BDO IN SOUTH AFRICA | FINANCIAL SERVICES

AN INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

AUDIT • ADVISORY • TAX

TABLE OF CONTENTS

AN INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING:

Christopher James O'Flaherty
BDO Financial Services Technology Junior Analyst

Emerging technologies, such as Artificial Intelligence, the Internet of Things (IoT), Blockchain technology and Robotics, has led to the fourth industrial revolution; encompassing multiple innovative new solutions, changing life as we know it on a day to day basis. This paper explores Artificial Intelligence (AI) and its development in recent years, which has led to new innovative solutions and opportunities. The risks pertaining to this technology, cyber included, will also be explored as well as how this technology interacts with other emerging technologies.

A SHORT INTRODUCTION TO AI:

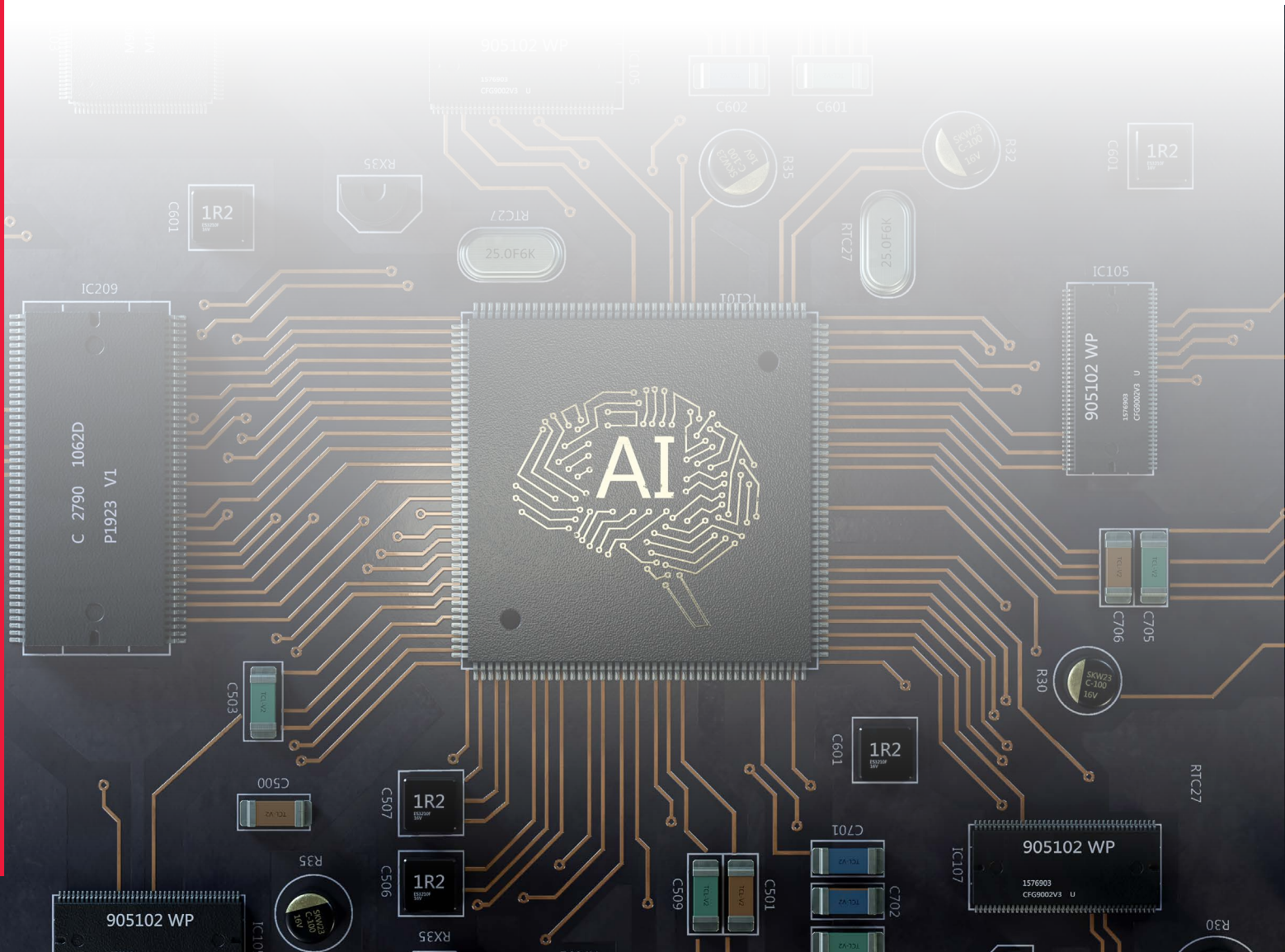
Artificial Intelligence is an umbrella term that encompasses a variety of technologies. The leading edge of AI, is Machine Learning.[1] However, AI encompasses natural language processing, autonomous vehicles, image recognition, robotic process automation and deep learning.[2]

Artificial is essentially anything that is man-made, such as a cell phone, a laptop or a robot. Intelligence is the ability to understand, think and learn. Artificial Intelligence is a broad area of computer science and is defined wherein machines have the ability to learn and think as a human would.[3]

There are three types of Artificial Intelligence:

1. Artificial Narrow Intelligence, also known as weak AI, does not possess an ability to think or self-learn. It simply performs a set of pre-defined functions.[4] This includes asking Siri to show you the weather.
2. Artificial General Intelligence, also known as strong AI, has the ability to think and make decisions, just like humans do.[5]
3. Artificial Super Intelligence is a hypothetical concept. This concept pertains to a machine being more intelligent than a human being. This has been referred to as the singularity wherein runaway technological growth will lead to unfathomable results.[6]

[1]https://bernardmarr.com/default.asp?contentID=1199
[2]https://medium.com/@neha49712/artificial-intelligence-and-its-sub-fields-a5a63d8263e8
[3]https://medium.com/datadriveninvestor/the-basics-of-artificial-intelligence-1e734535c793
[4]https://www.edureka.co/blog/types-of-artificial-intelligence/
[5]https://www.edureka.co/blog/types-of-artificial-intelligence/
[6]https://www.edureka.co/blog/types-of-artificial-intelligence/



A SHORT INTRODUCTION TO MACHINE LEARNING:

Machine Learning has been referred to as the leading edge of AI. However, this concept is not new. Developed in the 1950's, this technology initiated as a rule based program instructing computers to perform actions step by step.[7] Natural language translation commenced as a rule-based program. However, the human language has numerous exceptions.[8] The concept of feeding a computer a large amount of data to learn for itself is where this process started.

As a human being, we learn from experience through trial and error and the neurons make connections in our brains, this is known as tacit knowledge. Facial recognition is a form of tacit knowledge. We recognise a person's face, however it is difficult for us to accurately describe how or why, similarly to riding a bike. The reliance on billions of code is no longer required for computers to learn. Computers are enabled with the power of tacit knowledge to make connections and discover patterns in data.

Machines learn via four common algorithms:

- Supervised learning consists of training a model to achieve a desired level of accuracy.
- Unsupervised learning consists of a model clustering groups of data based on similarities in the data wherein there is no target variable to predict.
- Semi-supervised learning is a combination of both supervised and unsupervised learning.
- Reinforcement learning consists of a machine being trained to make decisions continually through trial and error.[9]

In summary, supervised learning is like being a student and having the teacher constantly watch over you at school and at home. Unsupervised learning is telling a student to figure a concept out themselves. Semi-supervised learning is like giving a student a lesson and then testing them on questions pertinent to that topic. Each algorithm type has its advantages and disadvantages in Machine Learning, and are used based on the parameters and needs of the data scientist or engineer. Statistical methods including regression and classification are used in these Machine Learning algorithms.

Machine Learning also comprises of its subfield, deep learning. Deep learning uses artificial neural networks to extract higher level features from raw data, similar to how the neurons make connections in a human brain.

[7] https://thenextweb.com/neural/2020/06/13/the-key-differences-between-rule-based-ai-and-machine-learning-syndication/
[8] https://enterprisersproject.com/article/2020/2/artificial-intelligence-ai-vs-natural-language-processing-nlp-differences
[9] https://expertsystem.com/machine-learning-definition/

USES OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING:

People use AI and Machine Learning every day without realising it, whether it be talking to Siri, or simply browsing on Google and your choices being remembered. Real-life applications per sector include:

- In Financial Services, AI and Machine Learning is used to speed up processes with a high accuracy of success. Some of its uses include: Credit granting, insurance underwriting, fraud prevention, claims administration, Robo-advisors, algorithmic trading, targeted marketing and sentiment analysis.

"American Express handles over 1 trillion dollars in transactions from more than 110 million of their credit cards each year. The company relies on Machine Learning to manage their data, discover spending trends and offer customers individualised offers. Additionally, Machine Learning is used by lending and credit card companies to manage and predict risk. These computer programs take into account a loan seeker's past credit history, along with thousands of other data points like cell phone and rent payments, to deem the risk of the lending company. By taking other data points into account, lenders can offer loans to a much wider array of individuals who couldn't get loans with traditional methods. Trading firms are using Machine Learning to amass a huge lake of data and determine the optimal price points to execute trades. These complex high-frequency trading algorithms take thousands, if not millions, of financial data points into account to buy and sell shares at the right moment."[10]

- The healthcare industry uses this technology to manage medical data, discover treatments and detect diseases. Updated systems in medical facilities can now quickly pull through data to display pertinent information.[11]
- AI and Machine Learning is used in social media to suggest pages for users to follow based on similar likes and interest. Facebook and Twitter were prompted by the spread of 'Fake News' in 2016 to use this technology in their platforms. Cambridge Analytica used this technology to determine users' preferences in the Trump Campaign and Brexit and could thereafter determine which users votes could be swayed.
- In retail, AI and Machine Learning is used to optimise sales as well as gather data on shoppers to customise preferences.

[10]https://builtin.com/machine-learning
[11]https://builtin.com/machine-learning

ARTIFICIAL INTELLIGENCE AND OTHER EMERGING TECHNOLOGIES:

IoT creates magnitudes of data. This has aided the Big Data phenomenon. Companies use IoT devices to create and store data such as where you are, how fast you drove somewhere, what your heart rate was during your workout, what your purchase interests are and various other points of information. This data is thereafter used in a multitude of ways, one of which is to train Machine Learning models. However, other technologies are also being used with AI; Quantum Artificial Intelligence will lead to a so-called quantum advantage wherein complex algorithms will be processed far quicker than possible today and AI has been combined with robotics to create robots such as Sophia.[12] However, as Artificial Intelligence develops and innovative solutions adjust the world as we know it, there are a variety of risks to account for.

[12]https://www.bernardmarr.com/default.asp?contentID=1178

RISKS:

Artificial intelligence and Machine Learning algorithms encompasses a variety of risks.

Artificial intelligence encompasses dangerous risks, which may include autonomous weapons and social manipulation, as well as an invasion of privacy and discrimination.[13] However, when breaking these risks down to a business and financial services perspective, some of the risks include bias, data risks, a lack of model variability, output interpretation, third party risks, regulatory risks, organisational risks, information security and operation information technology risks.

Below are descriptions of a few of the fundamental risks:

- Bias: Bias is inherent in Machine Learning algorithms as these algorithms are written by people. Bias can also be introduced by the data used, however this is far more difficult to manage as it is harder to uncover.[14]
- Data: Data is used to train models and if errors in the data occur, this can result in a failed model. Data risks include: data can be of low quality, a lack of data may cause risk, homogenous data wherein there is not enough variability in the data to be accurate, fake data and data compliance issues wherein you have the data but there is a possibility that you should not be using it. With the POPI act having come into effect, this elevates this risk.[15]
- Lack of model variability: Also known as over optimisation, this risk occurs when a model is over-trained and when real-life data is inputted into the model, it fails. This has been a common occurrence in trading algorithms wherein a model is trained to understand trades and when real world data is used, the model does not account for certain unpredictable factors.[16]
- Output Interpretation: This risk occurs when someone who does not understand the model, misinterprets the output. If used to make business decisions, this could lead to dire consequences.[17]

[13] https://bernardmarr.com/default.asp?contentID=1718
[14] https://ericbrown.com/machine-learning-risks-real.htm
[15] https://ericbrown.com/machine-learning-risks-real.htm
[16] https://ericbrown.com/machine-learning-risks-real.htm
[17] https://ericbrown.com/machine-learning-risks-real.htm

A CYBER PERSPECTIVE:

Artificial intelligence and Machine Learning also encompass a multitude of risks from a cyber-perspective, but also numerous advantages.[18]

Hackers gain an edge with Artificial Intelligence. Spear-Phishing is simplified and through social network mapping, automated technology and Machine Learning is used to build trust with targets, thus making Social Engineering easier.[19] Cars and drones can be weaponised, there is a rise of bot hackers and this may include personal/home attacks.

However through the use of Artificial Intelligence and Machine Learning, threat hunting processes are enhanced. There is an increased ability to filter spam as well as to uncover malicious attacks attempting to infiltrate a network. Network intrusion and prevention systems are becoming more robust as they are proactively enabled to identify malicious attack. The ability to detect botnets and hackers has become easier as the algorithms learn to detect from previous occurrences. Moreover, vulnerabilities are now uncovered and prepared before a malicious attacker has the chance to exploit it.

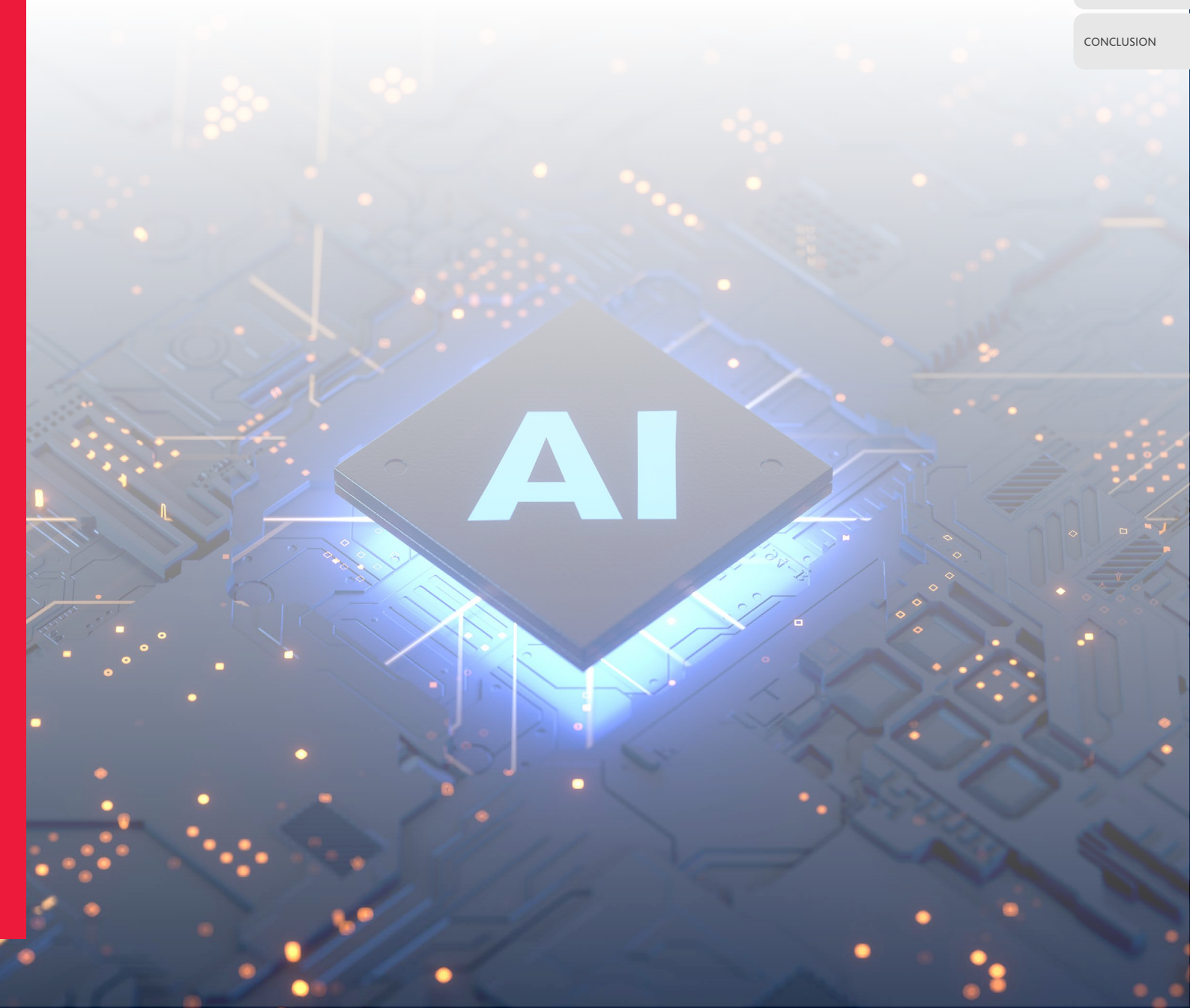
[18]https://www.getsmarter.com/blog/career-advice/the-opportunities-and-risks-of-ai-in-cybersecurity/
[19]https://www.cybersecurityintelligence.com/blog/the-impact-of-artificial-intelligence-on-cyber-security-4946.html

ARTIFICIAL INTELLIGENCE MYTH BUSTING:

In this section I will touch on a few common Artificial Intelligence myths:

- Artificial Intelligence is the same as robots: Robots use AI technology. Artificial Intelligence can be implemented on a website, on your phone or in a physical robot tasked to implement certain procedures.[20]
- Artificial Intelligence will replace your job: Artificial Intelligence will definitely replace some jobs, but it will also lead to the creation of others. Human beings essentially need to learn to work with the machines, as opposed to against them.[21]
- Machine Learning and AI are the same things: Machine Learning is a subset of Artificial Intelligence.
- Artificial Intelligence will take over the world: The singularity concept depicts a world wherein technological growth becomes uncontrollable and irreversible. Technological entrepreneur Elon Musk too believes the risk is real.[22] However for this to happen, numerous technological advancements would be required wherein robots self-develop and thus this is a number of technological milestones away.[23]

[20]https://www.koombea.com/blog/6-artificial-intelligence-myths-busted/
[21]https://www.koombea.com/blog/6-artificial-intelligence-myths-busted/
[22]https://searchenterpriseai.techtarget.com/definition/Singularity-the
[23]https://bernardmarr.com/default.asp?contentID=1718



ARTIFICIAL INTELLIGENCE AND COVID-19:

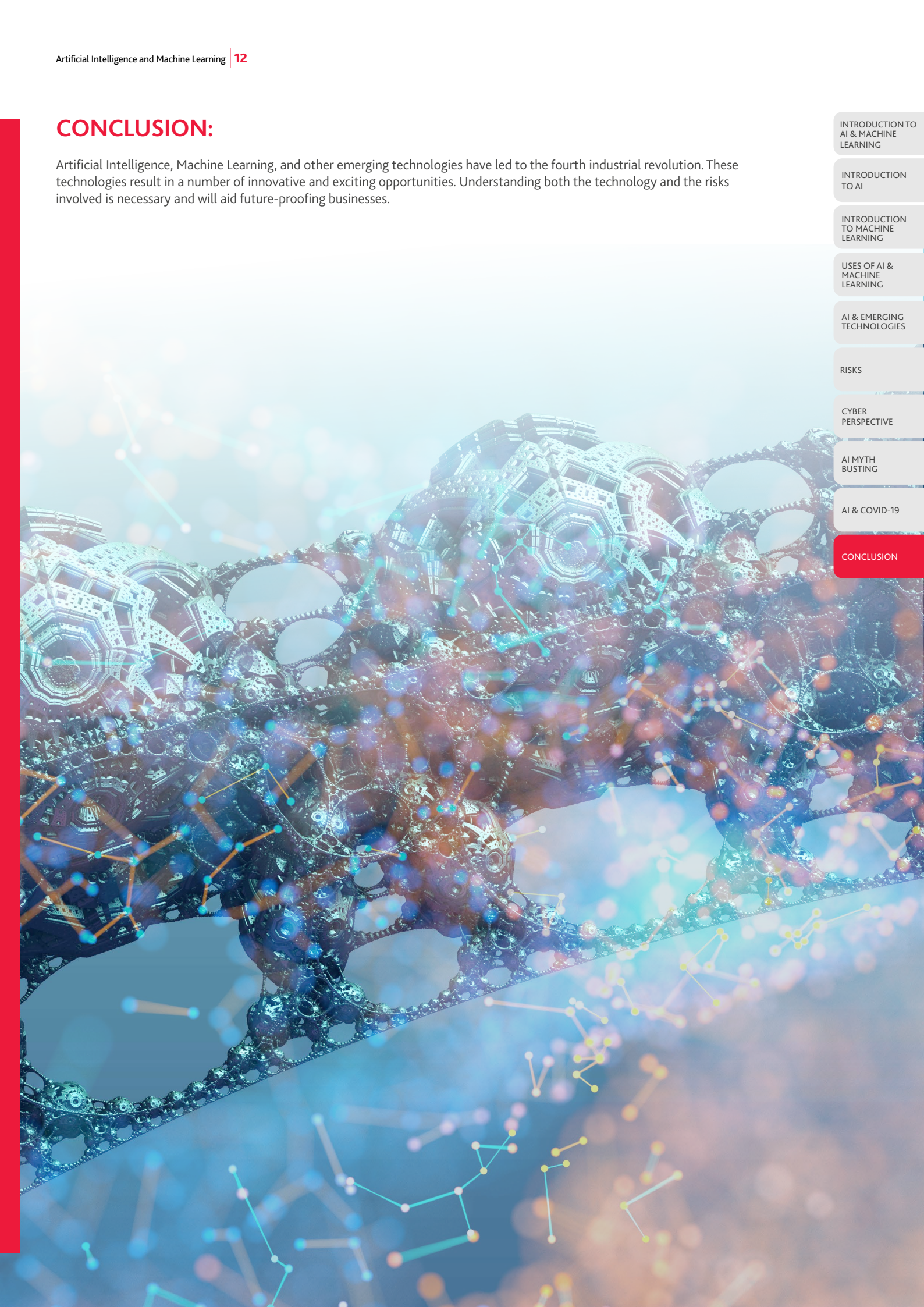
As the world combats the drastic effects of Covid-19, Artificial Intelligence and Machine Learning is being utilised and playing an integral role to fight the disease. The use of this technology is not only being used to try and detect a cure, but also aid organisations in a transition to a 'work from home' environment. A few of the uses of Artificial Intelligence and Machine Learning in a Covid-19 landscape include:

- The creation of Chabot's to screen Covid-19 symptoms,[24]
- Early incident response based on previous data on how the virus spreads,
- BlueDot, a Canadian start-up, uses AI to detect disease outbreaks by scanning news reports in 65 different languages,[25]
- Decision making is made easier to determine the needed number of meds or respiratory systems and many other decisions,[26]
- Closedloop, an AI start-up, has made it possible to determine those at highest risk.[27]

[24]https://www.weforum.org/agenda/2020/05/how-ai-and-machine-learning-are-helping-to-fight-covid-19/
[25]https://www.weforum.org/agenda/2020/05/how-ai-and-machine-learning-are-helping-to-fight-covid-19/
[26]https://www.weforum.org/agenda/2020/05/how-ai-and-machine-learning-are-helping-to-fight-covid-19/
[27]https://www.weforum.org/agenda/2020/05/how-ai-and-machine-learning-are-helping-to-fight-covid-19/

CONCLUSION:

Artificial Intelligence, Machine Learning, and other emerging technologies have led to the fourth industrial revolution. These technologies result in a number of innovative and exciting opportunities. Understanding both the technology and the risks involved is necessary and will aid future-proofing businesses.



WE TAKE IT PERSONALLY.
FOR FURTHER INFORMATION, CONTACT:

CHRISTOPHER O'FLAHERTY
BDO Financial Services Technology Junior Analyst
coflaherty@bdo.co.za

NEVELLAN MOODLEY
Head of BDO Financial Services Technology
nmoodley@bdo.co.za

/BDOSouthAfrica


/bdoafrica


/bdo_sa


/company/bdo-south-africa

www.bdo.co.za