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An Analysis On Technological Automation Based On Artificial Intelligence Has Taken Over Data Science As A Mathematical Function

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Abstract

Artificial intelligence (AI), machine learning (ML) and deep learning (DL) being used in conjunction with digital transformation and data science (DS). Robotic Process Automation (RPA) has numerous advantages in terms of automating organizational and business processes with the help of ML and AI. The fields of AI, ML, RPA and DS have a great deal of overlap, but they are not interchangeable. Here is a very simplified explanation of how these three areas differ:DS produces insights; produces predictions; AI produces actions.The findings highlight the significant role of AI-driven automation in enhancing efficiency, productivity, and competitiveness, while also emphasizing the need for addressing job displacement and ethical considerations in the deployment of these technologies. Overall, this research sheds light on the potential of AI to revolutionize industries and reshape the future of work in a more streamlined and ethically grounded technological landscape. Mathematical functions can be used to perform predictions for a given dataset. The types of functions include: Simple Linear, Multiple Linear, Polynomial etc. In this paper we will analyse how DS deals with huge chunks of data to analyze the patterns, trends and more and gave scientific facts and figures to form AI algorithm precisely i.e., AI has taken over DS as a function.

Keywords: Data science, mathematical modelling, mathematical functions, artificial intelligence, machine learning.

1.Introduction

The latest generation of AI advances, including techniques that address classification, estimation, and clustering problems, promises significantly more value still. Mathematical modelling and Functional analysis provide tools for understanding the properties of neural networks and other machine learning models, such as the ability to analyse the stability and generalization of these models. Mathematical concepts and mathematical functions are fundamentals in understanding and implementing all ML,AI, DS and other scientific modelling and learning techniques. Functional analysis is relevant to ML, AI, DS. In fact, functional analysis provides the mathematical foundation for many ML and AI algorithms. For example, optimization problems in ML and AI often involve functional analysis concepts such as inner products, normed spaces, and linear operators. The ability of digital computers to perform tasks that are commonly performed by humans is called AI. AI has made especially large strides in recent years, as machine-learning algorithms have become more sophisticated and made use of huge increases in computing power and of the exponential growth in data available to train them. AI tries to mimic the human mind by incorporating Problem-Solving, Decision-Making, and Reasoning abilities into machines. DS and AI work on data to produce similar outcomes dealing with analysis of the collection and preparation of data so that it can be used by AI in DS applications. Data scientists deal with huge chunks of data to analyse the patterns, trends and more. Using data analytics, data scientists can generate reports that are used to draw inferences. Technologies and automation are asserting themselves as major changes. The technologies are related to each other in more ways than one. Data Science utilizes this data and predictively and analyses it to gain insights. AI deals with working on data by using tools to develop Intelligent systems. Data scientists contribute to the growth and development of AI. They create algorithms designed to learn patterns and correlations from data, which AI can use to create predictive models that generate insight from data[7]. Data scientists also use AI as a tool to understand data and its scientific abstraction**.**

This paper aims to dig into the complex and multifaceted effect of AI in automation and robotics, dissecting its innovative advancements, revealing its wide-ranging benefits, addressing the inalienable challenges and eventually, analyzing its overarching impact on different businesses. The integration of AI into automation and robotics represents a worldview move, heralding a modern time where intelligent machines collaborate consistently with human partners, reshaping the operational scene. The focus here is not simply on the technological complexities but on the all-encompassing implications, that is, how these progressions modify production processes, redefine job roles and bring about a transformative wave that touches each aspect of industry

This paper briefly presents an analysis on dependencies and inter-dependencies of AI on DS and discusses on the fact that how AI calculation and estimation sensitivity depends on the science of collection, abstraction of data and vice-versa . The paper also tries to create relations between the main AI algorithm and data science and analyse how AI requires a lot of data to work on and obtain results. Our analysis shows that the mechanism of DS affects AI algorithm and AI based technological innovation. DS promotes technological innovation through accelerating knowledge [3,6] creation and technology spillover, improving learning and absorptive capacities while increasing R&D and talent investment. Our empirical results indicate that under the condition of controlling intensity of R&D investment, DS structure and scientific abstraction of data technical imitation, AI significantly promotes technological innovation. And the impact of AI on technological innovation experiences sector heterogeneity: AI has more significant impact on the technological innovation of low-tech sectors. The higher the level of AI [2], the greater its impact on technological innovation. Based on our established conclusions, we provide corresponding suggestions and recommendations for managerial decision-making problems like multi-level programming problems (MLPP), multi-objective programming problems (MOPP), multi-criteria programming problems (MCPP) and other large scale optimisation problems. Multi-objective optimization is a branch of mathematics used in a large range of applications. It deals with optimization problems involving two or more conflicting objective functions to be optimized. Consequently, there is not a single solution that simultaneously optimizes these objectives, but a set of compromise solutions. These compromise solutions are also called non-dominated, Pareto-optimal, efficient, or non-inferior solutions [2]. The best solution of this set is the one closest point to the utopia point. There are several approaches to perform multi-objective optimization. Undoubtedly the future of multi-objective optimization programming is in artificial intelligence applications[2]. One of the artificial intelligence models is the

Corona algorithm[2]. It aims to simulate the epidemic behaviour of the Corona virus that affects people's health and its treatment.

2.Technological Automation Based on Artificial Intelligence

Fundamentally, machines can't hope to mimic humans' cognitive processes without information - and Data scientists are tasked with feeding machines accurate, empirical data and statistical models that enable machines to learn autonomously. By constantly improving machine learning, society comes closer to realizing true AI. Data scientists create the algorithms that make AI happen -- in other words, that allow abstraction of data and facts extraction from sources of data autonomously, without programs written by software engineers or developers. Data scientists also use machine learning as an amplifier or tool to extract meaning from data at greater scale.AI can be classified into analytical, human inspired, and humanized AI [3] depending on the types of intelligence it exhibits (cognitive, emotional,, and social intelligence) or into artificial narrow, general and super intelligence by its evolutionary stage. Review [4] done by Jorge Ribeiro, Rui Lima, etl. conclude that most of the proprietary tools implement algorithms associated with the objectives of AI, such as recognition, optimization, classification and extraction of knowledge from either RPA documents or processes. It also enhances their optimization and exploration of the information by the users of these applications. The AI techniques and algorithms that these tools implement, focus on computer vision (image recognition using for example Artificial Neural Networks), statistical methods, decision trees, neural networks for classification and prediction, fuzzy logic and implementation of techniques associated with text mining, natural language processing and recommendation systems. On the other hand, Industry 4.0 - the revolution[4] we are experiencing today - lives on the fusion of the Internet of Things, Intelligent automation, Intelligent Devices and Processes and Cyber-Physical Systems. The combination of all these concepts and technologies brings a significant change in industrial processes, affecting the workflow of digital processes throughout the company. Nowadays, and to improve these processes, they are incorporating automation of some steps through robots (RPA)[4]. In addition, RPA nowadays incorporates, in many tools as we have shown in this paper, intelligent techniques and algorithms (AI), which allows to reach levels of intelligence in the automation of processes within a company. In recent years, AI algorithms [3,4] and Machine Learning (ML) approaches have been successfully applied in real world scenarios, such as commerce, industry and digital services. ML [4,6] is used to “teach” machines how to deal with data more efficiently, simulating the learning concept of rational beings and can be implemented with AI algorithms (or techniques), reflecting the paradigms / approaches of rational characteristics such as connectionist, genetics, statistics and probabilities, based on cases, etc. With the AI algorithms and based on the ML approach, it is possible to explore and extract information to classify, associate, optimize, group, predict, identify patterns, etc. Given the scope of the applicability of AI, RPA has gradually been adding, to its automation features, implementations of algorithms or AI techniques applied in certain contexts (e.g.: Enterprise Resource Planning, Accounting, Human Resources) to classify, recognize, categorize, etc. In recent years, some academic studies have been published as challenges and potential, as well as case studies of the applicability of RPA and AI, as are the cases of articles in the field of automatic discovery and data transformation, in the audit area, [4] in the application of Business Process mathematical management tools and in productivity optimization processes . Other studies on the intelligent automation of processes using RPA have been published, these may be further enhanced with the application of algorithms and AI techniques. AI has already become a mainstream technology, growing at a compound annual rate each year. Business entities are increasingly leveraging AI to drive their growth and transformation agenda in a purpose-centric way. Taking into account the technological evolution of the last decades and the proliferation of information systems in society, today we see the vast majority of services provided by companies and institutions as digital services. Allied to these advantages, the complementary use of AI algorithms and techniques allows to improve the accuracy and execution with the help of abstracted data and hence the conclusion that technological automation based on artificial intelligence has taken over data science as a function.

3. The dependencies of AI on DS : an analysis on the fact that how AI calculation and estimation sensitivity depend on the science of scientific data abstraction processes

It's important to consider how data science and AI intersect. We live in the era of Big Data and smart technologies[4]. A massive explosion of data has led to new technologies and smarter products. Terms like artificial intelligence, data science, deep learning, and machine learning are used on a day-to-day basis. Their applications can be seen in the real world. The fact that AI augments humans and does not replace them is widely acknowledged. But as businesses adopt AI, it is imperative that the method by which the output of the AI solution is arrived at, is completely transparent and traceable to make it a trustful solution. As present era expand its AI based efforts, we must address important and often difficult questions like: (i) Is AI being used responsibly? (ii) Can the results that AI produces be explained? (iii) What's about standpoint of data, data management, and data governance? Because data underpins all AI processes. A tremendous quantity of data is required to produce an accurate AI model. However, real-world data is highly non-linear and complex, this makes processing it to gain knowledge and insights a real challenge. While human-in-loop is a manageable challenge for business entities, those linked to limited usable data sets are more complex. In such a scenario, enterprises typically look for more usable alternate data, which has many more clues associated with their business, to improve their signal-to-noise ratio. AI is currently being utilized in a wide range of sophisticated applications [4], but the outcomes of many AI models are challenging to comprehend and trust due to their flexible nature and dependence on abstraction of observations. So, accuracy of AI activities, algorithms and researches widely depends on the scientific observations, collections and abstraction of data. By the following facts we can observe that AI has taken over DS as a function:

(i) To extract patterns from this kind of complex data, a huge mathematical functional analysis required on a large data set. A collection of convolutional filters/kernels [7,8] is used to cover all the differences that come from the non-linearity of the real-world data, this leads to high-performance AI models. However, by increasing the number of filters an AI model uses, strain is put on subsequent layers of the data analysis. One place where functional analysis is particularly relevant to machine learning and AI is the study of kernel methods, a notable example of which is the kernel Support Vector Machine, where the theory of Reproducing kernel Hilbert spaces (RKHS) from functional analysis plays a big role.

(ii) Explainable AI is critical for situations involving fairness and transparency where there are scenarios with sensitive information or data associated with it [4].

(iii) By its very nature, AI learns like we do before it gets ready to provide business solutions. With deterministic decision making, understanding and explaining the decision-making logic is straightforward since it is fully objective. Probabilistic decision making, on the other hand, is ambiguous due to its inherent subjectivity [2].AI and data share a symbiotic relationship. While AI can glean valuable and unprecedented insights from enterprise data, it needs high-quality data for gainful training and learning for AI to do its job.

(iv) Signal-to-noise ratio of data is another important consideration for enterprises to derive value from data and build a right and explainable AI model.

(v) Explainable artificial intelligence has become crucial for understanding how an AI model reaches decisions and for identifying sources of error. A concept of artificial intelligence that aims to make AI systems more transparent, interpretable, and comprehensible to human users are needed.

(vi) When the signal-to-noise ratio or the ratio of the predictable-to-unpredictable component of data is low, it results in the AI model: necessitating more data to validate the signal ; demanding extensive involvement of humans (human-in-loop) for its validation. The AI model built with such a low signal-to-noise ratio causes more challenges for explainability the National Institute of Standards (NIST), part of the U.S. Department of Commerce, defines four principles of explainable artificial intelligence:

- An AI system should supply "evidence, support, or reasoning for each output."
- An AI system should provide explanations that its users can understand.
- Explanation accuracy. An explanation should accurately reflect the process the AI system used to arrive at the output.
- Knowledge limits. An AI system should operate only under the conditions it was designed for and not provide output when it lacks sufficient confidence in the result.

(vii) A basic network may have several layers, with many filters, and neuronal units. Data analysis is a complex task often have millions or even billions of observations and parameters. The underlying representations and data flow [7,8] across the network's layers are difficult to examine, while the number of learnable variables increases as the networks' designs become increasingly complex [7,8].

(viii) A good data scientists understands his or her problem domain very well, what questions to answer, and peculiarities of the data associated with it. These may not be very new terminologies, but there is still some sort of confusion among these interrelated technologies. In the last few years AI algorithms and ML approaches have been successfully applied in real-world scenarios like commerce, industry and digital services, but they are not a widespread reality in Software Testing. Due to the complexity of software testing, most of the work of AI/ML applied to it is still academic. So, scientific obversions and collection, scientific abstraction of data using data science is so essential for the foundation and execution of AI Technology today.

4.Conclusion

This paper presents the analysis about AI dependencies on DS and open design approaches to innovation and engineering. Drawn from the observations, reviews and existing scenario about taking raw data abstraction as the base to create AI algorithm which is taken from DS scientific data collection, the extraction of information through DS activities, in the recognition, classification, forecasting, optimization of processes, abstraction processes and received more attention from the research community , AI based industry and related field. There is definitely some overlap between functional analysis, ML, AI and DS. However, ML, AI, DS also relies on other mathematical disciplines such as probability theory, statistics, and linear algebra etc. Within the industry data analytics and data science technologies have a growing importance in industry and engineering, and even though they have already shaped many economic sectors, they can be considered to be in an early stage of development. Spectacular breakthroughs are making headlines, many involving beyond-human capabilities in computer vision, natural language processing, and complex games. The integration of AI into automation and robotics, in spite of its promising potential, is not without its share of challenges and ethical contemplations.

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