

The importance of mathematical logic schemes in artificial intelligence

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Abstract: This article analyzes the importance of logic circuits in artificial intelligence systems and their application in various fields. Information is provided on the principles of operation, structure and implementation stages of logic circuits in artificial intelligence. Examples of increasing the efficiency of logic circuits in artificial intelligence systems and their application in real life are given.

Keywords: Artificial intelligence, mathematics, logic, reasoning, logical schema, algorithms, models, decision tree, Bayesian network, Neural network, decision making, practical examples.

Introduction: Decree of the President of the Republic of Uzbekistan Sh. Mirziyoyev: “On additional measures to improve the quality of education in higher education institutions and ensure their active participation in large-scale reforms being implemented in the country” No. PQ-3775 dated June 5, 2018, “Measures to improve the quality of education in mathematics and develop scientific research in the field of mathematics” dated May 7, 2020 The application of mathematical considerations to artificial intelligence is of great importance in the economic, social, and technical and technological development of our country, in fulfilling the tasks set forth in Resolutions No. PQ-4708 and No. PQ-4996 of February 17, 2021, “On measures to create conditions for the accelerated introduction of artificial intelligence technologies”. Mathematics provides the foundation that allows artificial intelligence systems to learn, reason, and make intelligent decisions.

Mathematics serves as the basis for artificial intelligence algorithms and models, which allow machines to process, analyze, and interpret large amounts of data.

Artificial intelligence is the development and operation of intelligent machines, drawing on many fields such as

psychology, mathematics, biology, and engineering to create computers that can think based on new information, react like humans, and change their behavior.

The importance of mathematics in artificial intelligence systems - algorithms use mathematical models and calculations used in machine learning, so artificial intelligence systems can automatically improve over time based on feedback from the environment.

Artificial intelligence (AI) is actively used today in various fields of science, technology, and everyday life. The effectiveness of AI systems depends on their decision-making ability, which is embodied in logical schemes. Logical schemes play an important role in various models of artificial intelligence, and their correct operation ensures the reliability and efficiency of AI systems.

METHODS

Mathematical logic is the laws, methods, and formulas (forms) of reasoning, and its founder is considered to be the ancient Greek thinker Aristotle (384-322 before christ).

A mathematical statement is a statement that can only accept one of two possible outcomes: “a certain event”

or “an impossible (impossible) event”.

A logic diagram is a set of formal rules, logical expressions, and algorithms used to solve a specific problem or make a decision. It is used to control the processes of processing, analyzing, and drawing conclusions from information.

A number of scientists have conducted important scientific research in the field of logical schemes (or logical systems) in artificial intelligence. For example:

John McCarthy – Considered one of the founders of the field of artificial intelligence, McCarthy has done extensive research on logical schemes and formal systems. His work “Programs with Common Sense” (1959) explores the basic principles of logical reasoning in artificial intelligence;

Alan Newell and Herbert Simon - together these scientists developed a programming system called “General Problem Solver” (1959), which learned to solve problems using logical rules.

Jude Pearl - his work “Probabilistic Reasoning in Intelligent Systems” (1988) includes important research on probabilistic reasoning and Bayesian networks in artificial intelligence.

Raymond Reiter – Reiter provides detailed information about default logic schemes and their applications in artificial intelligence in his work “A Logic for Default Reasoning” (1980).

Robert Kowalski - his work "Logic for Problem Solving" (1979) provides important information on the use of logic schemes in logic programming and artificial intelligence.

These works have made a significant contribution to the development of logic schemes in artificial intelligence and are considered an important source for researchers in the field.

RESULTS

Logic circuits are a key part of artificial intelligence, and logic circuits used in AI systems accelerate and optimize the decision-making process.

The use of various schemes - Bayesian networks in probabilistic calculations, decision trees in data classification, and neural networks in learning and prediction - gives high results.

The effectiveness of artificial intelligence depends on logic circuits, and properly designed logic circuits ensure that systems make accurate and reliable decisions.

Decision trees are one of the most widely used logic diagrams in artificial intelligence and machine learning, representing a visual and mathematical model for analyzing data and making decisions.

Bayesian networks are logic circuits used in artificial intelligence systems for decision-making under uncertainty and probabilistic analysis. They represent relationships between random variables in a graphical form and operate on the basis of Bayes' rule.

Neural networks are a model used in artificial intelligence systems to solve complex problems based on logical circuits, based on the principle of processing information, similar to the neurons of the human brain. They play an important role in analyzing, learning, and predicting large amounts of data.

Examples. We present some practical examples from various areas of artificial intelligence, including processing data into logical circuits, decision-making, and creating automated systems.

Example 1. In medicine, AI-based diagnostic systems use logic circuits to identify patients' symptoms. For example, if a patient has a high temperature, cough, and difficulty breathing, the logic circuit considers the possibility of COVID-19 or a lung infection and makes recommendations to the doctor.

Example 2. Autonomous cars make decisions based on logic circuits. For example, if there is a red light ahead (A=yes) and the car is moving (B=yes), then you should apply the brakes (C=yes). This circuit helps to drive the car safely.

Example 3. If a client usually makes transactions not exceeding 1 million soums, but suddenly a transaction of 100 million soums is made, the system may block this operation for verification or request additional confirmation based on logical rules.

Example 4. Logic circuits are used to respond to user commands. If the user asks “How is the weather?” (A=yes), then the system retrieves information from the Internet and returns a response (B=yes).

Example 5. Robots on a production line use logic circuits to isolate defective products. For example, if a product's size or weight is outside of the normal range, logic decisions are made to destroy it or redirect it to a rework line.

These examples demonstrate the importance of logic circuits in artificial intelligence systems. They are one of the main tools in ensuring the efficient and reliable operation of AI.

DISCUSSION

Logical schemes used in artificial intelligence systems are of fundamental importance in solving various problems. Unlike traditional programming methods, AI systems have the ability to learn and adapt to the environment independently, and logical schemes play an important role in this process.

For example, Decision Trees and Bayesian Networks can help you make decisions quickly and accurately. Neural Networks can also automate complex data processing and learning processes.

However, there are also problems associated with logic circuits. In particular, improperly designed circuits can lead to incorrect results, and computational complexity can reduce the efficiency of the system. Therefore, when developing logic circuits, special attention should be paid to optimizing and correctly processing data.

CONCLUSION

Logical schemes are of great importance in the development of artificial intelligence systems and increasing their efficiency. They enable AI systems to make accurate decisions, work quickly, and adapt. The results show that logical schemes can be effectively used in various AI areas, and their further improvement is considered one of the promising directions.

Deep learning and optimization of logic circuits can make a significant contribution to the future development of artificial intelligence systems. Therefore, it will be important to further expand research in this area and develop new logic models in the future.

This article serves as important theoretical and practical information for specialists and researchers working in the field of artificial intelligence.

REFERENCES

Зулфихаров И.М., Акбаров С.А. Математикани ўрганиш ҳар бир касб эгалари ҳаёти учун муҳимдир // “Педагогика ва психологияда инновациялар” журналі 2-маҳсул сон -2020 й. 170-177 б. –Тошкент.

Зулфихаров И.М. Талабаларни математика фанига қизиқтириш бизнинг бурчимиздир // “Физика-математика фанлари” электрон журнал, -Тошкент, -2020. 3-сон, 1-жилд, -11-16 б.

Зулфихаров И.М., Искандаров Д.Х., Маматов Ф.У. Талабаларни математик тафаккурини ривожлантиришда “интеграл” қонунига амал қилиш // “Differensial tenglamalar va matematikaning turdosh bo`limlari zamonaviy muammolari” mavzusidagi Xalqaro ilmiy konferensiya, -Farg`ona, -2020 yil. 12-13 mart, -308-311 б.

Зулфихаров И.М. Математикадан амалий машғулотларда ахборот-коммуникация технологияларининг ўрни // ЎзМУ хабарлари, – Тошкент. 2018, –№ 1/1. –118-120 б.

Zulfixarov I.M. Matematik mantiqning diskret texnikaga tatbiqlari / Andijon mashinasozlik instituti “Mashinasozlik” ilmiy-texnika jurnali 3-son, № 3, -2023 y.

Zulfixarov I.M., Mamasidiqov B.Q. Sun'iy intellektni yaratishda bul algebrasining mantiqiy yo'nalishdagi matematik tahlili / Andijon mashinasozlik instituti xalqaro ilmiy – texnik anjuman. -348-350 bet. 18-19-sentabr, 2023-yil.

Zulfixarov I.M., Mamasidiqov B.Q. Mexatronika va robototexnikada ikki karrali integralning mexanik tatbiqlari / Andijon mashinasozlik instituti xalqaro ilmiy-texnik anjuman. -2023 yil 19-21 oktyabr. 1027-1030 bet.

Икромов Х.Х. Обзор существующих методов подготовки развития информационных систем / Наманган МТИ махсус -2023/5-сон.

Атажонова С.Б. Interfaol ta'lim usullarining texnika yo'nalishlari talabalari faoliyatiga ta'siri / Наманган МТИ махсус -2023/7-сон.

Zulfixarov I.M., No'monov A.SH., Norqulova M.SH. Matematik mulohazalar bilan sun'iy intellektda bayes tarmoqlarini tashkil etish. TATU Farg'ona filiali “Tadqiq va tatbiq” ilmiy-uslubiy jurnal SJIF 2024 (5.3). Tom 02. Son. 02. 2024.