions to imitate human behavior"

- *Definition from AWS [2]*

Artificial Intelligence (AI) and BOTs are not novel concepts. They have been around for a long time in various capacity and probably known with different names. But in the recent years it has become synonymous with computer programming which has the ability to learn and evolve with as little human intervention as possible. Though we have not reached an era where computers function autonomously without any human aid, we have come very long way and lots of ideas that were deemed to be sci-fi have become reality with astonishing results. It is no surprise that more and more companies are working towards incorporating AI and BOTs in their IT landscape to produce fast and accurate outputs. However, adopting them is not a simple task, since it needs a significant amount of effort and investment to make this happen. Hence each company needs to test the scope and value-add and weigh it the pros and cons of moving forward and the easiest and most effective place to test the waters are the testing space, as it is one of the more stable area and provide enough opportunity to try and analyze ant new automation that the IT team plans to incorporate.

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Getting AI Ready for Testing

The efficiency of an AI depends on the amount of information it possesses and its ability to recognize pattens and deviations and provide desired result based on the organization's need. Taking a human analogy, it is like a student who is provided with education, however, the ability of the student to grasp the knowledge and apply it practical use makes them better than others and this capability is cultivated with years of dedication and practice and going through multiple iterations to get to the point where they are. Similarly, the machines running AI needs to go through several stages before it gets perfected, until then the learning continues.

Baselining

Baselining is the practice of defining the base functionalities, i.e., identifying and documenting expected behavior of the application in its different stages. In project terms, this is usually a set of business flows and the functional requirements that are gathered at the time of requirement gathering and ideally approved and finalized before the development starts. These documented flows need to be fed to the AI machine so that it is aware of the use of the flow. At this stage, all the machine has is the theoretical knowledge of the application and its flows. This is a very important step, yet incomplete. The level of information that the machine can have greatly depends on the amount and accuracy of the documentation. An incorrect or ambiguous document can result in the machine have incorrect expectation and provide incorrect results. Prior to baselining, it is an absolute necessity that the teams revisit their documentation and get them corrected so that the right data can be fed.

Another important point to consider is that the process that is used for baselining is a widely used process and not an exception. Exceptions should be separately considered with specific cases where the exceptions are applicable.

Machine Learning

"*In theory, theory and practice are the same. In practice, they are not.*" - *Albert Einstein.*

In reality, despite the company's best efforts, the ability to maintain an effective, accurate and up-to-date documentation is quite impossible. Due do various challenges such as timeline, efficiency of resource to accurately capture and document or even due to the level of complexity of the change, the documentation is ignored. When such documentation is used for baselining, it might be referring to an old incomplete or even obsolete process and testing the application using this information would be a disaster. In short, Hence the AI machine needs to be exposed to the application in its day to day functioning to gather the real-world activities. This is where the actual power and quality of the AI machine comes fore. In this step, the machine needs to be able to recognize each step of the process and corelate with the baselined activities and the flows associated with it. Any activity or flow should be recorded as deviation and should be produced to review and approval.

This should be a continuous activity, where the machine goes though the several iterations of the flows and familiarize and finalizes the business process. Any significant deviations would be identified along with the surrounding conditions, such as the input data, team performing the task, application set-ups, etc., and present it to the team so that they can make educated decisions as to whether this needs to be added as part of the accepted flow or an issue that needs to be addressed, and have the document updated with the actual flow. These finding are some of crucial part not just for testing, but to revisit the overall operations and its efficiency.

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BOTs for Testing

BOTs, unlike AI, operate within a specific boundary. They have pre-defined set of rules, that they strictly abide by including, but not limited to the types of input data, calculations, every influencing variable and the desired output. Even the slightest deviations with cause the BOTs to fail and every new scenario needs a modification or new BOT built. Again, taking a human analogy, though not very accurate, is like a person with security job, where they are expected to ensure the safety using per-defined protocols. Any change to the routine is strictly not allowed and will have to not do it or escalate to a higher authority for resolution.

BOTs can either come with pre-defined capabilities, in which case the only effort needed is to plug in the input and output details and probably the formulas. These types of BOTs are extremely efficient for testing rather simple flows. It can even be automated to an extent that, by integrating them with AI machines, they and even configure these BOTs with everything they need to execute scenarios and report the results without any human intervention. There are more than a few such BOTs available in the market today, which are procures by the companies to perform some mundane activities to reduce cost and errors. However, with the right coupling, they can be extremely effective in delivering much more than that.

The next type is programable BOTs. These are products that comes with tools and APIs that enables the organization to develop their own BOTs to satisfy their needs. Unlike the predefined BOTs, the capabilities of these BOTs endless only limited by the ability of the team coding it. These BOTs are easily extensible and can be altered as the business evolves. In certain aspects these are not much different from the software or the application that it serves, but their activities are severely limited and targeted. While these BOTs provide scalability, it comes with its own risk, where the changes might cause unexpected conditions resulting in buggy output.

Testing by Integrating AI and BOTs

Irrespective of the type, either one of these types of BOTs (or combination of both), can be efficient in automated testing. Using the continuous learning practice adopted using AI, with sufficient all possible valid branches of the processes can be identified. These branches can later be classified into individual scenarios and can even be broken down in to test cases. Having the scenarios and cases jotted down, the test scripts and the underlying steps can be developed with each activity recorded by the AI machine contributing to each test step.

With all these clearly marked, the BOTs can be strategically involved in the right areas to execute the test cases. While AI can be used to automatically plan and build the test cases, it's the job of the BOTs to execute them and perform subsequent operations, such as test results reporting, automated defect creation along with the relevant information such as the data involved and the scenario and the step it failed, to an extent up to notifying the team responsible for fixing it.

It is imperative that there is constant feed of input data to these bots for testing the application. In a sophisticated AI environment, the data needed for testing can be pulled from production with appropriate data scrambling and used for testing, i.e., while the production activities are done, every keystroke and click done by the user along same data, morphed, can be automatically pushed in to the testing system to check the behavior of the new system. This might sound farfetched, but there are areas where this is done with great success. These are some of the ideas and methods, where AI and BOTs can be employed in testing activities. But as mentioned earlier, the opportunities are abundant and with the evolving technologies, its no doubt that there much more that can be done.

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Benefits and Limitations

Like everything else, the use of AI and BOTs have their own advantages and disadvantages. While there is moral and ethical dilemma in entrusting the machine and providing it more control than fellow humans, the document intends to spare this subject and focus on technical aspects since the former is subject individual's perspective and ideologies.

The main benefit of AI and BOTs, like with any automation, is the ability to tirelessly perform the task in hand for number of iterations with the same level of accuracy provided the underlying conditions are the same. This eliminates the fatigue, errors and oversight that might happen with human testing.

The other key benefit is the cost factor. Especially with regression testing to ensure that the systems work as they used to and not affected by the new factors. Since there is little to no deviations to the test cases and the steps a properly designed BOTs can be triggered at will to check the functionality with confidence that all valid scenarios will be tested and results shared.

The use of AI and BOTs in testing, in particular, can be a great starting point for any organization to try these new tools and technologies, since by the time the project recaches the testing there will be a clarity on the intent of the project and the possibility of the requirement changing at this point, though possible, is rare and frowned upon. Letting AI work alongside different phases of a project would allow it to accumulate every change that the requirement would have gone through and mature by the time it reaches the testing phase, unlike manual testing, who would rely on their understanding of document and the details collection from long strenuous meeting with various teams.

While AI and BOTs come with loads of benefits, they are not without limitations. Some of these limitations might be current and would disappear as the technology evolves, yet it highly unlikely that it will be void of all issues.

One of the biggest concerns is the initial phases of these technologies. The ability of AI to completely understand the application depends upon the amount of information that it is exposed to, in other words, the quantity of the documentation in the baseline phase and the amount of access that it might get in the learning phase. These technologies cannot be implemented and used overnight. It takes time and effort and periodic checks to ensure that it is learning the right way, which is an exhausting and costly affair. The issue can be much higher if any misalignment goes unnoticed at the earlier stages which can cause the entire effort to go waste, or even worse, completely misdirecting the project.

The ability to let the machine continuously learn can also be challenging due to the compliance and sensitivity of the data and activities involved. Bringing in an AI machine in such cases would increase the attack surface and force the companies to enforce the security measures to these systems too, if not there will be a gap in the flow that AI cannot be made aware defeating the purpose of AI.

BOT's rigidity is a gray area, which can be perceived as good and bad. While the uncompromising nature of BOTs can assure consistent outcomes, any slight deviation, which can be accommodated using common sense, would result failure or creation of a new BOT. And it is for this reason, BOTs are less effective in dynamic environment. Also, as part of BOTs set-up, every little detail of the application or process that it tests needs to be set-up, even to the level of clicks and screen positioning. The slightest modification to these might make the BOTs behave different and up for maintenance.

The underlying application or process should be stable to use the BOTs. If the application or process is in its early stages and is subject to tuning and modification, BOTs simply cannot be used. With almost all products releasing security and functionality patches, pretty much every quarter, there is a chance that the behavior of the application

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would change, rendering the BOTs useless. At the same time, creating new BOTs or modifying it for every change that the application goes through, would result in a lot of old unwanted and obsolete BOTs or a complex BOT, that might have multiple points of failure.

Conclusion

While AI and BOTs have automated testing activity greatly, it is still in its infancy and has a potential to go a long way. It is evident that it has significantly brought down human intervention and errors, and yet it has not completely eliminated either, and quite possibly, would not in a long run. It is also important to note that even though AI and BOTs, individually or combined is a great testing assistant, it might not be best suited for all companies or all scenarios, since the effectiveness of these technologies is directly proportional to the extensivity of documentation and understanding of the business operations. The extent of using AI and BOTs can be unlimited, and with proper set-up and configuration, there can be a matrix of test cases executed with various combinations of input and output. With the use of plug and play type of BOTs, they can be widely reused to cater the testing activity as long as the application is active.

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