Software Testing and AI - The Perfect Marriage?

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TABLE OF CONTENTS

INTRODUCTION

As Artificial Intelligence (AI) continues to permeate most aspects of life and business, the burning question for Testing Practitioners is: "How will Software Testing be impacted by the availability and growing use of AI in Software Development?"

This opinion paper will look at how AI is already influencing testing in Financial Services, the pros and cons of such usage, the market for such innovation and the future for Software Testing & AI.

GIVE ME EFFICIENCY!

Testing is often, and at times, quite rightly, due to ineffective and inefficient practices, perceived as being over-laborious, costly and time hungry. As such, the search for testing efficiency continues, as the pressure to be "first to market" with financial applications and services is exponentially ever-growing. Software Testing, however, is and will continue to be, a critical aspect of Software Development and helps to ensure that offerings are "fit-for-purpose," supports business objectives and satisfies consumer demands.

So, how can Software Testing fulfil these objectives and become more efficient in using AI, whilst at the same time stay true to its necessary foundations and principles of eliminating bugs and providing quality deliverables? Before we discuss that matter, let us first look at the foundations of AI to understand a little more, how they apply in our current social and business activities.

WHAT IS AI?

Although, there are many variations on a theme when it comes to describing AI, it is, in essence, "the ability of a machine to display human-like capabilities such as reasoning, learning, planning and creativity." [1]

Whilst AI is considered by many to be in its infancy, it has, in fact, been around for a number of years. One of the earliest recognised examples, according to Britannica, occurred in the mid-1930s when the well-known proponent of machine learning and AI, Alan Turing, in his "Stored Program" concept, described "an abstract computing machine consisting of limitless memory and a scanner that moves back and forth through the memory, symbol by symbol, reading what it finds and writing further symbols." [2]

Since then, of course, AI has progressed in line with technological advances to provide us with such technical marvels as Self-Driving Cars, Chat-Bots, Google Home, Alexa, and even Smart Vacuum Cleaners - to name but a few.

1. European Parliament, 2023 https://www.europarl.europa.eu/news/en/headlines/society/20200827STO85804/what-is-artificial-intelligence-and-how-is-it-used
2. Copeland, B.J. "Artificial Intelligence -, www.britannica.com/technology/artificial-intelligence/Alan-Turing-and-the-beginning-of-AI. Accessed 16 Oct. 2023.

AI - HOW DOES IT DIFFER TO AUTOMATION AND MACHINE LEARNING?

Within the world of Software Testing, Automation and Machine Learning, both of which can be strongly complemented by AI, have been ever-present over the years in building and executing test cases in a mainly faster, more efficient manner - though there are of course, maintenance and cost considerations associated with these methods. On top of this, Model Based Testing (MBT) has also provided the ability to achieve maximum levels of test coverage. AI facilitates the amalgam of these test methodologies and indeed, greatly enhances them.

Whilst automation and AI have many commonalities, there are distinct differences that sets them apart. Machine Learning, by its nature can almost be considered a subset of broader AI.

Automated tests are pre-scripted, fixed instructions with expected results operating within a specific suite and tool\framework. AI tests on the other hand, are designed to learn from errors and improve bug detection capability and overall quality.

Machine Learning, by definition, is "the use and development of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyse and draw inferences from patterns in data."

Although related, Machine Learning is distinct from AI where it, as described by Columbia University, is:
"...artificial intelligence refers to the general ability of computers to emulate human thought and perform tasks in real-world environments, while machine learning refers to the technologies and algorithms that enable systems to identify patterns, make decisions, and improve themselves through experience and data...". [3]

3.Columbia University. "Artificial Intelligence (AI) vs. Machine Learning | Columbia AI." CU-CAI, 2023, ai.engineering.columbia.edu/ai-vs-machine-learning/. Accessed 18 Oct. 2023.

MARKET GROWTH

So, how are the markets reacting to this type of innovation? According to Future Market Insights, AI testing tools are "anticipated to capture a valuation of US$ 426.1 million in 2023 and is projected to rise to US$ 2,030.75 million by 2033."[4] The adoption of AI based testing tools aligns with the business need for bug free applications and speed to market, along with greater test coverage and improved quality.

In addition, "by implementing AI applications, banks are projected to save $447 billion by the end of 2032.[5] It is apparent therefore, that there is no longer a "gap in the market" for AI related testing and tools but rather now, a "market in the gap.""

INDUSTRY EXAMPLES

AI is already embedded in Financial Services applications and offerings. For example, the use of Chat-bots and Virtual Assistants are common in improving customer experiences across a range of services for example in, accessing account & transaction information, on-boarding, anti-fraud activities and credit decisioning.

The Covid pandemic has served to expedite the adoption and use of AI where minimal human interaction was required for almost three years as businesses-maintained operations to serve public needs. Using AI to streamline production services makes sense as the customer benefits by 24/7 availability and greater efficiencies across the complete banking process for products and services.

Some of the world's major financial institutions such as J.P. Morgan Chase and Morgan Stanley have now strongly embraced AI by investing in the development of embedded solutions whilst closer to home, Bank of Ireland won best application of AI in a large enterprise.[6] Many other Irish and UK Banks are now following suit in developing AI based applications and products.

4.https://www.futuremarketinsights.com/reports/ai-enabled-testing-tools-market#:~:text=The%20AI%2Denabled%20testing%20tools,US%24%202%2C030.75%20million%20by%202033.
5.Gupta,2023. https://www.finextra.com/blogposting/24358/artificial-intelligence-in-banking-2023-how-banks-use-ai#.
6.Irish Times, https://www.irishtimes.com/business/2022/11/23/bank-of-ireland-akara-and-webio-among-companies-honoured-at-ai-awards/.

THE GOOD AND THE BAD

Like every technological advance, besides benefits, there may be downsides or challenges to consider in advance of any switch. The adoption of such advances may lead to benefits by way of:

- **Test Efficiency** - AI in testing provides continuous data in relation to test releases and underlying test cases. This presents the opportunity for AI to continuously learn and improve existing test suites for subsequent executions.
- **Test Effectiveness** - Building automated tests with AI that self-cleanse, improves the reliability and effectiveness of tests under execution.
- **Test Coverage** - Using AI to develop test cases in alliance with automation and MBT Tools can provide almost limitless coverage - coverage which can be refined to suit the next prospective release as AI & Machine Learning kick in to learn from previous test failures and changes to code.
- **Quality of Deliverables** - As a result of increased effectiveness and efficiency, the quality of test deliverables can vastly improve and where bug discovery is greatly enhanced.
- **Cost of Ownership** - As increased effectiveness and efficiency brings improved quality, the overall cost of ownership in relation to applications and products, reduces - as bug leakage is minimised.
- **Speed to Market** - The ability to execute test cases faster, with increased coverage via Automated AI, leads to improved capability for quicker and more repeatable releases.

At the same time, there are challenges to be considered in moving to AI based testing and these can include:

- **Skills Deficit** - Whilst the use of AI has been prevalent in recent years, the skills required to embed AI to drive improved Test Processes may be an issue for some time to come. Software Testers will need to up-skill to be more familiar with AI Test Tools and at the same time learn programming skills in order to embed fully into the AI Test experience.
- **Development Time** - Like all test suites, there will be an overhead in developing new automated AI test cases or modifying existing tests.
- **Tooling Costs** - Depending on the skills and capability of the test team, there may also be added costs if on-boarding one of the many AI test tools available on the market today.

- **Biased Leanings** - The very nature of AI may lead to unconscious and conscious bias being programmed into algorithms - detrimentally impacting on downstream decision making.
- **Data** - AI needs data - lots of data. This is in order to continuously learn and improve from previous test experiences to generate newly defined test cases and to increase effective coverage. The sourcing and building of such data models may be costly at best and even prohibitive in the worst case.

AI TEST TOOLS

As AI for Testing takes off, so too does the opportunity for vendors to produce offerings to support business intentions in this space. A broad raft of AI Test Tools has already started to appear to service the market. These tools vary in their target audience in relation to the levels of testing for a development but have AI at their core. They range in capability from automation testing tools that supports all types of testing to AI testing that help detect visual bugs to platforms that use machine learning to create self-healing tests (tests can repair themselves using AI algorithms).

AI AND THE FUTURE OF SOFTWARE TESTING

So, what does the future hold for Software Testing via the impact of AI? Will it remain a battle between staunch practitioners of traditional testing methods, or will there be a "perfect marriage" between both?

Whilst the evidence is still growing, it appears as if the revolution is already underway. The proliferation of commercial tools and prevalence of AI as mentioned above is testament to this. Software Development is steamrolling towards the use of AI across the whole life cycle. If Software Testing is to remain relevant, current and remain true to the tenet of continuous improvement through technological advances, then AI must become yet another, but extremely powerful, addition in the armoury of the Test Practitioner.

CONCLUSION

To conclude, AI is, and will continue to, shake up the Financial Services world, the IT systems, applications, and products it presents to consumers and how then, these are proven for end use.

Whilst the power and potential of AI in Software Testing is gaining traction, Financial Institutions and Test Practitioners need to embrace its capability quickly and fully in bringing enhanced customer experiences to the market.

This in turn will lead to an increased competitive edge for organisations who are willing to engage in this technological disruption.

BIBLIOGRAPHY

1. _European Parliament, 2023_
   https://www.europarl.europa.eu/news/en/headlines/society/20200827STO85804/what-is-artificial-
   intelligence-and-how-is-it-used
2. _Copeland, B.J. " www.britannica.com/technology/artificial-intelligence/Alan-Turing-and-the-beginning-_
   of-AI. Accessed 16 Oct. 2023.
3. _Columbia University. "Artificial Intelligence (AI) vs. Machine Learning | Columbia AI." CU-CAI, 2023,_
   ai.engineering.columbia.edu/ai-vs-machine-learning/. Accessed 18 Oct. 2023.
4. _https://www.futuremarketinsights.com/reports/ai-enabled-testing-tools-_
   market#:~:text=The%20AI%2Denabled%20testing%20tools,US%24%202%2C030.75%20million%20by%
   _202033._
5. _Gupta,2023. https://www.finextra.com/blogposting/24358/artificial-intelligence-in-banking-2023-how-_
   banks-use-ai#.
6. _Irish Times, https://www.irishtimes.com/business/2022/11/23/bank-of-ireland-akara-and-webio-among-_
   companies-honoured-at-ai-awards/. Accessed 17 Oct. 2023.

Other sources:

- _"Artificial Intelligence in Banking 2023: How Banks Use AI." Finextra Research, 12 June 2023,_
  www.finextra.com/blogposting/24358/artificial-intelligence-in-banking-2023-how-banks-use-ai#.
  Accessed 18 Oct. 2023.
- _Tahvili, Sahar, and Leo Hatvani. Artificial Intelligence Methods for Optimization of the Software Testing_
  Process with Practical Examples and Exercises. [S.l.], Academic Press, 2022.

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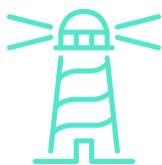
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