AI Dependent Modeling: Techniques, Applications and Research IssuesTowards Automation, Intelligent and Smart Systems

Dipanwita Biswas[1], Rana Pratap Singh Patel[2], Debrupa Pal[3]

[12]*Student, Computer Application Department, Narula Institute of Technology, Nilgunj Road, Agarpara, Kolkata 700109*
[3]*Assistant Professor, Computer Application Department, Narula Institute of Technology,Nilgunj Road, Agarpara 700109*

Abstract

Artificial intelligence (AI) is a leading technology of the current age of the Fourth Industrial Revolution (Industry 4.0 or 4IR), with the capability of incorporating human behaviour and intelligence into machines or systems. Thus, AI-based modelling is the key to build automated, intelligent, and smart systems according to today's needs. To solve real-world issues, various types of AI such as analytical, functional, interactive, textual, and visual AI can be applied to enhance the intelligence and capabilities of an application. However, developing an effective AI model is a challenging task due to the dynamic nature and variation in real-world problems and data.

I. INTRODUCTION

Nowadays, we live in a technological age, the Fourth Industrial Revolution, known as Industry 4.0 or 4IR [1,2], which envisions fast change in technology, industries, societal patterns, and processes as a consequence of enhanced interconnectivity and smart automation.AI has the potential to help people live more meaningful lives without having to work as hard, as well as manage the massive network of interconnected individuals, businesses, states, and nations in a way that benefits everyone. Thus, the primary goal of AI is to enable computers and machines to perform cognitive functions such as problem-solving, decision making, perception, and comprehension of human communication. Therefore, AI based modelling is the key to building automated, intelligent and smart systems according to today's needs, which has emerged as the next major technological milestone, influencing the future of practically every business by making every process better, faster, and more precise. Although the area of "artificial intelligence" is huge, we mainly focus on potential techniques towards solving real-world issues, where the results are used to build automated, intelligent, and smart systems in various application areas. To build AI-based models, we classify various AI techniques into ten categories: (1) machine learning; (2) neural networks and deep learning; (3) data mining, knowledge discovery and advanced analytics; (4) rule-based modeling and decision-making; (5) fuzzy logic-based approach; (6) knowledge representation, uncertainty reasoning, and expert system modelling; (7) case-based reasoning; (8) text mining and natural language processing; (9) visual analytics, computer vision and pattern recognition; (10) hybridization, searching and Optimization. These techniques can play an important role in developing intelligent and smart system

II. INDUSTRY 4.0 AND THE REVOLUTION OF AI

During the third industrial revolution, the advance of manufacturing technologies relates closely to information technologies such as computer numerical control, flexible manufacturing systems, computer-aided design, Artificial intelligence (AI) is primarily concerned with comprehending and carrying out intelligent tasks such as thinking, acquiring new abilities, and adapting to new contexts and challenges. AI is thus considered a branch of

science and engineering that focuses on simulating a wide range of issues and functions in the field of human intellect. However, due to the dynamic nature and diversity of real-world situations and data, building an effective AI model is a challenging task. Various machine learning [3] and deep learning [4] techniques can be used to build an analytical AI model to solve a particular real-world problem.

III. POTENTIAL AI TECHNIQUES

AI techniques can be used in developing intelligent and smart systems in various real-world application areas.Machine learning (ML) is known as one of the most promising AI technologies, which is typically the study of computer algorithms that automate analytical model building.Machine learning modelling has been employed in practically every aspect of our lives, including healthcare, cybersecurity, business, education, virtual assistance, recommendation systems, smart cities, and many more. Deep learning (DL) is known as another popular AI technique, which is based on artificial neural networks (ANN). AI approaches have been effectively applied to a variety of issues in a variety of application areas throughout the last several years. Healthcare, cybersecurity, business, social media, virtual reality and assistance, robotics, and many other application areas are common nowadays.Some potential real-world AI application areas are shown in Fig 1.
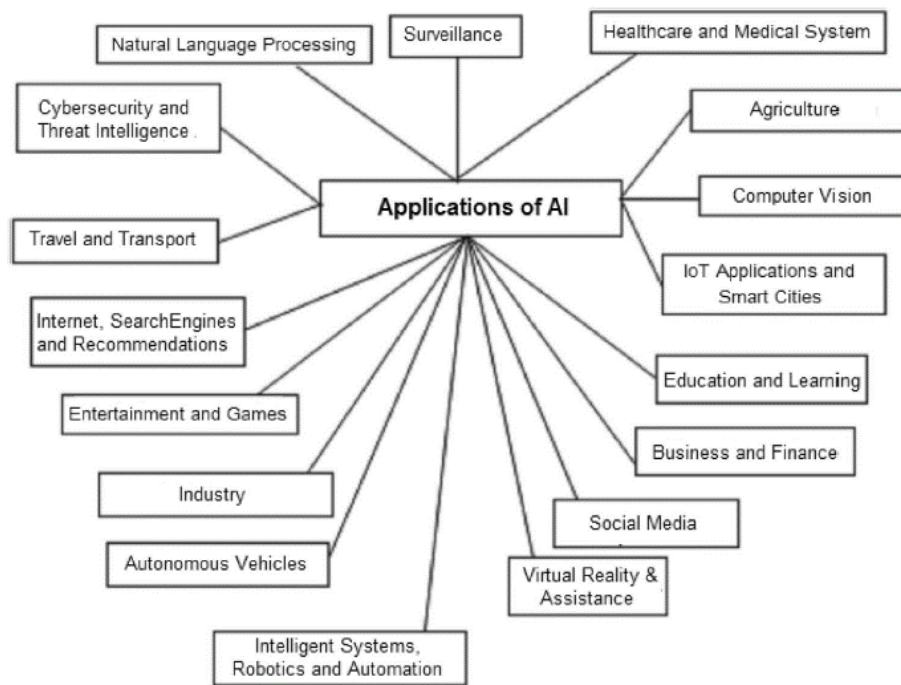

Fig 1: Real world application areas of AI [7]

Text mining [5], also known as text data mining, similar to text analytics, is the process of extracting meaningful information from a variety of text or written resources, such as websites, books, emails, reviews, docs, comments, articles, and so on. Information retrieval, lexical analysis to investigate word frequency distributions, pattern recognition, tagging or annotation, information extraction, and data mining techniques such as link and association analysis, visualization, and predictive analytics are all part of text analysis. Text mining achieves this by employing several analysis techniques, such as natural language processing (NLP). NLP is a text analysis technique that allows machines to interpret human speech. NLP tasks include speech recognition, also known as speech-to-text, word segmentation or tokenization, lemmatization and stemming, part of speech tagging, parsing, word sense disambiguation, named entity recognition, sentiment analysis, topic segmentation and recognition, and natural language generation, which is the task of converting structured data into human language [6]. Over the last decade, data mining has been a common word that is interchangeable with terms like knowledge mining from data, knowledge extraction, knowledge discovery from data (KDD), data or pattern analysis, etc.Data science is typically defined as a concept that unites statistics, data analysis, and related methodologies to analyse and investigate realities through data.

IV. CONCLUSION

Artificial intelligence is influencing the future of almost every sector and every person on the planet. AI has acted as the driving force behind developing technologies for industrial automation, medical applications, agriculture, IoT applications, cybersecurity services, etc.This interdisciplinary science comes with numerous advancements and approaches that are possible with the help of deep learning, machine learning algorithms, knowledge-based expert systems, natural language processing, visual recognition, etc.

REFERENCES

[1].   Maynard AD. Navigating the fourth industrial revolution. Nat Nanotechnol. 2015;10(12):1005–6.
[2].   Beata Ślusarczyk. Industry 4.0: are we ready? Pol J Manage Stud.2018;17:20.
[3].   Sarker IH. Machine learning: algorithms, real-world applications and research directions. SN Comput Sci. 2021;2(3):1–21
[4].   Sarker IH. Deep learning: a comprehensive overview on techniques, taxonomy, applications and research directions. SN Comput Sci. 2021;2(6):1–20
[5].   Allahyari M, Pouriyeh S, Assefi M, Safaei S, Trippe ED, Gutierrez JB, Kochut K. A brief survey of text mining: classification, clustering and extraction techniques. arXiv: 1707. 02919 (arXiv preprint), 2017.
[6].   Deng L, Liu Y. Deep learning in natural language processing. Berlin: Springer; 2018
[7].   Sarker, Iqbal H. "Ai-based modeling: Techniques, applications and research issues towards automation, intelligent and smart systems." SN Computer Science 3.2 (2022): 1-20.