Analysis of Artificial Intelligence Based Electronics Engineering Automation Nanotechnology and its Applications

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ABSTRACT
This article looks at how electronics engineering is using artificial intelligence (AI) and how this could revolutionize the field. AI-based systems have the potential to improve performance, reduce energy consumption, and increase system reliability. An overview of the most current advancements in electronics engineering's design automation, testing and diagnostics, production, maintenance, and control systems domains is provided by the study. Artificial intelligence (AI)-driven design automation tools streamline the design process by reducing costs and development time while improving accuracy and efficiency.

Keywords: Applications , Artificial intelligence, Electronics, Internet of Things , Testing, Nanotechnology

1. INTRODUCTION

Explainable AI to improve edge camera performance and fairness the increasing application of Artificial Intelligence (AI) in Edge camera systems for human detection has resulted in precise yet intricate models that are difficult to understand and troubleshoot. Our study offers a diagnostic approach for model debugging that leverages XAI and expert-driven problem detection and solution generation. We identified the training dataset as the primary source of bias in our validation of the Bytetrack model in a real-world office Edge network, and we proposed model augmentation as a workaround. To create fair and reliable models, our method assists in identifying model biases.

A Plan to optimize AI neural processor utilization on an automotive computing platform the automobile sector is changing as a result of AI advancements, opening up prospects for hardware and software that uses AI. Because AI-driven technologies in cars have the potential to greatly enhance the driving experience, they are becoming more and more popular. Using NPUs in particular, high-performance computing becomes essential for implementing the AI characteristics. DAIMO-NPU improves the inference sequence of the DNN models, which are the foundation of the AI features, in order to increase the effectiveness and use of NPUs. It facilitates the organization and scheduling of the model inference jobs as well as their execution on various NPU settings. The DAIMO-NPU implementation consists of three primary parts. Every time an AI feature is added, removed, or upgraded, a thorough plan for the model inference jobs must be created by the schedule-table generator. The onboard operator completes the tasks in accordance with the schedule table after reading it. Additionally, the schedule table can be further streamlined by breaking models up into smaller, optional segments. The incorporation of further NPU hardware characteristics into DAIMO-NPU will be explored in the ensuing improvements.

2. Artificial Intelligence (Ai) Electronics

The data revolution in electronic manufacturing AI/ML combined with digitization in order to meet market needs and overcome supply chain obstacles in the modern day, data collection and analytics are essential. In order to remain competitive, electronic devices of today must meet ever-higher standards of quality and reliability, as well as rising complexity. Known as "factory digitization," it is made possible by contemporary technologies like Manufacturing Execution Systems (MES), which combine machine data and the Internet of Things (IoT) to record a complete digital history of product testing and manufacturing. These solutions leverage web scale technologies that offer plug-and-play data connectivity, reduced support costs, and quick adoption, allowing businesses to be flexible and quick-thinking in the face of an increasingly complicated industry. The next generation of manufacturing innovation applied AI/ML is being unlocked by factory digitization, which produces highly contextual data. This wave is presently passing through testing, backend assembly, and semiconductor fabrication. is currently encroaching on the SMT sector. This article discusses the main aspects of how Factory Digitization is necessary for AI/ML to be embraced, the challenges and dangers associated with putting this digital transformation into practice, and how the correct infrastructure and AI/ML methodology may give electronics manufacturing tremendous competitive advantages.

Real-time machine learning-based pothole detection using drones on a variety of Edge AI devices finding potholes is a crucial part of maintaining and improving road safety. Potholes on the road can harm automobiles, put drivers in danger, and raise maintenance expenses. Early pothole identification can help drivers navigate more safely. It can also be used to notify the local government body of the potholes' position so they can take appropriate action. In this paper, we used two object detection models, YOLOv5, YOLOv7, and YOLOv8, to detect potholes. We then used the trained models on Edge AI Devices for inference in real-time.

3. Applications

New VLSI technologies for high-Performance Applications in AI and ML the capabilities of machine learning (ML) and artificial intelligence (AI) algorithms are always growing, requiring high-performance and effective hardware systems.

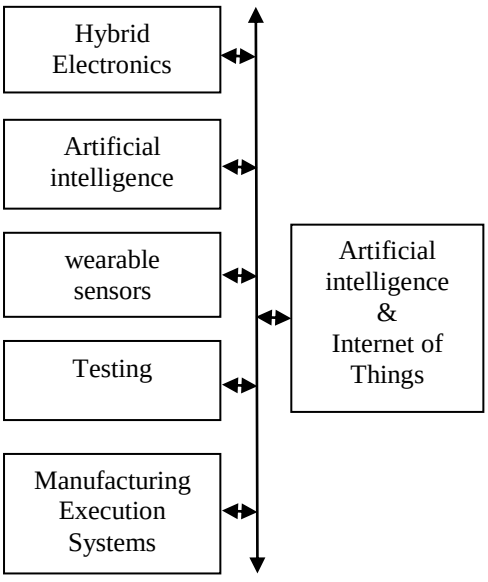

Fig 1. Block diagram

The looked into the development of VLSI-based hardware accelerators designed to efficiently handle the demanding workloads of machine learning tasks. We have also looked into low-power VLSI architectures that maintain computational capacity while lowering power consumption to address energy efficiency problems in AI and ML systems. Power management techniques and enhancements to circuit design are examined in order to strike a balance between energy consumption and performance. In order to handle the complexity and scalability of AI and ML systems, the study places a strong emphasis on hardware-software co-design methodologies. Specifically, it takes into account the integration of VLSI-based hardware accelerators with software frameworks to gain optimal performance and flexibility. We also looked at the state-of-the-art VLSI technology that could be used to enable strong ML and AI applications.

These technologies, which include neuromorphic computing, approximation computing, and in-memory computing, have the potential to greatly increase the speed and efficacy of AI and ML algorithms. The study also addresses the problems of creating VLSI for AI and ML algorithms, as well as potential solutions for issues with data mobility, memory management, scalability, and design complexity.
Intel's UP Squared board. In addition to being assessed on a specific test dataset, the models are put to the test in real-time ambulance identification scenarios using drone footage. The experimental results successfully show our approach's efficacy in practical situations. The YOLOv5 and YOLOv8 mean Average Precision (mAP50-90) figures show how well they perform in real-time inference and drone-based ambulance detection, respectively, at 0.723 and 0.979.
Applications such as transportation systems, traffic management, and intelligent emergency services might benefit from this in real-world scenarios. Our study adds to the body of knowledge in ambulance detection and categorization by shedding light on the efficacy of machine learning methods.
Utilizing cloud computing, big data, and AI in Smart factories .A new AI economic form is produced when big data, cloud computing, and artificial intelligence (AI) are combined as tools to increase intelligence and better comprehend and change the world.

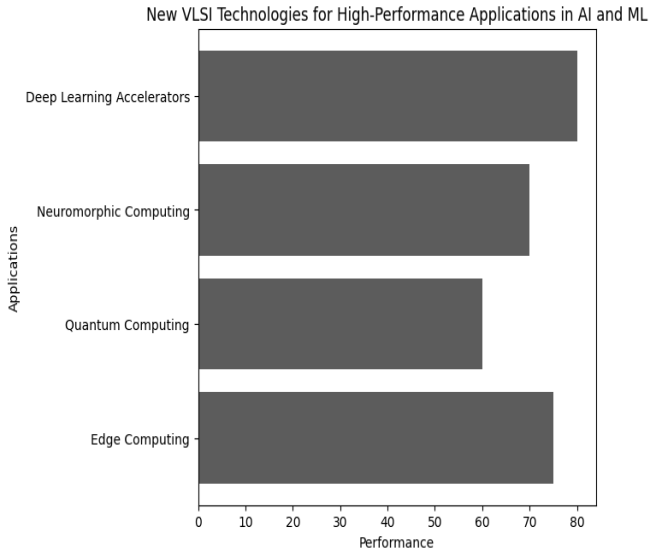

Fig 2. New VLSI Technologies for High-Performance Applications in AI and ML

4. Hybrid Electronics Applications

Sports biomechanics wearable sensors with internet of things Sport biomechanics is the research of how athletes move when competing in sports. Its objectives are to decrease the risk of player injury, give coaches practical resources and athlete training recommendations, and assess athlete performance objectively. When playing sports, the user can wear small sensors that watch their motions and gather data. This research aims to develop wearable, low-cost bionic sensors that can track biomechanical, bio vital data, workload, and functional motions. This lowers injury rates while enhancing sports performance. Players should be able to access physiological data from wearable sensors on a continual basis. This data can then be utilized to create individualized, non-restrictive training programmers. Athletes should be obliged to wear sensors.
Wearable healthcare applications with flexible Hybrid Electronics nevertheless, the scarce clinical resources and medical staff are unable to meet the increasing demands outside of hospitals modules, wearable technology such as smart watches can offer personalized, real-time bio data collecting in addition to improved health management with the use of artificial intelligence. Flexible hybrid electronics with ECG SiP incorporated was suggested, offering a reduced profile and more structural flexibility, to provide a more comfortable experience. Examined was the patch's durability through a 100,000-time rolling test that mimicked conditions of daily use.
Assessing electronic component testing using AI-powered test enhancement before putting an AI strategy for testing into practice, a number of hazards must be taken into consideration because of the customization from chip to chip. In summary, AI-enabled solutions have the potential to enhance current manual testing techniques and provide new test services. A new regulatory framework is also advised to keep up with the rapid advancement of emerging technologies like artificial intelligence..

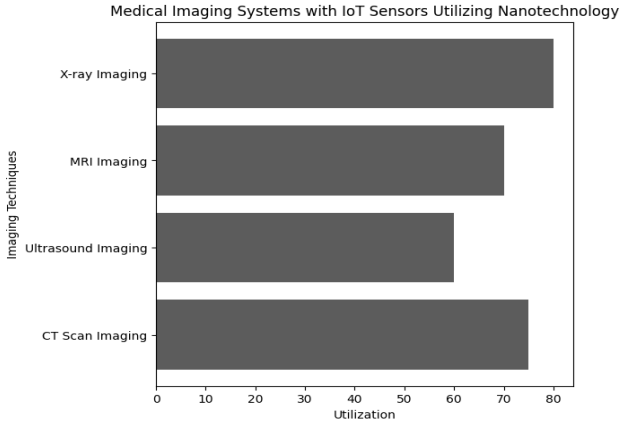

Fig 3. Medical Imaging Systems with IoT Sensors Utilizing Nanotechnology'

Emergency services, such as fire departments and ambulances, are vital foundations for any nation. There are times when patients' health and safety are at risk due to ambulance delays arriving at hospitals. The reason for this delay is frequently traffic congestion. Due to the increase in traffic these days, it's critical to immediately identify and locate ambulances in order to expedite emergency services and save lives. In this research, we have suggested a machine learning approach to recognize and detect ambulances.

5. Internet Of Things Electronics

Integration approach for interactive systems that are standalone compliant for added internet of things electronics outline the rationale and sources of inspiration for choosing my doctoral topic, discuss the work completed thus far, and offer a quick preview of what is ahead. My goal is to improve the usefulness of objects, people, and plants by offering them adaptable, affordable add-on systems that can be integrated with Internet of objects (IoT)-based systems to make everything smart. The selected a research question for each subcategory in an attempt to identify plausible answers. Developing an acoustic sensor for people that uses foil and is specially designed to monitor wheezing through the diaphragm. Next, match filtering will be applied to distinguish between various wheezing noises. In order to monitor the microclimate along plants more precisely, The creating a flexible, stand-alone, ultra-lightweight platform that looks at the leaf rather than the soil. To keep an eye on the condition of the pills, The intend to add temperature and humidity sensors based on paper. Since paper sensors cannot be soldered, it is difficult to devise an integration strategy for using them in electronic systems.

6. Integrating Internet Of Things (Iot)

Unlocking IoT Integration's Potential for Smart Home Energy optimization in order to bring in a new era of energy-

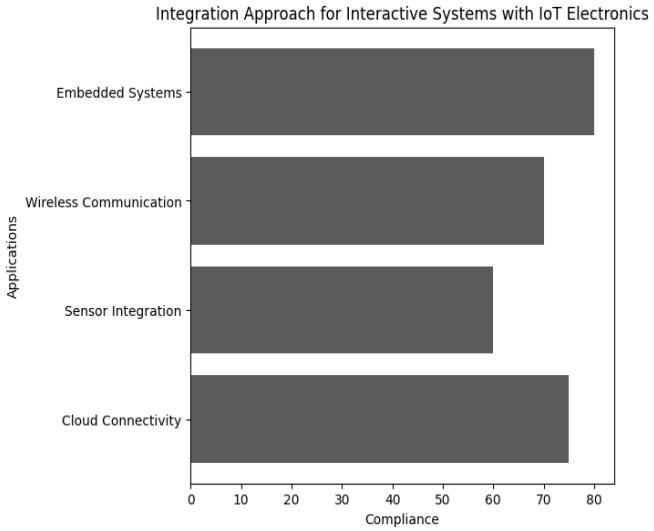

Fig 4. Integration Approach for Interactive Systems with IoT Electronics

efficient living, this research study investigates the revolutionary potential of integrating Internet of Things (IoT) devices with smart home technology. With an emphasis on energy optimization, the paper investigates how a complex web of interconnected devices forms effective home environments. starting with an examination of particular gadgets, including sophisticated lighting controls and thermostats By carefully examining user behavior, it reveals how these gadgets shape and affect home energy usage. The study highlights data analytics and demonstrates how information processing may be used to provide individualized, effective energy management. It offers creative answers for smooth IoT integration, addressing issues like privacy and interoperability. An environmental evaluation that highlights the mutually beneficial interaction between IoT and smart homes in promoting a sustainable and environmentally friendly future rounds out the research.

7. Wearable Device With Multiple Sensors

Utilizing an audio Wearable Device with multiple Sensors for sleep analysis, wellness monitoring, and forecasting

in the fast-paced, socially complicated world of today, sleep is frequently disregarded or undervalued.

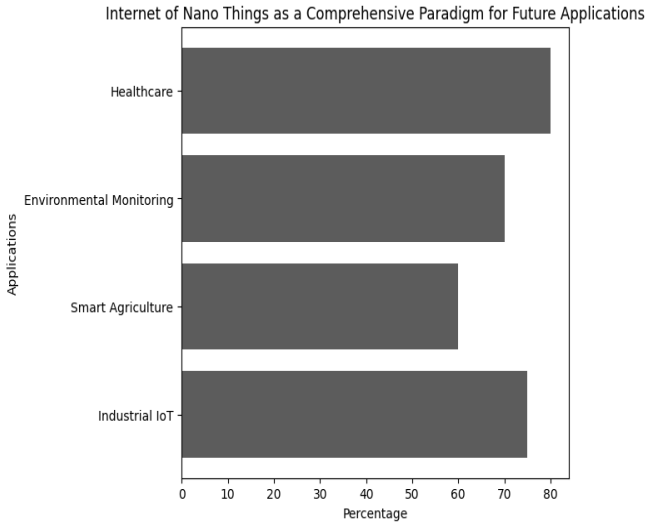

Fig 5. 'Internet of Nano Things as a Comprehensive Paradigm for Future Applications

It is astonishing to discover that a number of illnesses and disorders have a clear correlation with chronic sleep deprivation. Sleep has a direct impact on an individual's physical and mental health.

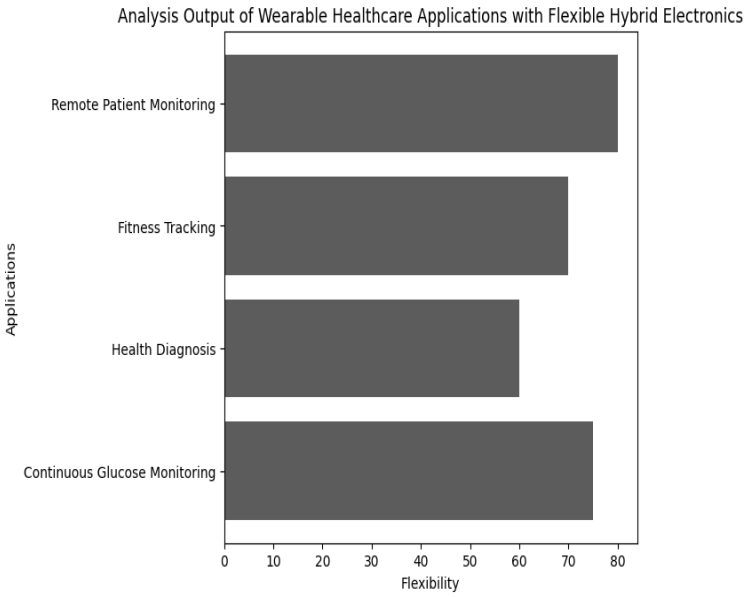

Fig 6. Analysis Output of Wearable Healthcare Applications with Flexible Hybrid Electronics

Even while many would agree that having poor quality sleep is an issue, there aren't many widely accepted, tried-and-true alternatives.

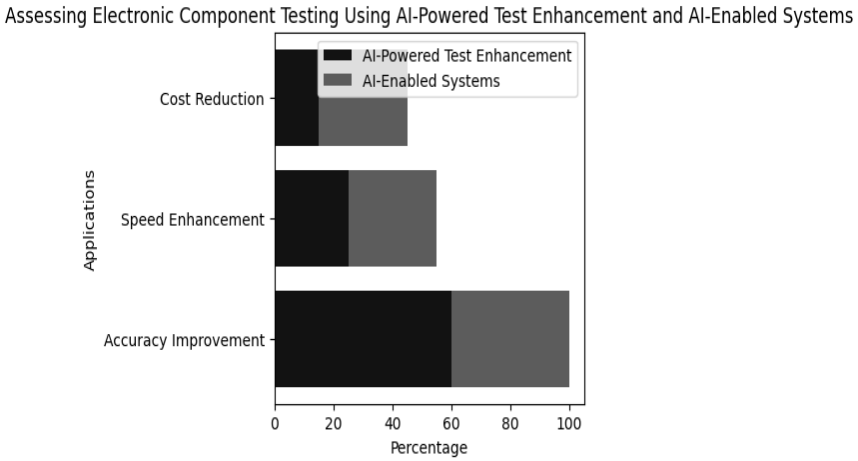

Fig 7. Assessing Electronic Component Testing Using AI-Powered Test Enhancement and AI-Enabled Systems

The main obstacle to getting a decent night's sleep has been shown to be calming down a racing mind. This work describes how to help and analyze sleep using audio and sensor data. An individual's overall well-being can be enhanced by extending the intelligence obtained from the sensor data. Sleep analysis and health tracking employ historical data.

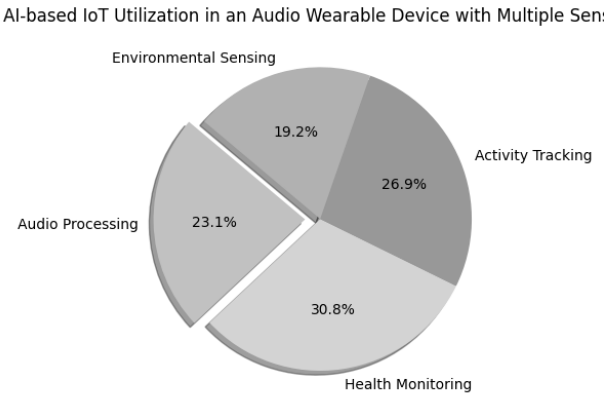

Fig 8. AI-based IoT Utilization in an Audio Wearable Device with Multiple Sensors

The device's processing of sensor and audio data will yield a variety of data points. Positive and negative trends and events related to wellbeing can be forecasted using a variety of data. Either positive reinforcement or a warning to seek necessary medical attention would be provided by these predictions.

CONCLUSION

Early defect detection and diagnosis by AI-powered systems reduces costs and downtime. AI-driven industrial solutions increase efficacy, cut waste, and maximize efficiency. AI-based maintenance techniques increase equipment reliability while lowering costs and downtime. Artificial intelligence (AI)-powered control systems boost stability, lower energy usage, and enhance system performance. New strategies and applications that push the limits of electronics engineering are probably going to emerge as AI develops. It is imperative to tackle issues like job displacement, moral quandaries, data security, and privacy. However, with enough thought and preparation, the use of AI in the electronics sector has the potential to significantly progress a number of enterprises and industries.

Assessing electronic component testing using AI-Powered test enhancement AI-enabled systems have the potential to enhance current manual testing procedures and provide new test services. A new regulatory framework is also advised to keep up with the rapid advancement of emerging technologies like artificial intelligence. IoT nanotechnology sensors with high sensitivity for better data processing and

acquisition.The Internet of nano Things is thought to be a comprehensive paradigm for applications in the future, utilizing enhanced technical expertise in data classification and collecting The research demonstrate that, in comparison to alternative approaches, the suggested model utilizing an IoT sensor with nanotechnology is efficient in obtaining data at a greater response and accuracy rate.

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