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## A STUDY ON APPLICATION OF INTEGRATED CIRCUIT IN ARTIFICIAL INTELLIGENCE

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### ABSTRACT

Artificial intelligence and integrated circuit technology go hand in hand. The capacity of computers and other devices to learn and compute is a key factor in the development of artificial intelligence. Integrated circuits help artificial intelligence algorithms function in this way. The two areas of integrated circuit application research that have gotten the most interest recently are circuit defect analysis and artificial intelligence chips. In recent years, the two have come closer together as a result of the quick development of technology, and more scientists and researchers have committed to the interdisciplinary study of the two subjects. This research investigates the application of artificial intelligence technologies in integrated circuits. The connection between artificial intelligence technology and integrated circuit is demonstrated, and its applications in the three fields of chip, integrated circuit problem diagnosis, and circuit design optimization are explored. It is ultimately determined that the merger of integrated circuit and artificial intelligence research and applications will have a substantial impact on the level of science, technology, and human social life.

**Keywords:** - Artificial Intelligence, Integrated Circuit, CNN (Convolution Neural Network), Circuit designers

### I. INTRODUCTION

The circuit, which is frequently built on the surface of semiconductor wafers and mostly comprises of passive components but also includes semiconductor devices, can be made smaller by using an integrated circuit, a compact electronic component or device. The basis of intelligent technology, integrated circuit technology serves a variety of markets, including the computer, medical, and industrial. Thanks to the continued development of AI technology, integrating integrated circuit technology and artificial intelligence technology has lately become one of the main areas for information technology development. Working together and promoting are linked ideas. The rapid development of integrated circuits has made it possible for computer technology to advance so quickly. The advancement of computer technology is necessary for artificial intelligence technology to flourish, therefore integrated circuits play a crucial role in this process. Additionally, hardware is required to execute artificial intelligence algorithms, and integrated circuits are at the heart of this hardware (chips). Numerous data operations, including recursion, circulation, convolution, etc., are necessary for many mathematical representations of artificial intelligence. Many companies have started to develop or have already produced chips that are specifically built to execute artificial intelligence algorithms and implement AI functions because these algorithms run at different rates on different kinds of integrated circuits. However, the design, analysis, detection, and other procedures of united circuits have made substantial use of artificial intelligence skills. By getting around the limitations of human processes, it enables designers and manufacturers to accomplish circuit design and manufacturing more precisely and faster.

### II. ARTIFICIAL INTELLIGENCE

Artificial intelligence is the imitation of human intelligence in machines designed to behave and deliberate like individuals (AI). Any computer that exhibits traits of the human intellect, like as learning and problem-solving, can also be referred to by the phrase. Artificial intelligence is based on the idea that human intelligence can be described in such a way that a computer can easily copy it and do tasks of any complexity. The goal of artificial intelligence is to mimic human cognitive functions. Scientists and creators in the field are making rapid progress in concrete descriptions of knowledge, logic, and vision. Some people think that soon inventors might be able to create systems which go beyond what people are now capable of understanding or comprehend.

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### III. INTEGRATED CIRCUIT

Prior to the development of integrated circuits, building circuits typically included selecting the individual parts—such as diodes, transistors, resistors, inductors, and capacitors—and manually connecting them. However, due to problems with size and power consumption, it was necessary to develop a compact size circuit with lower power consumption, dependability, and shockproof. After the invention of semiconductors and transistors, things were considerably simpler, but integrated circuits dramatically changed the way electronics technology was seen. Bob Noyce of Intel and Jack Kilby of Texas Instruments are the two separate inventors of integrated circuits.

### IV. ARTIFICIAL INTELLIGENCE APPLICATIONS IN INTEGRATED CIRCUITS

#### 1. AI chips :-

The microcontroller and arithmetic are the two components that make up a typical CPU. The other units are employed to make sure that commands can be carried out in an orderly way, even though the input is only calculated by a separate ALU unit. This general architecture fits perfectly with the computation approach used in standard programming. Due to the fact that deep learning's computation mode requires massive data operations rather than several programme instructions, this structure is no longer adequate. Since a rate of the CPU and memory could be enhanced continuously to speed up the execution of instructions, especially within the limit of energy usage, the growth of CPU systems encounters an impassable limit.

#### 2. Defect detection :-

There will invariably be issues with faults in the integrated circuit's design, testing, and overall operation. The speed, latency, and power of AI chips have all considerably improved. A MAC (Multiplier and Accumulation) acceleration array at the heart of modern AI processors accelerates the much more significant inversion action in the CNN (Convolutional Neural Network), which is used to execute a lot of compute clusters in projects for artificial intelligence (other noncompeting tasks are still under the responsibility of CPU). As an illustration, Google's TPU chip has processing speeds that are 15–30 times quicker than those of CPUs and GPUs, and it uses energy up to 30-80 times more efficiently. Due to the usually fuzzy nature of the network of circuit failures, the fault phenomenon may not always be directly related to the fault itself. This also makes fault inquiry more challenging. The advancement of artificial intelligence technology makes it possible to analyse errors more precisely, logically, and scientifically, especially by determining their root causes. This method focuses on the soul and identity qualities of data, and can spread data by using an artificial neural network as an example. It is designed for handling defect detection circumstances that cannot be expressed by simple equations and can manage non-linearity, tolerance, and feedback loop problems that are challenging to handle in previous model. Input units, output units, and hidden units are the three different categories of processing elements that make up an artificial neural network. Once the input unit has received the data and signals from the outside, it is the output unit's responsibility to communicate the processed findings. The hidden unit, which cannot be seen from the outside of the neural network system, is situated between the input unit and the output unit.

#### 3. Optimizing the design of circuits: -

Circuit designers frequently have to continuously simulate using their past design knowledge in order to discover the desired parameters' highest value. It is simple to have too many parameters and need multiple iterations in the typical simulation optimization procedure, which further results in a drawn-out simulation iteration. Circuit simulation is used to find the matching target parameters after machine learning technology samples the design parameters prior to optimization. The sample findings are used to construct a machine learning model. By predicting the link between design parameters and target parameters, the model implements circuit optimization. This method has the benefit of just using a small number of samples to build a machine learning model. Every optimisation is then developed by the model, whose forecast accuracy considerably exceeds that of the simulation.

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## V. CONCLUSION

The key properties of AI bits intelligence chips, circuit defect detection, and circuit design optimization—are elaborated on in this study as it examines the use of AI technology in computer chips. First off, the development of artificial intelligence chips shows how quickly computer chips or Intelligent systems have progressed. To identify circuit defects, Utilizing its benefits in calculating quantity, calculation speed, and calculation precision, tech. Artificial neural network training is used to build the model, the human brain's neural network is abstracted from the standpoint of processing of information, and clustering is used to determine the nature and source of the error. Thirdly, machine learning technology is used to improve the conventional simulation optimization procedure for circuit design optimization and build a model for the sample findings. This improves the efficiency of design optimization, reduces the number and length of simulations, improves parameter compliance and accuracy, and uses less computer energy. The combination of these three elements clearly conveys the relationship and trajectory of integrated circuits' and artificial intelligence's complimentary and synchronised growth. One might predict that as artificial intelligence technology develops and integrated circuit hardware is continually improved and optimised, integrated circuits will eventually become more intelligent, able to carry out more technical tasks, and practical for human living. In addition to making important contributions to societal progress, the development of integrated circuits and artificial intelligence will lead to significant advances in science and technology.

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