



UNITEDWORLD INSTITUTE OF TECHNOLOGY (UIT)

Summative Assessment (SA) Deep Learning in Automation Case Study

Submitted BY
Jui Patel
(Enrl. No.: 20220701050)

**Course Code and Title: 21BSCS99E42-Airtificial Neural
Network**

**B.Sc. (Hons.) Computer Science / Data Science /
AIML**

IV Semester – Dec 2023 – April 2024

Dec/Apr 2024

INDEX

| | | |
|-------------------------------------|----|---------------|
| Introduction | 3 | |
| Deep Learning | 4 | CO2, CO3, CO4 |
| Transformation in Automation | 6 | CO1, CO5 |
| Impact | 10 | |
| Problem & Solution | 12 | |
| Future | 13 | |
| Conclusion | 15 | |
| References | 16 | |
| Plagiarism | 17 | |

CO1: Understand the similarity of biological networks and Neural networks.

CO2: Understand neural networks using various learning rules.

CO3: Understand the concepts of forward and backward propagation.

CO4: Understand and construct the Hopfield models.

INTRODUCTION

The increasing availability of data and processing power in recent years has led to a rise in the importance of deep learning, a subset of artificial intelligence and machine learning. Automation in manufacturing and other fields where machines can now carry out tasks that formerly required human brains is being revolutionised by technology. A subset of machine learning is called deep learning. It makes use of artificial neural networks, or "deep neural networks," which can handle even the most difficult circumstances. They can carry out complex decision-making procedures, such as quality control, and they enable businesses to automate and digitise an increasing number of activities. They are reaching new heights in production efficiency by doing this.

An overview of deep learning and its importance in the field of artificial intelligence. It draws attention to the quick development of deep learning algorithms and their potential. They support the automation of different work roles. Artificial neural networks are used in deep learning, a subset of machine learning, to extract knowledge from data. Its uses for artificial intelligence are growing quickly, and it has developed into a potent instrument. It has been demonstrated that deep learning algorithms perform remarkably well on tasks including speech recognition, image recognition, and natural language processing. They are also being used to create new applications in industries like banking, transportation, and healthcare. An increasing number of jobs can now be automated because to the quick development of deep learning algorithms.

DEEP LEARNING

The goal of deep learning, a branch of artificial intelligence (AI), is to teach machines how to think critically and learn on their own. By simulating how the human brain works, it enables machines to analyse enormous volumes of data and produce insightful conclusions. Natural language processing, image and audio identification, and pattern recognition are areas in which deep learning systems shine. They are essential to automation because of their capacity to grow, learn, and adapt over time. Additionally, unstructured data such as text, photos, and videos can be handled by deep learning models, which traditional algorithms find difficult to decipher.

This feature creates new opportunities for automation across a range of industries, such as financial forecasts, medical diagnosis, driverless cars, and tailored e-commerce recommendations. Deep learning's convergence with automation technologies is set to transform entire sectors and reshape the nature of labour in the future as it develops.

Deep Learning in automation

By utilising data to its full potential, deep learning algorithms are essential to automation. These algorithms are capable of recognising patterns, identifying abnormalities, and producing precise forecasts through the ingestion and analysis of enormous datasets.

Furthermore, the potential for automation in a variety of industries is increased by deep learning algorithms' capacity to glean insightful information from unstructured data sources including pictures, videos, and natural language. The way tasks are completed and decisions are made is being revolutionised by the incorporation of deep learning into automation processes. Examples of this

include autonomous vehicles that interpret traffic conditions in real-time and chatbots that offer personalised recommendations based on user interactions.

Correlation Learning Model

The correction rule likewise modifies the weights according to the phases of the two neurons, following a notion that is comparable to that of the Hebbian rule. The weight should be toward the positive side if the neurons are in the same phase as one another, and towards the negative side if they are in the opposite phase. The fact that this rule is supervised is the sole distinction it has with the Hebbian learning rule. The applied neurons to operation in automation will be at the opposite side of the phase because the weights will be at the positive side of the working phase when industry work is done by machines and robots.

Backward & Forward Propagation

Backward propagation is a useful approach for training artificial neural networks (ANNs) that reduces costs by identifying which biases and weights need to be avoided or changed. Additionally, similar process known as "forward propagation" employs a hidden layer and functions roughly in the opposite way as "backward." When automation is applied in deep learning, THE dissemination is set according on the organization's Wishlist and demand.

Hopfield Model

One layer of "n" completely linked recurrent neurons makes up the Hopfield Neural Networks, which were created by Dr. John J. Hopfield. Auto-association and optimization activities are the usual uses for it. Compared to our typical neural networks, it produces a distinct response and is computed through a converging interactive process. When optimizing is required for automation, the requirement must be met with the existing level of involvement.

Transformation in Automation

Automation and innovation were crucial because of the digital revolution that began in the second part of the 20th century. This revolution brought about significant changes to markets, industries, and consumer behaviour. The digitalization of mechanical and analogue technologies leads to the increasing prevalence of computers. Since then, computers' storage and communication capabilities have continued to grow. The days of relying only on traditional methods and approaches are long gone. Organisations must quickly adapt and change in the digital sphere as a result of the growing role of technology, as this is crucial to their success.

Automating business processes is one of the most crucial stages towards modern management of a company's productivity and efficiency. It involves utilising modern IT systems to reduce or eliminate the need for human labour, as well as to speed up financial or decision-making processes. These technologies integrate as many systems and processes as they can and automatically perform repetitive operations. Workers who were previously engaged in tedious tasks can now focus on more significant projects for the company. As a result, workers can exploit their potential more successfully. Process automation also supports decision-making processes. By allowing contemporary IT technology to handle his task and "bail" him out of menial decisions, a manager can focus more on the development of new products or services.

Innovation

Automation makes existing processes more efficient, whereas innovation focuses on developing novel and creative solutions, services, and goods. New developments in digital transformation serve as growth accelerators, making them capable of offering the following:

- **Competitive advantage:** businesses that stand out in a crowded digital market by offering inventive and distinctive solutions that appeal to customers,
- **Customer focus:** The primary goal of consumer-facing innovation is to comprehend the wants and pain areas of customers and develop solutions that may successfully solve them.'
- **Market Expansion:** The launch of novel goods and services leads to the development of new markets and income streams in addition to fostering company expansion.
- **Flexibility:** Innovation fosters more flexibility. Businesses that use innovative solutions are better able to react swiftly to shifts in the market and adjust to the ever-changing business environment.
- **Sustainability:** Innovation encompasses more than just new items; it also involves sustainable practices. Companies also create innovations that help to minimise the detrimental influence on the environment, all while keeping in mind the future of our world.

AI and RPA are kind of combined in intelligent automation. These technologies work in concert to produce a novel and ground-breaking level of automation processes. In order to fully comprehend this combination, let us examine each of these technologies separately first:

- **Robotic Process Automation (RPA):** This technique automates commercial operations by simulating human labour with robots. A collection of algorithms that are intended to integrate systems and carry out particular tasks make up their software. RPA is utilised for repetitive and monotonous tasks including copying, handling claims, retrieving data, and creating reports.

- Artificial intelligence refers to technology that can not only execute repetitive tasks, gather and analyse data, but also learn from its experiences and apply those lessons to enhance its performance.

Artificial intelligence has made RPA capable of handling increasingly difficult tasks. RPA, for instance, can alert clients when a complaint is received and retrieve information from it. These two technologies working together can also automate the processing of complaints. The algorithm will be able to produce a precise, content-related response by comprehending the nature of the complaint. The most recent technology provides for thorough coverage of project procedures as they exist now. Businesses that choose to use intelligent automation can expect to grow while fostering innovation. This can result in a number of advantages, including better work quality, enhanced productivity, efficiency, and customer satisfaction with the services provided. Additionally, it definitely aids in achieving the main objective of every business, which is to enhance performance.

These days, there are more and more uses for intelligent automation. Its uses in practically every field, including manufacturing, finance, and medicine, are demonstrating its possibilities in both public and commercial businesses. Automation and robotization will eventually become essential for all businesses that wish to stay competitive and move in the right path due to their wide range of applications and the rapid advancement of technology.

ANN & BNN

Because biological neural networks (BNNs) incorporate components of the brain's organic structure, such as cell bodies, dendrites, axons, terminal boutons, and many more, they are somewhat comparable to artificial neural networks. Weights function as the cell body in ANN in a similar way. Both have the same functional topology, and when we utilize deep learning as a platform for automation, both will have a same kind of structure when coming up with a mechanical or biological answer.

Dynamical Systems, Stability of Equilibrium States

It is essential to comprehend the stability of dynamical systems in many fields, including fluid dynamics, engineering, biology, and classical mechanics. The capacity of a subset of phase space to draw trajectories from nearby areas is referred to as stability. Being in balance with a system is one thing; being stable with it is quite another. As in a steady equilibrium, for instance. Equilibrium comes in three flavors: neutral, unstable, and stable.

IMPACT

Manufacturing:

Deep learning is completely changing automation in the manufacturing sector by guaranteeing constant product quality and streamlining production procedures. Deep learning systems can identify irregularities and anticipate equipment failures by evaluating sensor data. This reduces downtime and lowers the need for expensive repairs. These algorithms can also improve robotics systems' precision, which will raise output and decrease mistakes.

For instance, deep learning algorithms are being utilised to enhance quality control in the car manufacturing industry. These algorithms are able to detect even the slightest flaws that might not be noticeable to the human eye by examining pictures of automotive components. This enables producers to identify and address possible problems before they escalate, guaranteeing that only superior items are sent onto the market.

Healthcare

Deep learning models are being used by medical imaging specialists more and more to help with tasks including tumour recognition, abnormality detection, and therapy recommendation. For instance, healthcare professionals can teach deep learning algorithms to identify patterns in MRI images that point to a certain kind of tumour or identify illnesses like Alzheimer's disease.

Medical imaging can be made faster and more accurate with the use of deep learning models. A deep learning system, for example, might identify anomalies in pictures that medical professionals might overlook otherwise. Additionally, because deep learning models can swiftly comprehend vast amounts of data, they can potentially enable speedier examination of medical pictures.

Lastly, deep learning models are also being used by providers in diagnostic applications. For example, using patient data from X-rays or blood tests, deep learning algorithms can be trained to diagnose a wide range of illnesses and

conditions. Furthermore, deep learning models have the ability to track a patient's state over time and suggest remedies for particular ailments. Deep learning models are becoming more and more significant in the healthcare industry. Healthcare practitioners can give their patients more effective and efficient care with the use of deep learning since it can swiftly analyse large volumes of data and make correct diagnoses.

Retail

Deep learning is revolutionising automation in the retail sector by improving customer experiences and streamlining supply chain operations. To tailor marketing campaigns and product recommendations, deep learning algorithms can examine client data including past purchases and online interactions. These algorithms can also improve pricing tactics, demand forecasts, and inventory management, which will boost sales and satisfy customers. Furthermore, deep learning is essential to enhancing the effectiveness of distribution and logistical procedures in the retail industry. Deep learning algorithms can optimise route planning and delivery schedules by analysing a variety of parameters, including traffic patterns, weather, and historical data. This contributes to a more sustainable and ecologically friendly retail industry by cutting down on carbon emissions and fuel use in addition to speeding up deliveries.

PROBLEM & SOLUTION

Problem Statement

Deep learning has enormous potential for automation, but there are obstacles to be addressed. The availability of labelled data for deep learning algorithm training is one of the primary obstacles. Large datasets can be expensive and time-consuming to gather and curate. Gaining confidence in the automation systems also requires addressing concerns about data security and privacy. Interpretability of the models is a major obstacle to deep learning implementation for automation. Deep learning algorithms are sometimes referred to as "black boxes" since it might be challenging to comprehend how they arrive at a certain conclusion. In sectors where regulatory compliance necessitates unambiguous justifications for automated decision-making, this lack of transparency may provide a challenge.

Solution

Pilot projects should be the first step in any organization's progressive scaling up of deep learning for automation. Resource constraints can be addressed by utilising cloud computing and constructing a robust data architecture. Effective deep learning-based automation system design and implementation require cooperation between automation engineers, data scientists, and domain specialists. In addition, to guarantee that the deep learning models continue to function at their best throughout time, ongoing observation and assessment are necessary. Maintaining the precision and dependability of automated processes can be facilitated by putting in place methods for model retraining and adaptability to changing data patterns. Potential biases or mistakes that can result from the application of deep learning algorithms can also be found with the help of routine audits and evaluations of the automation systems.

Future

Deep learning has a bright future in automation. It is anticipated that improvements in hardware capabilities and deep learning algorithms would further improve the effectiveness and performance of automation systems. More advanced robotics systems, driverless cars, and intelligent virtual assistants are all possible in the future. Furthermore, new automation opportunities will arise from the combination of deep learning with other cutting-edge technologies like blockchain, 5G, and the Internet of Things (IoT).

The healthcare industry is one where deep learning is anticipated to have a big influence. Deep learning algorithms have the capacity to evaluate enormous volumes of medical data, which helps with disease diagnosis, patient outcome prediction, and even the creation of individualised treatment programmes. In the future, imagine a medical professional who has access to an AI-powered assistant that can swiftly assess a patient's symptoms, medical background, and genetic data to make a precise diagnosis in a timely manner.

Deep learning's influence on various sectors and technological advancements is increasing as it advances and transforms automation. It will change the nature of employment, freeing up humans to concentrate on more strategic and creative duties while machines take care of monotonous labour. Major changes will occur in sectors like manufacturing, healthcare, and retail. Deep learning algorithms can be utilised in the manufacturing sector to enhance production procedures, identify flaws instantly, and anticipate equipment breakdowns before they happen. This lowers maintenance expenses and downtime while also enhancing the quality of the final output. Deep learning and IoT device integration also pave the way for the development of "smart factories," where machinery can interact with one another and make decisions on its own to maximise productivity. Deep learning has the potential to completely transform the retail customer experience. Intelligent automation systems can enhance

inventory management, optimise pricing tactics, and offer personalised recommendations by analysing client behaviour and preferences. Imagine entering a store where the checkout process is quick and easy, and the shelves are automatically restocked in response to consumer demand.

Conclusion

To sum up, deep learning has the enormous potential to transform automation in a variety of sectors and technological contexts. Automation's future will be shaped by its capacity to improve automation systems' capabilities, streamline operations, and generate data-driven insights. In this dynamic digital environment, companies which use deep learning and effectively navigate implementation obstacles will have a competitive advantage.

One of the most potent technologies that could automate a lot of occupations is deep learning. To guarantee that deep learning is applied responsibly and does not result in a mass loss of jobs, deep learning must be used for beneficial purposes. Workers will need ongoing skill development and training in order to take advantage of the new opportunities brought about by deep learning as well as to adjust to the changing nature of the labour market. Deep learning systems must be developed and used with ethical considerations in mind. We can make sure that deep learning is applied to advance society and build a more affluent future for all by taking these factors into consideration.

The vital technology of deep learning is being swiftly embraced by a wide range of companies in numerous industries. It's likely that your company, regardless of industry, may leverage machine learning technologies and use cases in some capacity. The advantages are priceless and include better customer satisfaction, reduced expenses, and enhanced efficiency. Only when the proper competency levels are built in cutting-edge data technologies, like deep learning, for obtaining trustworthy business insights, will those hoping to fully benefit from AI be able to do so. It is best to consult a data scientist, who is a specialist in the field, for this.

References

Gerosa, Sel. 2024. "How Deep Learning Facilitates Automation & Innovation and When to Use It." *Mosaic Data Science*.

<https://mosaicdatascience.com/2022/02/02/how-deep-learning-facilitates-automation-innovation-and-when-to-use-it/>.

"Machine Learning Automation for Faster Data Science Pipelines." 2024. *For Faster Data Science Pipelines*. Accessed April 6.

<https://www.run.ai/guides/machine-learning-engineering/machine-learning-automation>.

Spurgeon, Will. 2024. "Advantages of Deep Learning for Industrial Automation." *Clearview_Wordmark_RGB*. Accessed April 6.

<https://www.clearview-imaging.com/en/blog/advantages-of-deep-learning-for-industrial-automation>.

"Automated Machine Learning." 2023. *DataRobot AI Platform*. November 15. <https://www.datarobot.com/wiki/automated-machine-learning/>.

Gillis, Alexander S., Ed Burns, and Kate Brush. 2023. "What Is Deep Learning and How Does It Work?: Definition from TechTarget." *Enterprise AI*. TechTarget. July 27.

<https://www.techtarget.com/searchenterpriseai/definition/deep-learning-deep-neural-network>.

Plagiarism



PLAGIARISM SCAN REPORT

Date April 08, 2024

Exclude URL: NO



Unique Content 100

Plagiarized Content 0

Word Count 984

Records Found 0

CONTENT CHECKED FOR PLAGIARISM:

UNITEDWORLD INSTITUTE OF TECHNOLOGY (UIT)

Summative Assessment (SA)

Submitted BY

Jui Patel

(Enrl. No.: 20220701050)

Course Code and Title: 21BSCS99E42-Artificial Neural Network

B.Sc. (Hons.) Computer Science / Data Science / AIML

IV Semester – Dec 2023 – April 2024

Dec/Apr 2024

INDEX

INTRODUCTION

The increasing availability of data and processing power in recent years has led to a rise in the importance of deep learning, a subset of artificial intelligence and machine learning. Automation in manufacturing and other fields where machines can now carry out tasks that formerly required human brains is being revolutionised by technology. A subset of machine learning is called deep learning. It makes use of artificial neural networks, or "deep neural networks," which can handle even the most difficult circumstances. They can carry out complex decision-making procedures, such as quality control, and they enable businesses to automate and digitise an increasing number of activities. They are reaching new heights in production efficiency by doing this.



PLAGIARISM SCAN REPORT

Date April 06, 2024

Exclude URL: NO



Unique Content 100

Plagiarized Content 0

Word Count 698

Records Found 0

CONTENT CHECKED FOR PLAGIARISM:

Future

Deep learning has a bright future in automation. It is anticipated that improvements in hardware capabilities and deep learning algorithms would further improve the effectiveness and performance of automation systems. More advanced robotics systems, driverless cars, and intelligent virtual assistants are all possible in the future. Furthermore, new automation opportunities will arise from the combination of deep learning with other cutting-edge technologies like blockchain, 5G, and the Internet of Things (IoT).

The healthcare industry is one where deep learning is anticipated to have a big influence. Deep learning algorithms have the capacity to evaluate enormous volumes of medical data, which helps with disease diagnosis, patient outcome prediction, and even the creation of individualised treatment programmes. In the future, imagine a medical professional who has access to an AI-powered assistant that can swiftly assess a patient's symptoms, medical background, and genetic data to make a precise diagnosis in a timely manner. Deep learning's influence on various sectors and technological advancements is increasing as it advances and transforms automation. It will change the nature of employment, freeing up humans to concentrate on more strategic and creative duties while machines take care of monotonous labour. Major changes will occur in sectors like manufacturing, healthcare, and retail.

Deep learning algorithms can be utilised in the manufacturing sector to enhance production procedures, identify flaws instantly, and anticipate equipment breakdowns before they happen. This lowers maintenance expenses and downtime while also enhancing the quality of the final output. Deep learning and IoT device



PLAGIARISM SCAN REPORT

Date April 06, 2024

Exclude URL: NO



Unique Content 100

Plagiarized Content 0

Word Count 978

Records Found 0

CONTENT CHECKED FOR PLAGIARISM:

Robotic Process Automation (RPA): This technique automates commercial operations by simulating human labour with robots. A collection of algorithms that are intended to integrate systems and carry out particular tasks make up their software. RPA is utilised for repetitive and monotonous tasks including copying, handling claims, retrieving data, and creating reports.

Artificial intelligence refers to technology that can not only execute repetitive tasks, gather and analyse data, but also learn from its experiences and apply those lessons to enhance its performance.

Artificial intelligence has made RPA capable of handling increasingly difficult tasks. RPA, for instance, can alert clients when a complaint is received and retrieve information from it. These two technologies working together can also automate the processing of complaints. The algorithm will be able to produce a precise, content-related response by comprehending the nature of the complaint. The most recent technology provides for thorough coverage of project procedures as they exist now. Businesses that choose to use intelligent automation can expect to grow while fostering innovation. This can result in a number of advantages, including better work quality, enhanced productivity, efficiency, and customer satisfaction with the services provided. Additionally, it definitely aids in achieving the main objective of every business, which is to enhance performance.

These days, there are more and more uses for intelligent automation. Its uses in practically every field, including manufacturing, finance, and medicine, are demonstrating its possibilities in both public and commercial businesses. Automation and robotization will eventually become essential for all businesses that