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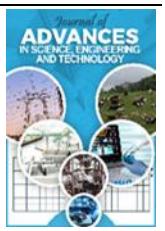

Editorial

The frontier researches in science, engineering and technology are rapidly developing day by day. These frontier topics in research today are at the intersection of multiple disciplines, and a breakthrough in one area of research often drives progress in others. The rapid pace of technological innovation that we often hear about today means that these frontier topics will continue to evolve, potentially shaping the future in unimaginable ways. More so, the technologies under development are interrelated and integrated (Duran & Sengil, 2019). Their application in research and industry often requires the use of more than one technology. Therefore, this brings a new era in technologically interrelated research, where researchers must take an interdisciplinary approach in solving problems. The current trend and the direction frontier topical research in science, engineering and technology is taking is difficult to predict. The aim of this editorial is therefore to highlight the future frontiers of science, engineering and technology that we would all do well to know more about. Fig. 1 shows the interdependence and linkage between frontier research topics in science, engineering, and technology. It can be observed that AI and machine learning links with many research disciplines for supportive purposes and integration. The parting question for this article is "which of these topics interests you? How can research advances in these topics be used to enhance your work? Alternatively, do you have a specific area that you would wish to explore further?

While Artificial Intelligence (AI) can help ease the access to data and information that is required by various sectors of the economy or predict scenarios, machine learning on the other hand can be leveraged to make prediction and obtain improved data for research. AI can be linked to advanced manufacturing and robotics. Notable applications of advanced manufacturing and robotics are in 3D printing and materials design, applications in automation that is applicable in industry, logistics and healthcare, as well as in smart manufacturing. AI also can inform nanotechnology trends, as well as enhance the material science technology. Nanotechnology finds application in medicine and health related fields as in novel diagnostic instruments, imagery and methodologies, tissue engineering, targeted medicinal products, biomedical implants and pharmaceutical products (Haleem et al., 2023). Of interest are the Self-Healing Materials that can repair themselves when damaged, with applications in construction, electronics and aerospace. High-Temperature Superconductors attracts a lot of interest because these special superconductors can work at higher temperatures, which could revolutionize energy transmission, magnetic levitation and other power applications (Chen et al., 2004). Securing advances in digital technology has yielded Blockchain and Decentralized Technologies that find application in Cryptocurrencies, secure voting systems and identity verification. In addition, the decentralized technologies have found use in scalability, efficiency of processes and systems, and data and digital assets.

Energy of the future has attracted a lot of research interest and more so, in exploring the different types of hydrogen for energy source; the blue, grey, green, turquoise, and brown hydrogen that have no significant carbon dioxide emissions. Other researchable topics that are ongoing are in fusion energy, carbon capture and utilization, and advanced nuclear power (Liu 2024). In climate science modeling and general environmental modelling, many assumptions are used (Pirtle, 2010). It will be interesting if the current models are improved for accurate prediction on climate and environment phenomena. Blockchain find application in financial services such as in security for digital assets, payment remittance and other private/public service delivery (Peters et al., 2015).

Researchers have developed technologies that can be used for efficient running of smart cities. Example of such applications are the sensors that are used in various technologies, application in AI, networking, cloud computing, urban analytics and internet (Hassankhani et al., 2021). Frontier research in this area of smart cities and urban technology are in transport, for instance autonomous vehicles and drones. In addition, we can research on modern technologies in urban farming. Quantum biology has

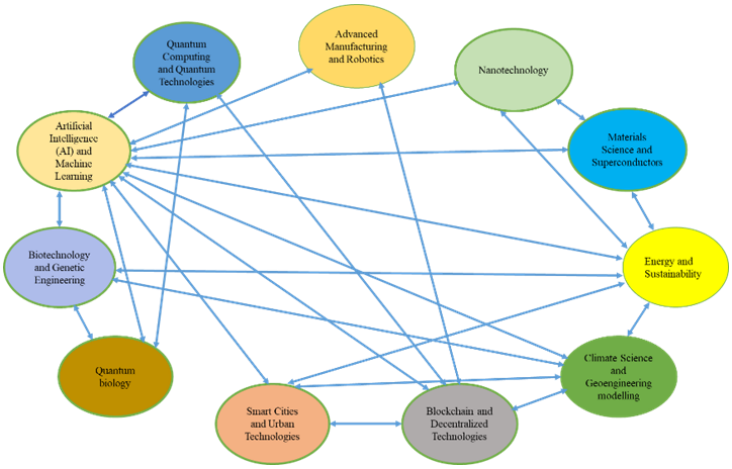

Fig. 1: Interdependence and linkage between frontier research topics in science, engineering, and technology.

attracted interest from researchers. Quantum biology therefore presents opportunity for understanding protein folding, genetic engineering, photosynthesis and DNA mutations. Topical issues within this field of study will involve DNA extraction, gene cloning and modification. Some of the frontier research in the area of Biotechnology and Genetic Engineering are in synthetic biology is creating new organisms or modifying existing ones to solve problems like energy production, carbon capture, or drug production, using genomic and other data to tailor treatments to individual patients. (Khoshandam et al, 2024).

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