Integration of Artificial Intelligence based on Electronic Information Engineering

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ABSTRACT

Our analysis of the rapid development of core technologies in the new era of "Internet plus AI" is based on research into the applications of AI technology in the manufacturing sector in recent years. Next, we suggest novel approaches, methods, and configurations for intelligent manufacturing, as well as an architecture and technology system for intelligent manufacturing. In light of this, the purpose of this article is to examine artificial intelligence as it relates to Internet of Things technology in electronic information engineering. The goal is to increase people's material well-being and happiness by better optimizing artificial intelligence and IoT technology, mastering technical concepts, and applying them logically. To better simulate life and optimize information conditions, this paper analyses the experimental results through model construction. It also suggests ways to apply artificial intelligence and IoT technology to electronic information engineering. In conclusion, this research employs sixteen typical mechanics datasets to verify the correctness and generalizability of the method and concludes that it helps improve the usage of AI and IoT technologies.

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1. INTRODUCTION

The community of computer science and applications is growing rapidly due to the contributions of excellent research papers and fresh discoveries. The standardized journals authorize and oversee the legitimacy of these superior works. Such research efforts are published in numerous reputable and significant publications. One of the most prestigious computer science journals is Engineering Applications of Artificial Intelligence, which is published by Elsevier [1]. The journal's articles can be broadly classified into three subject areas: electrical and electronic engineering, control and system engineering, and artificial intelligence.

There's no denying the growing momentum of the new economic and technological revolutions. The era of ubiquitous systems, data-drivenness, collaborative services, cross-border insertion, autonomous intelligence, and mass invention, which we refer to as "Internet plus AI" is (see Figure 1.1), in our opinion, drawing near. In order to facilitate the revolutionary transformation of designs, implies and ecological systems with regard to their usage to the national economy, well-being, and national security, new AI technologies must rapidly develop and fuse with Internet, new-generation data, novel energy substances, and biotechnology technologies [2]. The foundation of a country's economy, way of life, and security is its manufacturing sector. Manufacturing designs, manufacturing techniques, and production ecosystems are undergoing a revolutionary transformation thanks to the deep merging of manufacturing technologies with information and communication technology, intelligent technology, and product-related knowledge, among other things. The Internet has become more widely used, sensors are becoming more widely distributed, big data is emerging, e-commerce is growing, the information community is growing, and data and knowledge are becoming more integrated with society, the physical world, and cyberspace. All of these factors have drastically altered the information environment for the development of AI and brought about a new evolutionary phase: 2.0 AI.

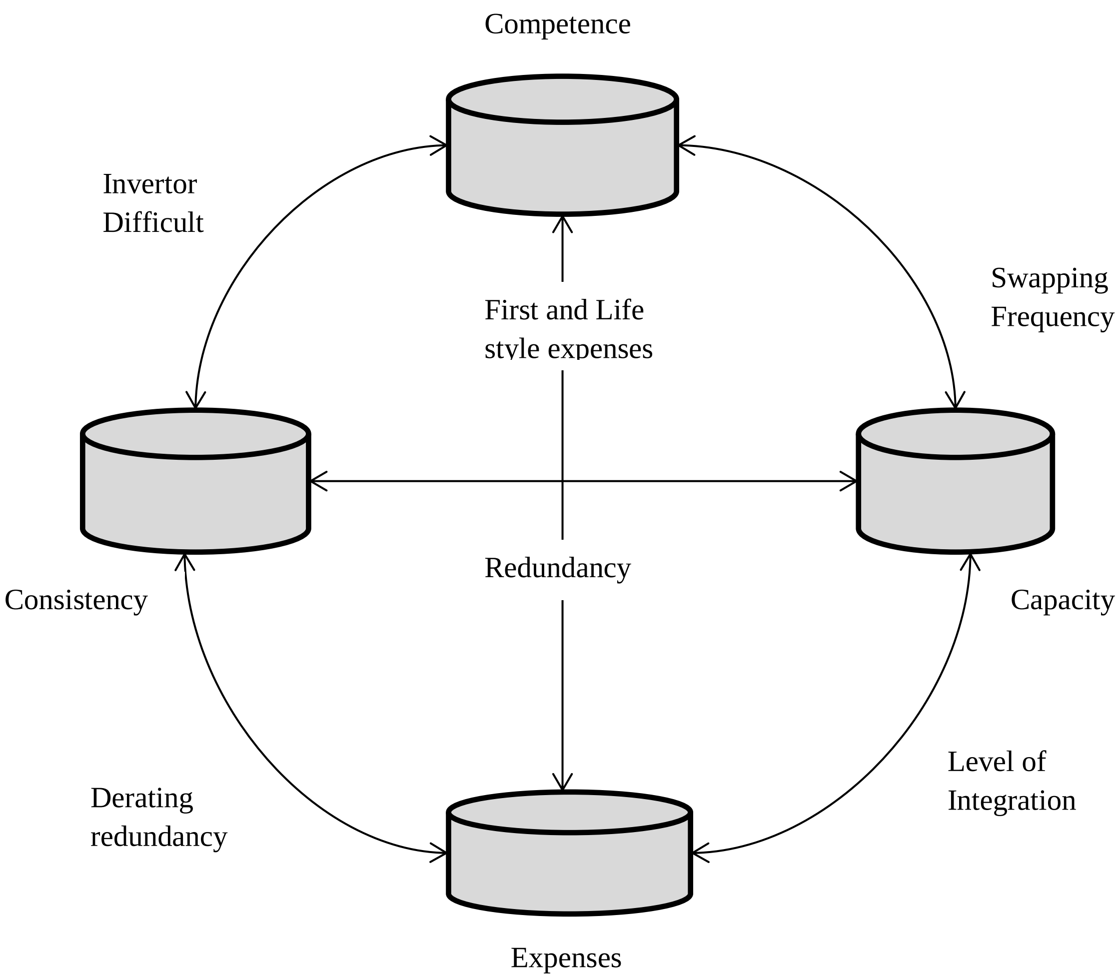

Figure 1.1. AI aids in power electrical converter optimization

Electrical devices used to convert electrical energy are called power converters. A current's amplitude or frequency can be altered, as well as alternating current, or AC, being converted to direct current (DC) and vice versa. Smartphones, computers, televisions, renewable energy sources, and electric cars are just a few of the devices that require power converters. Consequently, it does not provide an exhaustive analysis of AI algorithms and their applications in power electronics. This paper seeks to close this gap by providing a thorough, life-cycle-based evaluation of published research on AI approaches in power electronics, which has yet to be systematically consolidated. The following are among the contributions made by this article:

I. The relationships between the pertinent AI algorithms, their primary purposes, and the pertinent implementations are found by a methodical life-cycle analysis of the AI algorithms used in power electronics.

II. The historical turning points of AI algorithms and power software are depicted in a timeline diagram. Additionally, it provides quantitative data on application trends and technique utilization proportions.

III. The benefits and drawbacks of AI algorithms are thoroughly examined, and sample applications are offered at every stage of the technology's life cycle, along with a discussion of the difficulties and potential study areas.

This article's remaining sections are arranged as follows. The uses, approaches, and turning points of artificial intelligence in power electronics are covered in Section 2. Sections 3 cover the design, control, and maintenance applications of AI, respectively. In Section 4, an outlook on AI applications for power electronics is presented. Section 5 brings this article to a close.

2. LITERATURE REVIEW

Jiang, Y. et.al [3] Machine and electronic engineering is not a stand-alone subject; rather, it is an extensive field that encompasses many different disciplines. During the design process, engineers take into account the system arrangement, specific goals, and various technologies, including production, management, and other technologies. They then use a variety of strategies to integrate these innovations closely, thereby completing the entire design process. Unlike other items, which consist of various parts, physical and electronic devices have a relatively straightforward construction.

An, N., Wang, L., et.al [4] AI is playing an increasingly significant role as new technologies are discovered and introduced. Businesses and manufacturers are likewise striving for better productivity at the same time. In order to guarantee the highest interest rate, they should also make sure that the rate is correct. This means that our research is essential since it has significant practical significance. AI and applied science are very limited in what they can discuss when it comes to the relationship between the two. AI can think beyond logical reasoning, according to some perspectives.

Dragičević, T., et.al [5] Historically, redundancies have been one of the most attractive ways to give computers the ability to withstand failures. Even while the redundant design is quite successful in this regard, it usually results in a large increase in the system's size and cost, which lowers its level of competition in the market. An alternative approach involves choosing individual converter parts, such as switches, inductors, and capacitors, which have adequate thermal and electrical stress margins. This approach is expected to result in low failure rates for these components and, ultimately, good system dependability.

Han, Y., Li, D., et.al [6] In Mid-17, the concept of AI made its debut during the 1800s. It was during this time that scientists from abroad created the first computer ever. The world's attention was drawn to this computer solely by its outward appearance at that time. A key element in ushering in a new era of networks is the first computer's enormous size and ease of use. The Fifth World Joint Symposium on AI took place after the turn of the 20th century. Artificial intelligence has entered a rapid development stage as a result of governments paying much more attention to the subject after the summit. The globe was overtaken by the internet at the start of the twenty-first century.

Li, B. H., et.al [7] The intelligent production system is used to apply artificial intelligence to the field of smart manufacturing. It makes little sense to apply AI outside of intelligent manufacturing systems. Intelligent manufacturing systems are characterized by autonomous intelligent detecting, interconnection, interaction, education, evaluation, thinking, decision-making, oversight, and management of human, machine, substance, surroundings, and data in the whole system and life cycle against the backdrop of the "Internet plus AI." The system is comprised of several layers, including resources and abilities, ubiquitous system, service device, smart cloud service use, security oversight, and standard requirements system.

Shi, Q., Dong, B., et.al [8] The work offered here offers a timely overview of wearable electronics, taking into account the recent advancements in this sector. It covers developing substances, generating mechanisms, architectural arrangements, usage, and the fusion of advanced technologies. Initially, a summary of the advancements in wearable electronics and optics is provided for uses in chemical and physical detecting, human-machine interaction, display interaction, and other areas. Second, wearable electronics systems that are self-sufficient and have integrated power capture and preservation technologies are showcased.

Zang, J., et.al [9] The National Bureau of Standards (NBS) released the "Web plus" action plan on March 22, 2016, which included 48 important projects and 8 significant actions. This plan was created in compliance with the State Council's and the CPC Central Committee's decision-making strategy to support information building, reform, and development. During the "13th Five-Year" term, digitization will follow the worldwide technological trend. Following the national informatization plan as a guide, it will actively assist the creation of "Internet+" and completely support advancement, aid, reformation and growth, safeguarding resources, conservation, and economic growth initiatives.

Gupta, C., et.al [10] This field is expanding quickly and has seen significant growth in the last several years. We should anticipate further advancements in the future as AI continues to evolve. AI is being developed to complement human decision-making as well as assist with everyday tasks. Expert systems were used in the early stages of AI; they were designed to advise and assist human users in making decisions. Prologue, LISP, and other rule-based programming languages were used in the development of these expert systems. The subsequent phase was natural language processing, which improved machine comprehension of person's speech by transforming words into text that could be read by computers.

3. METHODS AND MATERIALS

3.1 Artificial Intelligence

Artificial intelligence struggles to fully encapsulate the mysteries of human intelligence due to a multitude of circumstances, making it impossible for scholars to agree upon a single definition of the field.

3.1.1 Benefits

The use of AI technology has greatly improved and benefited people's lives. When combined with other human tools and materials [11], AI technology has fundamentally altered people's routines and given their lives new meaning.

People's lives are improved and made smarter by computational intelligence.

3.1.2 Drawbacks:

Individual privacy has been compromised by AI advancement.

- The following is a quick introduction to some of the commonly used artificial intelligence algorithms used in network reconstruction, including the expert system's genetic algorithm, simulated annealing technique, human king neural network, and particle swarm method.
- The virtual annealing method helps to speed up the pace of the SA algorithm by choosing a suitable divergence index based on temperature differences.
- Particle Swarm method: The PSO method reconstructs the problem using binary coding. There are numerous uses for the PSO algorithm's improvement in reconstruction.
- The world has become more competitive as digital data has grown quickly in recent years. It has developed into one of the global economy's most significant strategic industries.
- Several nations have elevated the electronic information sector to the top of their national agendas to compete at the highest level in the industry. Over the last ten years, there has been a notable development in our nation's digital data industry. The industry's strength, revenue as a percentage of GDP, role as a catalyst for economic expansion, and influence on growth have all increased. The growth of the electronic information manufacturing sector has received an increasing amount of attention.

3.2 AI Features and Approaches for Power Electronic Systems

An overview of the techniques, features, and flow diagram of AI for electrical engineering is provided in Figure 3.1 [12]. It is evident that AI has been widely used in the three unique life-cycle phases of electrical and electronic systems—design, oversight, and repair.

The primary purposes of AI are classified as optimisation, regression, classification, and data architecture exploration. AI serves as a functional layer between power electronic applications and other apps.

- When given constraints, equalities, or inequalities that the solutions must satisfy, optimization is the process of finding an optimal solution that maximizes or minimizes objective functions from a set of feasible alternatives. For instance, in a design task, optimization is a tool used to investigate an optimal set of variables that maximizes or minimizes design goals with design constraints.
- Labelling input data or information with a label designating one of the k distinct classes is the process of categorization.
- In maintenance, finding anomalies and fault diagnosis are two common classification duties used to identify fault labels using condition monitoring data.
- Regression analysis aims to predict the outcome of one or more continuous target variables given input data by establishing the link between input and the target variables. A regression model, for instance, can be used to facilitate an intelligent controller by establishing a relationship between the input electrical impulses and the resultant control variables.
- It is made up of three main components: compressing data, which projects dimensional data down to low-dimensional data for feature reduction, density estimation, which ascertains the distribution of data within the input space, and data clustering, which finds groupings of related data inside files. For instance, under the field of data structure investigation is the deterioration state clustering in upkeep.

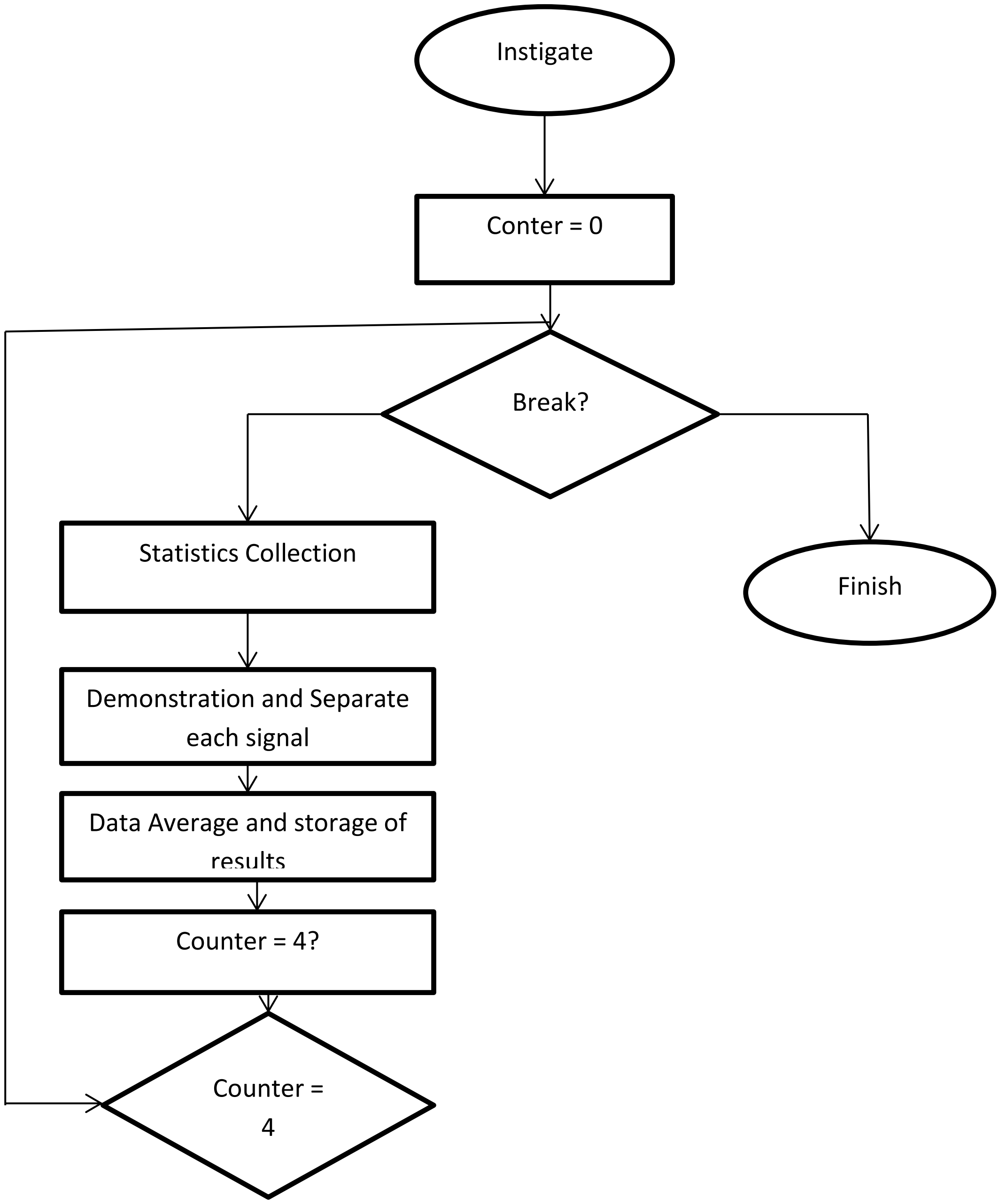

Figure 3.1 flow diagrams for the created programme

3.3 Dependable AI Instruments

One of the grid infrastructure's mission-critical components is PES. The comprehension, transparency, and legitimacy of AI tools must be examined in order to reduce the "black box" barrier and guarantee the dependable application of these tools. As of right now, the majority of programmers claim to be very accurate for a given task. But rarely are the sensitivity and resilience of the AI tools examined.

Apart from evaluating the correctness of the model, it is necessary to conduct a quantitative assessment of potential bias and uncertainty and investigate the causal relationship between AI tools [13]. Establishing the AI tool inside the Bayesian framework for enabling unpredictability quantification capabilities is one workable solution.

The first inputs for the PES condition tracking are often electrical or electro-thermal information. These could be:

- The data that is now available for control and protection, including the heat-sink temperature, case temperatures, dc-link voltage, conversion input/output voltages and currents; and o In extra measured data for condition monitoring, like an IGBT module's on-state saturated voltage and a capacitor's ripple power.

3.4 Artificial Intelligence Research Directions

3.4.1 Expert System

A software system known as an expert system (ES) is designed to capture human expertise and support decision-making. It is particularly helpful in situations when there is a lack of information or a high volume of complex information. Expert networks are especially helpful for online activities in the control domain because they can explain and validate a line of reasoning in addition to incorporating symbolic and rule-based information that links situations and activities. Figure 3.2 illustrates the core components of the ES, which include the knowledge foundation, databases, translation mechanism, thinking machine, gathering information, and graphical user interface.

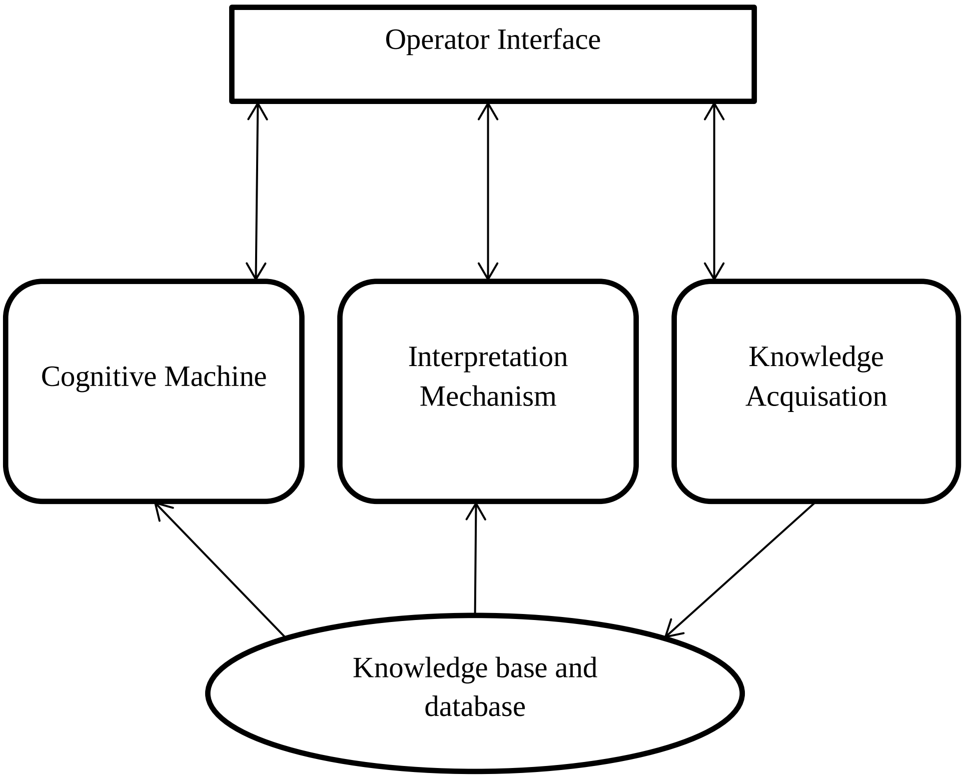

Figure 3.2. The expert system's sketching

4. IMPLEMENTATION AND EXPERIMENTAL RESULTS

While the firefly algorithm was first being initialized, some of the fireflies were dispersed at random throughout the troubleshooting region. These fireflies have roughly the same fluorescent dye content when they first emerge. The objective of the event: each firefly's fluorescein value is derived from the separation between its current location and the solution's ideal location. The firefly's fluorescence content increases as it get closer to the solution's ideal position. Fireflies use the following communication method: The fluorescein content of a firefly is determined by its tail color; all fireflies belong to a single group. The more adept one is at drawing in and interacting with another firefly, the more the other fireflies will adapt to the presence of fluorescein and migrate toward the taller fireflies on their own.

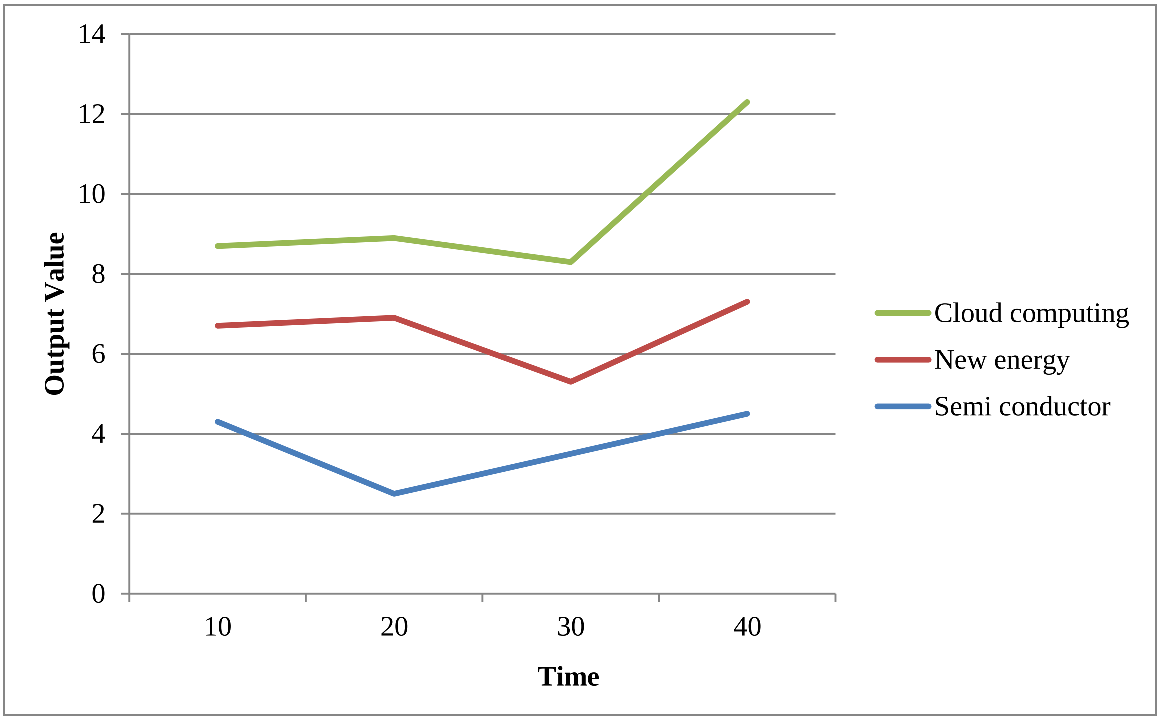

Figure 4.1 Variations in the electronic information sector's domestic output value

The modern electronic information sector in our nation is driving the social and economic development of our nation and is steadily rising to the top of the continental business hierarchy [14]. The change in the overall output value of the domestic electronic computer technology industry is depicted in Figure 4.1.

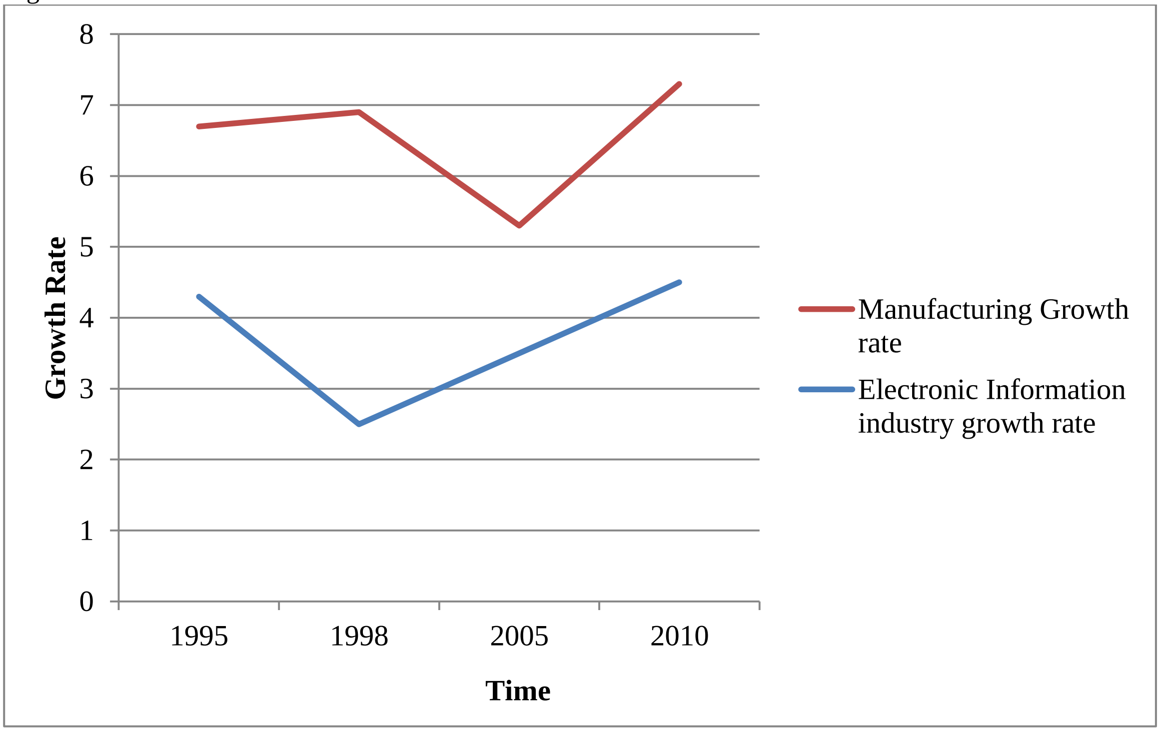

Figure 4.2 Rate of expansion of the national electronic information sector

The national electronic information industry grew at a rate faster than the manufacturing sector between 1997 and 2000, as Figure 4.2 illustrates. It went through the beginning, expansion, and mature stages before entering the twenty-first century. As a result of the manufacturing industry's growth pace, its growth rate started to lag.

4.1 Analysis of Predictive Model Experiments

4.1.1 Benefits of SVR Mode Analysis and Optimisation for SVR Prediction Models

- A solid theoretical foundation is provided by the framework, and the idea of minimizing structural risk can be employed.
- This model can finally become a secondary planning problem by solving the tiny sample problem efficiently.
- The support vector dictates the topological structure of the support vector machine. The classic neural network is concealed due to its heavy reliance on the user's numerous attempts on the network topology.

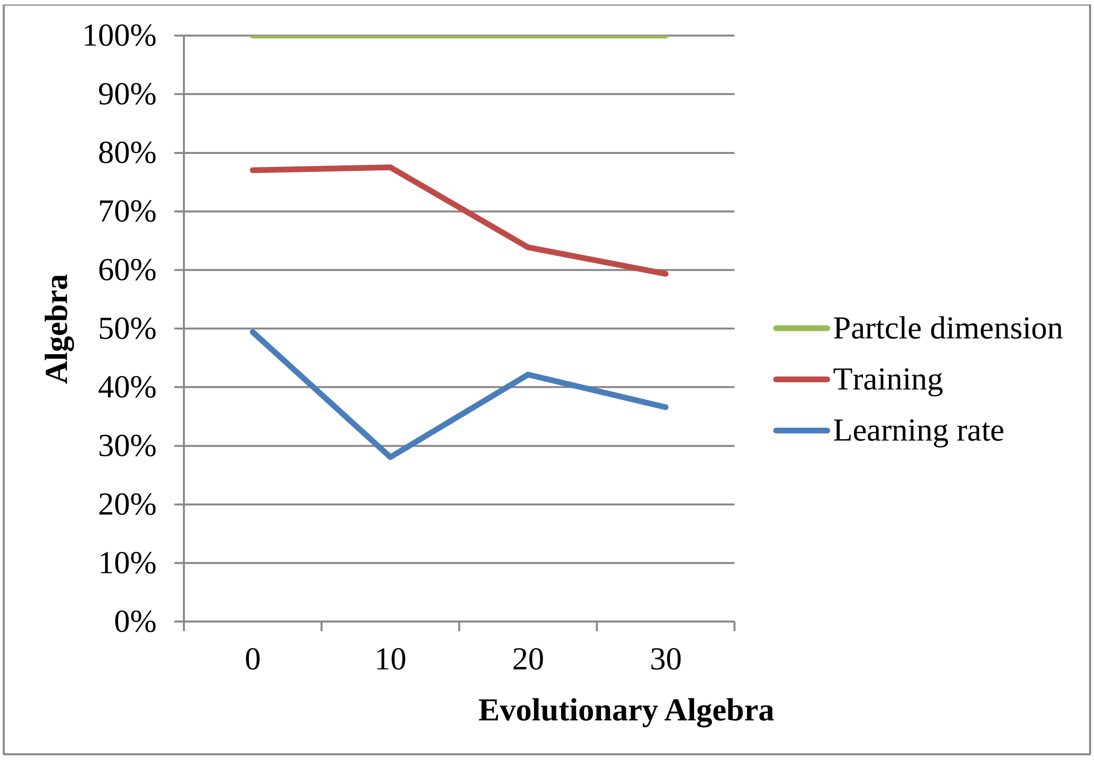

Figure 4.3 Fitness Trend

This section describes how the SVR prediction model is constructed and optimised to avoid the standard neural network's over-reliance on the user's frequent experimentation with the network topology. An ideal classification surface is created in order to address the issue of separating the two samples. AI is integrated with air quality electronic monitoring equipment to provide real-time monitoring, early warning, and forecasting through the analysis of the neural network early warning and prediction model. The neural network beforehand forecast model's validity and superiority in predicting outcomes are both confirmed. E-discovery defines the path of development for the use of electronic data.

5. CONCLUSION

One significant outcome of human scientific and economic progress is electronic information technology. It is extensively utilized throughout all societal domains, and its potential for growth and application is boundless. The present investigation provides an overview of the state of electronic information, develops an algorithm utilizing statistical connection, and examines the feature extraction technique for electronic information in light of this method.

AI techniques used in power electronic systems can be divided into three categories based on their applications: design, control, and maintenance. In each stage of the life cycle, the features, requirements, application trend, and usage % of AI are covered. Applications connected to AI are mostly concerned with optimization, prediction, regression, and data structure investigation from a function standpoint. A timeline map is created by identifying and classifying the significant dates for pertinent algorithm variations and applications. Illustrative examples, problems, and opportunities for future research are addressed for each life-cycle phase.

But the Internet of Things' artificial intelligence technology is still in its experimental stages and is not yet sufficiently developed. By reducing or completely preventing tragedies, it offers a more certain guarantee for worker safety. Because of this, the application of artificial intelligence, Internet of Things technologies, and electronic information engineering ought to be done so in a methodical and reasonable manner.

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