The Real Analysis and Its Role with Artificial Intelligence in Future

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التحليل الحقيقي ودوره مع الذكاء الاصطناعي في المستقبل

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Abstract

Merging real analysis with artificial intelligence is a vital matter for the future of technology because it provides accurate mathematical foundations that enhance the efficiency and accuracy of smart algorithms, and enables better modification and analysis of complex systems, and it is important to achieve technical progress in multiple areas. Reasons for the important integration. In artificial intelligence (AI), especially in machine learning we Know mathematical tools are linear algebra, statistics, calculus rather than real analysis. These areas provide the foundation for models and algorithm which is process data, AI and ML use linear equations, vectors and matrices to transformation and analyze data to arrive to estimated solutions. Linear Algebra is a key tool in neural networks. Calculus, probability and real analysis are key tools for optimization and dealing with imperfect data inputs in artificial intelligence and machine learning. However, the real analysis plays a significant role in advancing AI in a deeper and more formal sense.

Keywords: Optimization, Real Analysis, Deep Learning (DL), Neural Networks, Machine Learning (ML).

الملخص

أن دمج التحليل الحقيقي مع الذكاء الاصطناعي هو أمر حيوي لمستقبل التكنولوجيا لأنه يوفر أسسًا رياضية دقيقة تعزز كفاءة ودقة الخوارزميات الذكية، وتمكن من تعديل وتحليل الأنظمة المعقدة بشكل أفضل، ومن المهم تحقيق تقدم تقني في مجالات متعددة. أسباب التكامل المهم. في الذكاء الاصطناعي (AI)، وخاصة في التعلم الآلي، نعلم أن الأدوات الرياضية هي الجبر الخطي والإحصاء وحساب التفاضل والتكامل بدلاً من التحليل الحقيقي. توفر هذه المجالات الأساس للنماذج والخوارزمية وهي بيانات العملية، ويستخدم الذكاء الاصطناعي والتعلم الآلي المعادلات الخطية والمتجهات والمصفوفات لتحويل البيانات وتحليلها للوصول إلى حلول مقدرة. الجبر الخطي هو أداة رئيسية في الشبكات العصبية. يعد حساب التفاضل والتكامل والاحتمالات والتحليل الحقيقي أدوات رئيسية لتحسين ومعالجة مدخلات البيانات غير الكاملة في الذكاء الاصطناعي والتعلم الآلي. ومع ذلك، يلعب التحليل الحقيقي دورًا مهمًا في تطوير الذكاء الاصطناعي بمعنى أعمق وأكثر رسمية.

الكلمات المفتاحية: التحسين، التحليل الحقيقي، التعلم العميق، شبكة طبيعية، التعلم الالي.

Introduction

Artificial Intelligence (AI) and Machine Learning (ML) have emerged as transformative technologies. Revolutionizing appears in many fields as diverse as healthcare , transports, and entertainment .The Mathematics is very important subject and the mathematic is not merely a tool for computation ,it's the language which the system is the designed ,analysis and optimized. The real analysis provides the language and tools necessary to formalize and solve complicated problems.

The real analysis is one of the branches of mathematical study The group of real numbers and the functions of Knowledge of it , and it is an accurate copy of the science of differentiation and integration. This field focuses on concepts such as sequences, the limits, continuity of derivation integration as well as studying the consequences of function and their characteristics and provides an elaborate theoretical frame work to study concepts.

Real Analysis contents:

The structure of the real numbers is the study of the full system of real numbers as an arrange field that does not contain ((gaps)),with a focus on the properties of absolute value and prejudices such as tragedy of the triangle

for any real numbers $x \ and \ y, |x + y| \leq |x| + |y|$.

The series and sequences study the limits of the consequences and Cauchy consequences and the series of the forces that are used to define central functions.

Groups in the real numbers are studding groups such as Open sets, closed sets, compact sets, with their properties and every important theorem like Bolzano Weierstrass which says:

((every bounded sequence of real numbers has a convergent subsequence))

x_n is cauchy if $\forall \epsilon > 0 , \exists N \in \mathbb{Z} , n, m \geq N$

$|x_n - x_m| < \epsilon$.

Communication and the derivatives of functions focus on concepts of limits of functions, definition of the functions of important applications such as the average mean value theorem says:

For a function f is continuous on closed interval $[a, b]$ and differentiable on the open interval (a, b) such that:

$$f'(c) = \frac{f(b) - f(a)}{b - a}.$$

and the Hospital rules.

The Proof and the methods of proof, the real analysis depends on mathematical proof such as direct proof and indirect proof of mathematical induction.

Real Integration, the real analysis studying Riemann integrationn if we Said the function is Riemann integral on $[a, b]$

$L(f) = U(f) = \int_a^b f(x) \ \ dx$.

Advanced concepts like Banach space and theories related to the consequences the field of real analysis of deeper applications in mathematics and science.

Applications of real analysis

The applications are deep and multiple ,include many fields that are closely related to science and engineering.

1-Mathematical Modeling and Applied Sciences:

The Real Analysis is used to describe natural and engineering phenomena accurately through continuity based models, derivation and integration . This is necessary in engineering and physics control system.

2-Solving the differential equations:

The real analysis helps to solve differential equations which are essential in the modeling of dynamic processes in science.

3-Finance and Economy :

We Know that the real analysis of mathematical modeling of financial markets uses risk analysis ,and economic expectations, through across tools such as calculus and advanced complementarity and measurement theory.

4- Development Algorithms of Artificial Intelligence:

The developed algorithms of artificial intelligence in real analysis especially Machine Learning (ML) depending on the real analysis tools to understand the patterns of prediction data, and reduce errors through sports models based on the real theories in mathematical analysis.

What is the role of real analysis of artificial intelligence in the future?

The future role of real analysis in the field of artificial intelligence lies in being for exact sporty basis for understanding the behavior of models and algorithms used in automated learning and data processing, through the ability to design automatic learning algorithms with Rapprochement and improved continuity ,where the real analysis is used to study functions and standards that govern the behavior of models during training ,which helps to improve accuracy of prediction and the performance of networks nervousness. Stability and speed of learning nervous networks via concepts of derivation and differenation , which supports applications such as Gradient Descent to improve training efficiency and reduce treatment time. Studying and understanding rapprochement in the sequences and modeling of large data , which contributes to designing artificial intelligence system capable of dealing with huge data and analyzing them with high efficiency. Providing strong mathematical tools to analyze cost functions and target function used in artificial intelligence to improve performance through optimism an integral part. Modern artificial intelligence algorithms .From supporting the ability to quickly and accurately conclude real time especially in computer` vision applications and self-driving cars, as it requires continuous and accurate algorithms to make immediate decisions .

What's the role of artificial intelligence in real analysis ?

The areas which to real analysis forms is essential back bone for (AL), and machine learning (ML) . The real analysis understanding functions, convergence for training algorithms to ensure their stability and performance.

Enabling deep learning in deep learning, nervous networks depends on account of the gradients of function, which are very necessary in real analysis, and improve the quality of expectations and smart models.

In fact increase of mathematical strength and accuracy provides real analysis for developing advanced mathematical tools that enable artificial intelligence to study complicated mathematical problems with higher efficiency. Mathematics helps to solve the challenging task of hypothetical problems in artificial intelligence usining traditional methods and techniques.

Results and discussion

Here is a table showes the relation ship between the real analysis and artificial intelligence

SN.	The side	Real analysis	Artificial Intelligence
1	Definition	A branch of mathematics .Using theories of numbers and studies the function and its integration and derivation	Use mathematical theories. including concept of real analysis,to build smart models and data analysis in artificial intelligence
2	The basic concepts	Consecutive, the limits, the closed and open sets, integration	Applications in continuity models,defferentiation of nervous networks learning algorithms such as reverse spread
3	Tools mathematical used	Derivatives the function and sequences such as Cauchy sequence ,sets.	Derivatives and integration possibilites for games games theory and compex sports models for patterns analysis and decision-making.
4	Practical Applications	Proof the characteristics of real functions,studing changes and solutions of differential algebraic equations.	It helps in developing artificial intelligence to learn and analyzing compex data such as recognition and smart decisions.
5	The relation between real analysis and (AI)	Provides the theoretical basis for understanding the behavior of functions and calculating derivatives that are used in machine learning models and data analysis.	Artificial intelligence depends on this understanding to improve the performance of algorithms and models.

Conclusion

analysis is a critical component understanding how we represent data as well as perform model optimizations. In addition, the real analysis provides tools for an accurate understanding of the behavior of the limits and derivation, which enables the improvement foment   deep learning models and neural networks to achieve higher performance and greater accuracy in prediction and decision-making. Dealing with real analysis helps in a model and study the change of smart systems over time.

In conclusion, the real analysis constitutes the basic building block on which the arithmetic capabilities of artificial intelligence and learning are built are built are built are built with a very high level of efficiency.

Compliance with ethical standards

Disclosure of conflict of interest
The authors declare that they have no conflict of interest.

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