Artificial Intelligence: An Overview

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Abstract: *Artificial intelligence has been studied for decades and remains one of the most puzzling subjects in computer science, its most powerful technology for humanity, where we now live in the age of massive data, an age in which we have the ability to collect huge amounts of information that hinder the person's process. Artificial intelligence has already been fruitful, In many industries such as technology, banking, marketing, and entertainment. Artificial intelligence is science that has changed our lives already. In this paper, artificial intelligence was including concept, method, application, and integration. At the same time, the definitions and methods of artificial intelligence were summarized. On the end, the structure and classification of AI and its related fields and application areas were introduced in details.*

Keywords: Artificial Intelligence, Definition, Methods, Applications

1. Introduction

Artificial intelligence is a way of making a computer, a robot controlled by a computer, or a program that thinks intelligently, in the same way, that smart humans think, and has a long history. AI is the object of searching for an object the method of classification, it is also a set of mathematical and statistical techniques.

Artificial intelligence is achieved by studying how the human mind thinks, how a man learns, decides, and works while trying to solve a problem, and then use the results of this study as a basis for developing software and smart systems.

2. The Definition of Artificial Intelligence

The development of research and technology in this area made it difficult to define a specific definition but we will review the definitions reached by some researchers and academics. Programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable. [1]

Artificial Intelligence is the study of man-made computational devices and systems which can be made to act in a manner which we would be inclined to call intelligent." – The University of Louisiana at Lafayette [2]

Individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought." American Psychological Association [3]

Intelligence is a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience." Common statement with 52 expert signatories [4]

Intelligence is assimilation to the extent that it incorporates all the given data of experience within its framework. .

There can be no doubt either, that mental life is also accommodation to the environment. Assimilation can never be pure because by incorporating new elements into its earlier schemata the intelligence constantly modifies the latter in order to adjust them to new elements." J. Piaget [5]

The ability of a system to act appropriately in an uncertain environment, where appropriate action is that which increases the probability of success, and success is the achievement of behavioral sub-goals that support the system's ultimate goal." J. S. Albus [6]

Intelligent systems are expected to work, and work well, in many different environments. Their property of intelligence allows them to maximize the probability of success even if full knowledge of the situation is not available. Functioning of intelligent systems cannot be considered separately from the environment and the concrete situation including the goal." R. R.Gudwin [7]

The essential, domain-independent skills necessary for acquiring a wide range of domain-specific knowledge – the ability to learn anything. Achieving this with 'artificial general intelligence' (AGI) requires a highly adaptive, general-purpose system that can autonomously acquire an extremely wide range of specific knowledge and skills and can improve its own cognitiveability through self-directed learning." P. Voss [8]

Intelligence is the ability to process information properly in a complex environment. The criteria of properness are not predefined and hence not available beforehand. They are acquired as a result of the information processing." H. Nakashima [9]. Intelligence is the ability for an information processing system to adapt toits environment with insufficient knowledge and resources." P. Wang [10]

[An intelligent agent does what] is appropriate for its circumstances andits goal, it is flexible to changing environments and changing goals, itlearns from experience,

and it makes appropriate choices given perceptual limitations and finite computation." D. Poole [11]

Any system . . . that generates adaptive behaviour to meet goals in a range of environments can be said to be intelligent." D. Fogel [12]

3. The Research of Artificial Intelligence Methods

AI techniques can be partitioned into two general classes:
(A)Symbolic AI, which centers around the improvement of the learning-based framework (KBS), AND (B) Computational Intelligence which incorporates such strategies as neural networks (NN), Fuzz System (FS), and transformative processing. A very brief prologue to these AI techniques is given beneath, and every strategy is talked about in more detail in the distinctive areas of this round.

3.1 Symbolic AI

Symbolic artificial intelligence is the term for the collection of all methods in artificial intelligence research that are based on high-level "symbolic" (human-readable) representations of problems, logic and search. Symbolic AI was the dominant paradigm of AI research from the mid-1950s until the late 1980s [13].

Symbolic computation (algebraic computation)
Symbolic computation is a logical zone that alludes to the examination and advancement of calculations and programming for controlling scientific articulations and other numerical articles. Albeit appropriately, computer algebra should be a subfield of scientific computing, they are by and large considered as particular fields on the grounds that logical figuring is generally in light of numerical calculation with estimated gliding point numbers, while emblematic calculation underlines correct calculation with articulations containing factors that have no given esteem and are controlled as symbols.

Programming applications that perform emblematic estimations are called computer algebra systems, with the term framework insinuating the multifaceted nature of the fundamental applications that incorporate, no less than, a strategy to speak to numerical information in a computer, a client programming dialect (usually different from the language used for the implementation), a dedicated memory manager, a user interface for the input/output of mathematical expressions, an expansive arrangement of schedules to perform common activities, similar to rearrangements of articulations, separation utilizing chain administer, polynomial factorization, uncertain coordination, and so forth.

Computer algebra is generally used to analyze in arithmetic and to outline the equations that are utilized as a part of numerical projects. It is likewise utilized for finish logical calculations, when simply numerical strategies flop, as out in the open key cryptography or for some nonlinear issues.
E.g. Accounting Databases:

The use of artificial intelligence is investigated as the basis to mitigate the problems of accounting databases. The following are some difficulties with existing accounting database systems. The needs of decision makers are not met by accounting information. Humans do not understand or cannot process the computerized accounting databases. Systems are not easy to use. There is focus on the numeric data

Integrating intelligent systems with accounting databases can assist (either with the decision maker or independent of decision maker) in the investigation of large volumes of data with or without direct participation of the decision maker. Thus, the systems can analyse the data and assist the users understanding or interpreting transactions to determine what accounting events are captured by the system [14]. With the artificial intelligence we store and retrieve knowledge in natural language. There are some artificial intelligence tools or techniques that help in the broader understanding of events captured by the accounting system. There is more emphasis on symbolic or text data rather than just numeric data to capture context. The artificial intelligence and expert system builds intelligence into the database to assist users. Without user's direct participation such models help the users by sorting through large quantities of data. Such models also assist the decision makers under time constraints; suggest alternatives in the searching and evaluation of data.

3.2 Computational Intelligence

Computational Intelligence is integrating the fields of Artificial Neural Networks, Evolutionary Computation, and Fuzzy Logic. It is the term formed by IEEE https://cis.ieee.org/[15].

The central scientific goal of computational intelligence is to understand the principles that make intelligent behaviour possible, in natural or artificial systems. The main hypothesis is that reasoning is computation. The central engineering goal is to specify methods for the design of useful, intelligent artifacts.

Neural Networks (NN)
The inventor of the first neurocomputer, Dr. Robert Hecht-Nielsen, defines a neural network as−
"...a computing system made up of a number of simple, highly interconnected processing elements, which process information by their dynamic state response to external inputs."

ANN is a mathematical model that consists of an interconnected group of artificial neurons which processes the information.

E.g. Artificial Neural Network (ANN) in PSS:

In the power systems, the most uses of the counterfeit neural system utilize a multilayer feed forward arrange. In the neural versatile PSS, sustain forward neural system with a solitary concealed layer is proposed which incorporates two sub-systems: versatile neuro-identifier, in which the dynamic qualities of the plant are followed and a versatile

microcontroller to soggy the low-recurrence motions. Spiral premise work organizes (RBFN) has three layers: input layers, concealed layers, and yield layers. The shrouded layer discovers focuses and widths of the spiral premise capacities for singular example units and the yielding layer finds the weights between the example units and the yield units utilizing an unsupervised learning calculation. An intermittent neural system (RNN) adjustment controller is proposed to enhance the transient soundness of energy frameworks in which both the senator and AVR is utilized. The heaviness of the proposed controller is balanced online. The flag yield of the main RNN is added to the PSS flag yield for excitation the flag yield of the second RNN is utilized as a control balancing out the flag for the senator framework. ANNs are savvy controllers to control nonlinear, dynamic frameworks through realizing, which can without much of a stretch accommodate. The nonlinearities and time conditions

Artificial Neural Networks Approach on Diagnostic Science

Endoscopic Images: Image order is an imperative advance in CAD. In the grouping of endoscopic pictures, a hybrid implementation by advanced fuzzy inference neural network which combines fuzzy systems and Radial Basis Function (RBF) was proposed. The idea of the combination of various classifiers committed to particular element parameters with a precision of 94.28%, however, RBF was characterized by a very fast training rate than fuzzy. It extracted both texture and statistical features [16].

E.g. MRI Brain Tumour Analysis

For the MRI brain tumor images, a general regression neural network (GRNN) based automatic three-dimensional classification method was proposed. This method had good time-consuming rate and classification accuracy. Another intelligent classification technique proposed was Least Squares Support Vector Machines(LS-SVM). It identifies normal and abnormal slices of brain MRI data. This technique had a higher accuracy of classification over other classifiers as the false negative in LS-SVM was very low compared. Due to automatic defects detection in MR images of the brain, extensive research is being performed.

Artificial Intelligence Approaches for Medical Image Classification

Artificial intelligence techniques are utilized for demonstrative sciences in biomedical picture characterization. Demonstrate based wise investigation and choice help instruments are critical in medicinal imaging for PC helped finding and assessment. Computer-aided design helps radiologist who utilizes the yield from an automated investigation of restorative pictures as a moment feeling in distinguishing sores, surveying the degree of infection, and enhancing the exactness and consistency of radiological determination to decrease the rate of false negative cases [17]

Application of Artificial Intelligence Techniques in Network Intrusion Detection

Interruption Detection Systems (IDS) utilizes the different Artificial Intelligence procedures for shielding PC and correspondence systems from interlopers. Interruption Detection System (IDS) is the way of observing the occasions happening in the system and identifying the indications of interruption.

Fuzz System (FS)

Fuzzy mathematics is the investigation of fuzzy structures or structures that involve fuzziness i.e., such scientific structures that at a few focuses supplant the two traditional truth esteems 0 and 1 with a bigger structure of degrees. The greater part of our conventional devices for formal displaying, thinking, and registering are fresh, deterministic, and exact in character. Fresh means dichotomous, that is, yes-or-no sort instead of pretty much compose.

Fuzzy Logic (FL):

In 1964, Lotfi Zadeh developed FL to address inaccuracy and uncertainty which usually exist in engineering problems. The methods of fuzzy logic have been investigated in numerous medicinal applications. The fuzzy logic is favoured over the different calculated relapse examination in diagnosing lung malignancy utilizing tumor marker profiles. fuzzy logic is likewise utilized as a part of the determination of intense leukemia and bosom and pancreatic growth and furthermore, foresee patients" survival with bosom malignancy. They can likewise describe MRI pictures of mind tumors ultrasound pictures of the bosom, ultrasound. fuzzy logic controllers have been intended for the organization of vasodilators in the peri-agent period to control pulse.

Expert Systems

The expert system is a computer system that emulates the decision-making ability of a human expert. [18] Expert systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if–then rules rather than through conventional procedural code. [19] The first expert systems were created in the 1970s and then proliferated in the 1980s. [20] Expert systems were among the first truly successful forms of artificial intelligence (AI) software.

e.g. Fuzzy Expert Systems in Medicine:

Fuzzy logic is a data handling methodology that permits ambiguity? and hence is particularly suited to medical applications. It captures and uses the concept of fuzziness in a computationally effective manner. The most likely area of application for this theory lies in medical diagnostics and, to a lesser extent, in the description of biological systems [21].

Fuzzy Inference Systems (FIS) in IDS:

Sampada et al [24] proposed two machine learning paradigms:

Artificial Neural Networks and Fuzzy Inference System,for the design of an Intrusion Detection System. Theyused

SNORT to perform real- time traffic analysis and packet logging on IP network during the training phase of the system. They constructed a signature pattern database using Protocol Analysis and Neuro-Fuzzy learning method. They then tested and validated the models using the 1998 DARPA Intrusion Detection Evaluation Data and TCP dump raw data. The dataset contains 24 attack types. The attacks fall into four main categories viz. Denial of Service (DOS), Remote to User (R2L), User to Root (U2R), and Probing. From the results, it was shown that the Fuzzy Inference System was faster in training, taking few seconds, than the Artificial Neural Networks which took few minutes to converge. Generally, both techniques proved to be good, but with the Fuzzy Networks with its higher classification accuracies. Their experiment also showed the importance of variable selection, as the two techniques performed worse when all the variables were used without the selection of the variables. Good results were recorded when a subset (about 40%) of the variables were used [22].

Evolutionary Computing
Evolutionary computation is a group of calculations for worldwide streamlining roused by organic advancement and the subfield of manmade brainpower and delicate processing considering these calculations. In specialized terms, they are a group of populace-based experimentation issue solvers with a metaheuristic or stochastic streamlining character.

Evolutionary computation techniques can deliver exceedingly streamlined arrangements in an extensive variety of issue settings, making them mainstream in software engineering. Numerous variations and expansions exist, suited to more particular groups of issues and information structures. The transformative calculation is likewise at times utilized as a part of developmental science as an in the silicon test method to think about basic parts of general developmental procedures.

E.g. Evolutionary Computation in Medicine:

Evolutionary computation is the general term for several computational techniques based on natural evolution process that imitates the mechanism of natural selection and survival of the fittest in solving real-world problems. The most widely used form of evolutionary computation for medical applications is „Genetic Algorithms‟ [18].„Genetic Algorithms‟ based on the natural biological evolution are the most widely used form of evolutionary computation for medical applications. The principles of Genetic algorithms have been used to predict outcome in critically ill patients. MRI segmentation of brain tumors to measure the efficacy of treatment strategies is also done through evolutionary computation. They have also been used in computerized analysis of mammographic micro calcification.

4. Structural Artificial Intelligence

Speaking to learning utilizing consistent formalism, similar to predicate rationale, has a few focal points. They can be joined with capable induction instruments like determination, which makes prevailing upon realities simple. Be that as it may, utilizing sensible formalism complex structures of the world, objects and their connections, occasions, arrangements of occasions and so forth can't be portrayed effectively. A decent framework for the portrayal of organized learning in a specific space ought to have the accompanying four properties:
1) Representational Adequacy: The capacity to speak to a wide range of information that is required in that area.
2) Inferential Adequacy: The capacity to control the spoke to structure and induce new structures.
3) Inferential Efficiency: The capacity to consolidate extra data into the information structure that will help the deduction components.
4) Acquisitional Efficiency: The capacity to secure new data effectively, either by coordinate inclusion or by program control.

The procedures that have been produced in AI frameworks to achieve these targets fall into two classifications:
1) Definitive Methods: In this learning is spoken to as a static accumulation of certainties which are controlled by general techniques. Here the realities should be put away just a single and they can be utilized as a part of any number of ways. Realities can be effectively added to definitive frameworks without changing the general methods.
2) Procedural Method: In this information is spoken to as strategies. Default thinking and probabilistic thinking are cases of procedural strategies. In these, heuristic information of "How to do things productively "can be effectively spoken to.

By and by, the vast majority of the learning portrayal utilizes a blend of both. A large portion of the information portrayal structures has been created to deal with programs that handle regular dialect input. One reason that learning structures are so imperative is that they give an approach to speak to data about ordinarily happening examples of things. such depictions are some of the time called blueprint. One meaning of the blueprint is "Pattern alludes to a dynamic association of the past responses, or of past experience, which should dependably work in any very much adjusted natural reaction".

By utilizing blueprints, individuals, and in addition programs, can abuse the way that this present reality isn't arbitrary. There are a few kinds of patterns that have demonstrated value in AI programs. They incorporate
1) Frames: Used to portray an accumulation of qualities that a given question has (e.g. Depiction of a seat).
2) Scripts: Used to portray the normal arrangement of occasions (e.g.: an eatery scene).
3) Stereotypes: Used to portrayed attributes of individuals.
4) Rule models: Used to portray normal highlights shared among an arrangement of principles in a creation framework.

Casings and contents are utilized widely in an assortment of AI programs. Before choosing a particular learning portrayal structure, the accompanying issues must be considered.
1) The essential properties of articles, assuming any, which are basic to each issue area must be distinguished and dealt with suitably.
2) The whole information ought to be spoken to as a decent arrangement of natives.

3) Mechanisms must be contrived to get to significant parts in a huge learning base.

5. Artificial Intelligence System

Artificial intelligence System (AI) can be regarded as a term for simulated intelligence in machines. These machines are programmed to "think" like a human and mimic the way a person acts. The ideal characteristic of artificial intelligence is its ability to rationalize and take actions that have the best chance of achieving a specific goal, although the term can be applied to any machine that exhibits traits associated with a human mind, such as learning and solving problems.

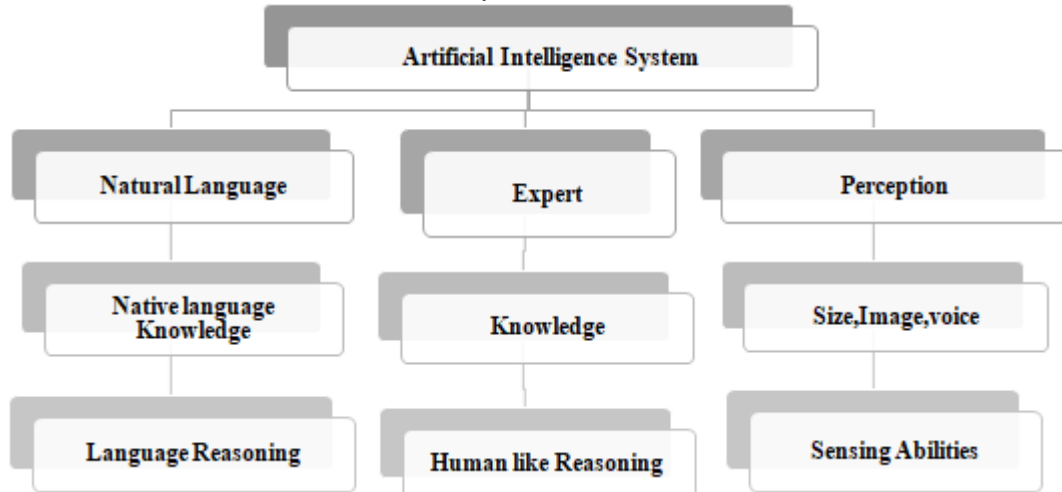### 5.1 The Structure of Artificial Intelligence

Figure 3: Categories of Artificial Intelligence

5.2 The Classification of Artificial Intelligence System

The process of classification is one such technique where we classify data into a given number of classes. During classification, we arrange data into a fixed number of categories so that it can be used most effectively and efficiently.
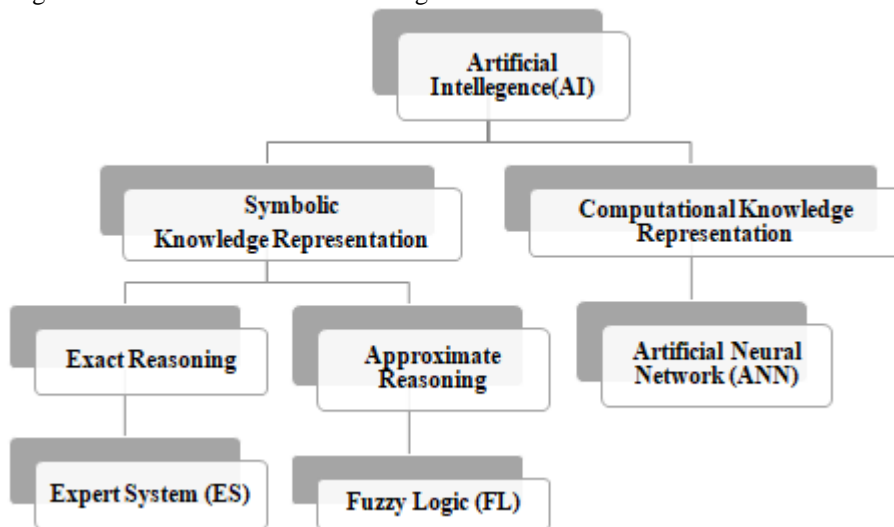

Figure 1: Classification of AI Techniques

6. Applications

The reality of the matter is that application was a standout amongst the most essential components of AI hypothesis. Counterfeit consciousness has been produced for a long time, and the innovation of AI has been connected in numerous fields, for example, computer engineering, nerve biology, medicine image analysis, archaeology, geologic reconnoitering, space navigation, armament technology and so on. Detailed applications, for example:

Applications of AI

AI has been overwhelming in different fields, for example, −
- **Gaming** − AI assumes the critical part in key diversions, for example, chess, poker, tic-tac-toe, and so forth., where the machine can think about a substantial number of conceivable positions in view of heuristic learning.
- **Natural Language Processing** − It is conceivable to associate with the PC that comprehends the characteristic dialect talked by people.
- **Expert Systems** − There are a few applications which coordinate machine, programming, and uncommon data to

give thinking and exhorting. They give clarification and exhortation to the clients.

- **Vision Systems** − these frameworks comprehend, translate, and fathom visual contribution on the PC. For instance, A spying plane takes photos, which are utilized to make sense of spatial data or guide of the zones. Specialists utilize the clinical master framework to analyse the patient. Police utilize PC programming that can perceive the substance of criminal with the put away picture made by the measurable craftsman.
- **Speech Recognition** − Some canny frameworks are fit for hearing and fathoming the dialect as far as sentences and their implications while a human converse with it. It can deal with various accents, slang words, clamor out of sight, change in human's commotion because of frosty, and so forth.

- **Handwriting Recognition** − The Handwriting Recognition programming peruses the content composed on paper by a pen or on screen by a stylus. It can perceive the states of the letters and change over it into editable content.
- **Intelligent Robots** − Robots can play out the assignments given by a human. They have sensors to distinguish physical information from this present reality, for example, light, warm, temperature, development, sound, knock, and weight. They have productive processors, various sensors and colossal memory, to display insight. What's more, they are equipped for gaining from their missteps and they can adjust to the new condition.
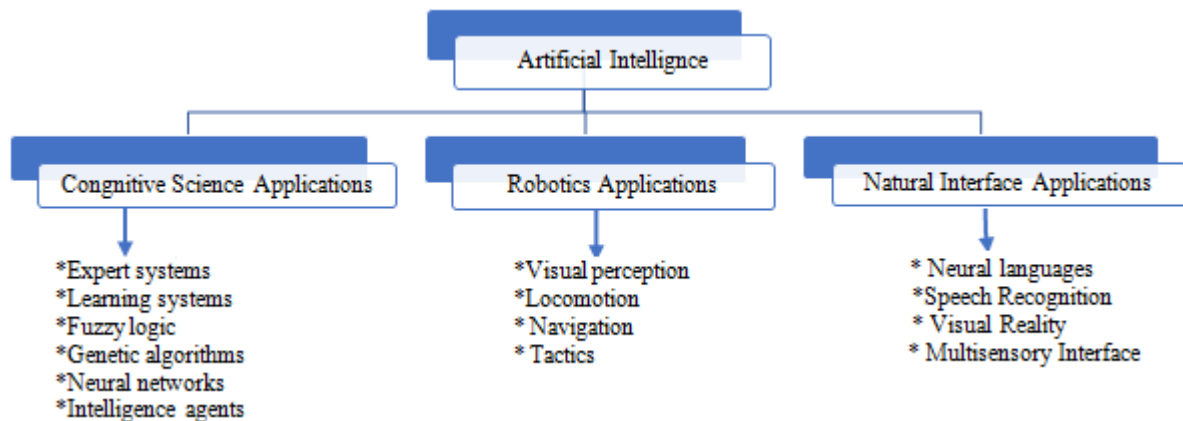

Figure 2: Applications of AI

Related Fields

Table 1: The related fields of AI

Computer science	Finance
Education	Heavy industry
Hospitals and medicine	Media
Human resources and recruiting	Music
Marketing	Toys and games
News, publishing and writing	Transportation
Online and telephone customer service	Power system stabilizers (PSSs) Design
Telecommunications maintenance	homeland security

7. Conclusions

In its broadest sense, Artificial Intelligence is the heart of all scientific inquiry, including understanding ourselves and the real-world around us. And the developing of Artificial Intelligence is increasing very fast, the related Artificial Intelligence fields and the application of Artificial Intelligence became wider and wider.

In this paper, we expatiate Artificial Intelligence in the round, including the definition of AI, the methods of AI, the composition of AI system, the related fields of AI and the application of Artificial Intelligence.

In addition, it is an important trend to use Artificial Intelligence in engineering; we should make efforts on this.And Artificial Intelligence scientists should pay attention to the new technique of AI and enlarge theapplication areas of AI.

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