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Quantum Technology in Medical Diagnosis

Kahksha Ahmed[1], Mohd Arsalan[2], Prashant Kumar Sharma[3], Puneet Garg[4]

[1,2,3]SAITM Gurugram, Delhi NCR, India

[4]KIET Group of Institutions, Delhi NCR, Ghaziabad, India

kahkasha.ahmed@gmail.com, shekabbass@gmail.com, prashant_25mca042@saitm.ac.in, puneetgarg.research@gmail.com

Abstract: The development of quantum technology has advanced rapidly to become a critical transformative device for use in medical diagnosis and treatment, surpassing the boundaries of normal methods. By applying principles such as superposition, complexity, and quantum tunnelling in QDs, it is now possible to produce highly sensitive equipment that can diagnose diseases at their earliest stages. Quantum sensors enable tracking physical characteristics with nuclear accuracy, helping detect molecular alterations before symptoms appear. Quantum computing increases diagnostic capabilities by rapidly processing large therapeutic datasets, enabling the recognition of various patterns and gene sequences and the immediate suggestion of personalised treatments. Combining QD with IoT and AI-based healthcare systems creates an ecosystem that enables continuous monitoring, future-state analysis, and instant decision-making. This kind of cooperation is expected to yield good results in the case of neurodegenerative and infectious diseases. However, implementing QD in medical diagnostics faces several significant obstacles, including high growth costs, scalability issues, technical immaturity, and regulatory gaps. Nevertheless, further work is going on despite these limitations. The current chapter will focus on the technical basis, present uses, limitations, and future of quantum technology in diagnosis.

Keywords: *Quantum Technology, Quantum Sensors, Quantum Tunnelling, Internet of Medical Things (IOMT), Quantum Diagnostics, Quantum Technologies.*

1. Introduction: Language at the Digital Frontier

This is a new and rapidly evolving area of technology that uses the principles of quantum mechanics to build devices and systems with superior performance to their classical counterparts. This marks a revolution in how we manipulate data, energy, and matter at a fundamental level [57][1]. No longer limited to physics, quantum technology is being applied in domains such as cryptography, communication, computation, and, recently, medicine. Quantum technology promises the ability to provide vital diagnostic instruments that can perform sweeps at gigahertz speeds, with high sensitivity and specificity at the molecular level. Such innovations could lead to earlier diagnosis, better disease treatment, and improved patient outcomes.[56][59][58][70].

1.1. Quantum technology defined

The science behind the designing and utilization of quantum-based systems and devices through applying the principles of quantum mechanics, i.e., the physical law concerning the nature and behavior of matter and energy on a microscopic level, is known as quantum technology.[55][61][60]. Quantum technology utilises quantum bits, or qubits, which, by quantum-mechanical principles, can be in a superposition of states, i.e., 0 and 1 (a principle termed superposition), unlike conventional technology, where bits assume the state 0 or 1. As a result, quantum-based devices can process and analyse data in ways that current computers cannot. The use of such technology in medical diagnostics enables scientists to explore sophisticated cellular activities, decode genetic codes, and detect molecular anomalies. Moreover, quantum technology enables the development of sensors and imaging systems that detect the smallest fluctuations in biological signals, essential for diagnosing disease early and accurately [54][3][63][62].

1.2 Fundamental Principles: Superposition, Entanglement, and Quantum Tunnelling

Three basic principles form the basis of quantum technologies: superposition, entanglement, and quantum tunnelling.[53][65][64].

- Superposition makes it possible for a quantum particle (such as an electron or a photon) to exist in various states at the same time. For example, a qubit in a quantum computer can store states 0 and 1 simultaneously, which means that calculations can be carried out with a high degree of parallelism. The ability of quantum systems to explore many possibilities in parallel simulations makes them faster in diagnostics.[52][67][66].

- Entanglement is a unique principle that enables multiple particles to be correlated such that the state of one changes the state of another one regardless of how far apart they are from each other. It might be applied for quantum imaging and sensing purposes by conducting really precise measurements at very high resolution. For example, quantum imaging using entangled photons may improve the quality of medical diagnostics as per figure 1 [51][4][69][68].

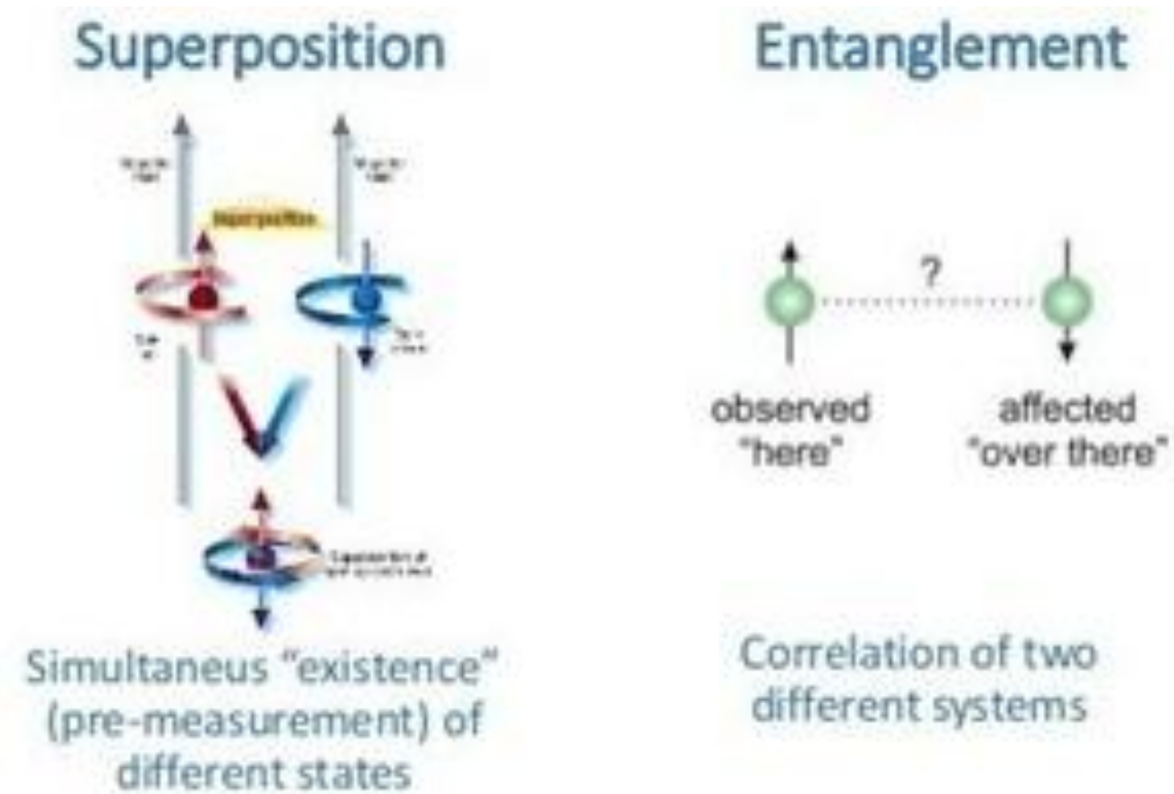


Figure 1: Superposition and quantum entanglement of qubits enable quantum computers to achieve parallel processing [20].

2. Quantum Computing: Overview, Context, and Supporting Technologies

The enabling technologies for quantum computing that support the development of current quantum computing systems are introduced in this chapter. Specifically, there are multiple categories into which quantum computing-enabling technology falls.[50][71][70].

2.1. Comparing Classical and Quantum Computing

The reader is directed to Figure 2, which compares the relative advantages, disadvantages, and possible applications of quantum computing paradigms and traditional computing techniques. The elementary computing unit in a quantum computer is not a bit, as in a classical computer, but rather a quantum bit, or "qubit", that has two states (levels), i.e., a qubit can be in a state of 0 or 1, or simultaneously in an intermediate state that represents two different states within the same quantum system [121].

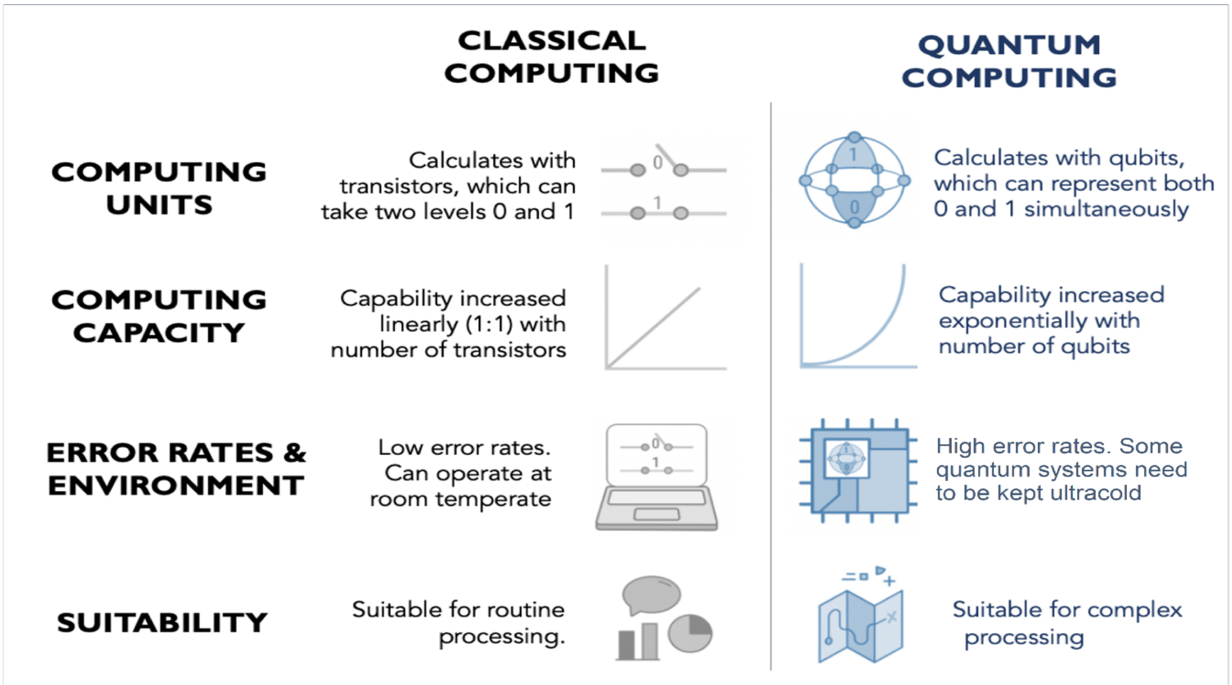


Figure 2. Four important characteristics are compared between classical and quantum computing: (1) processing units; (2) computing capability; (3) appropriateness; and (4) error rates. [12].

For the purpose of creating a Qualization of a photon or an electron spin, quantum physical systems are utilised. One-quit computers[49] [6], two-quit computers, and high-quit quantum computers are among the various types of quantum computers that are available.[48][73][72]. The invention of the 5-qubit quantum computer in early 2000 marked a significant advancement in quantum computing. Since then, a number of noteworthy advancements have been made, and the most well-known quantum computer of the modern age is IBM's newest 433 quint quantum computing processor[47] [7]. Nonetheless, research indicates that 50 quality points are required to achieve quantum dominance. Quantum domination is defined as the capacity of a programmable quantum device, capable of solving a problem that cannot be resolved in a possible time by classical computers [46][8][75][74].

Numerous fields, such as communication, image processing, information theory, electronics, and cryptography, can greatly benefit from the use of quantum computing. With the rapid development and increasing availability of quantum hardware, practical quantum algorithms are gradually transitioning into real-world implementation from theoretical constructions. This has opened up transforming possibilities in many verticals such as financial modelling, climate and weather forecasts, fundamental physics research and transport systems adaptation. [45][77][76].These verticals are painted in Figure 3, which highlights the scope and effect of quantum computing in the diverse domain.

Quantum computing has already demonstrated its value in increasing the performance of the classical (non-quantum) algorithms used in these areas.[44][79][78]. For example, quantum-inspired algorithms have been employed to adapt to logistics, intensify machine learning models and improve signal processing techniques. In addition, the increasing global interest in the manufacture of physically scalable quantum computing hardware has fully strengthened the vision of the operating quantum paradise. Such paradigms are expected to solve computational problems that are currently intractable for classical computers due to their complexity and resource demands. Due to quantum computing being mature, it is estimated to be a fundamental tool in solving the world's most challenging computational functions, leading to a revolution in both scientific research and practical applications, as given in Figure 3[151].

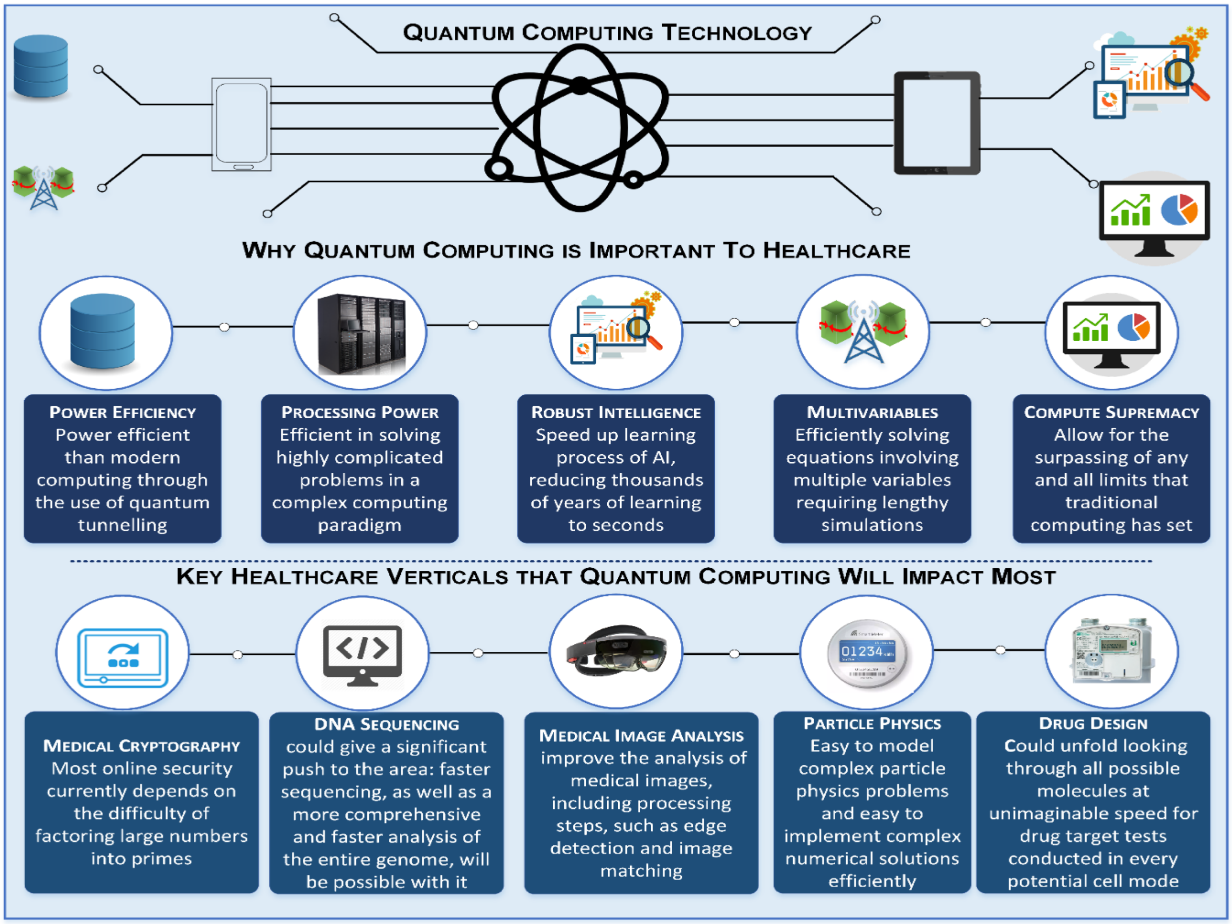


Figure 3. Why use quantum computing, and which key verticals will it disrupt?[12]

2.2. Brief History of Quantum

Quantum computing was first conceptualised in 1981 by physicist Richard Feynman, who suggested using the quantum system to simulate physical processes that are beyond classical computer models. Since then, quantum computing has evolved into a rapidly moving technical field from a theoretical concept. While the initial developments were slow and large academic, there has been rapid progress in recent years, inspired by progress in hardware, algorithms and industry participation [43][9][81][80].

In today's world, leading technology firms have started to provide quantum cloud services, including Amazon Brackets, IBM Quantum, and Microsoft Azure Quantum, quantum computing frameworks.[42][83][82]. In 2019, Sycamore, a 54-qubit quantum computer from Google, accomplished a task in 200 seconds that would take around 10,000 years to accomplish. This achievement, termed "quantum supremacy," illustrated the revolutionary nature of quantum computing. Significant happenings in this sphere are portrayed in Figure 4 below. It is interesting to observe that while earlier there were wider gaps between milestones, recent times have seen a more rapid evolution in this sphere.[41][85][84].

Nevertheless, quantum computing is still in its infancy despite these advancements. Quantum decorations—the breakdown of phenomena like superpositions and entanglements—can result from the extreme sensitivity of quantum computers to environmental disturbances like heat, electromagnetic noise, building blocks, and construction blocks. As a result, the quantum system should be operated at very low temperatures, often near absolute zero. These challenges have led to active research in fault-tolerant quantum computing, which aims to create a stable, error-resistant system [40][10][87][86].

Given the quick speed of development, it is a suitable time for healthcare researchers and physicians to detect the applications of quantum computing in diagnostics, genomics and medical data analysis. Due to the quantum system's maturity, they have the ability to bring revolution in healthcare by enabling rapid, more accurate and personal medical solutions, as per figure 4.[39][89][88].

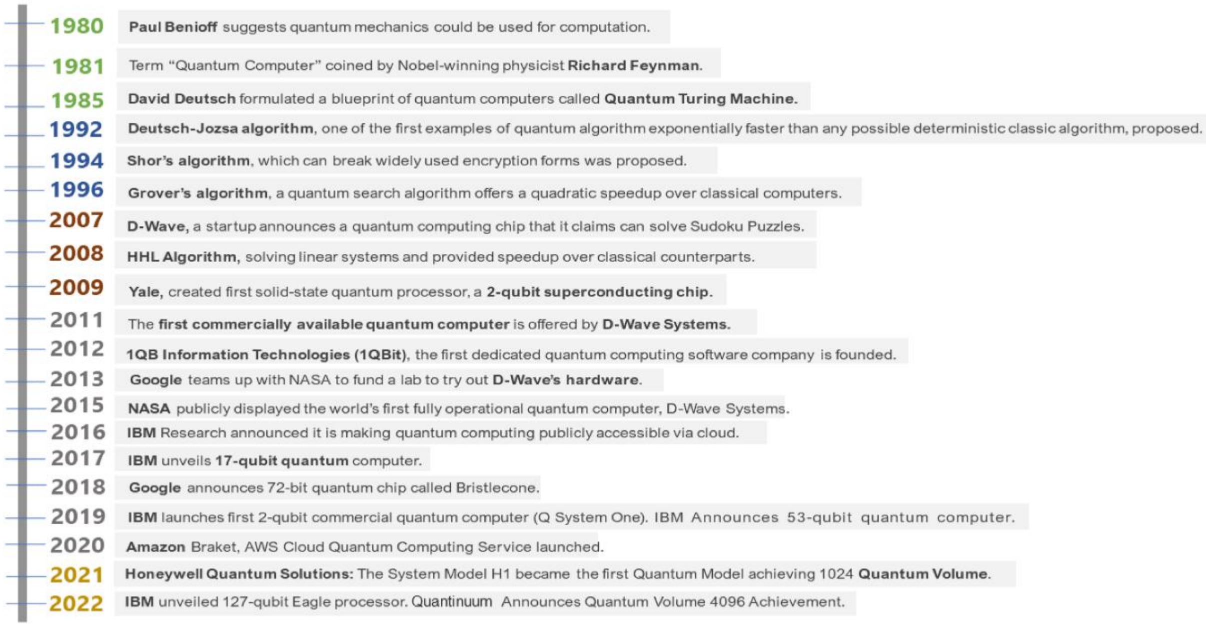


Figure 4. Timeline of developments in quantum computing technology [12]

3. Need for Advanced Diagnostic Tools in Medicine

The accuracy and timeliness of disease diagnosis play an important role in treatment and patient outcomes. Traditional clinical methods, while reliable, often come down to detecting diseases of complex or early stages to a certain extent. As the global burden of chronic and infectious diseases increases, more advanced, sensitive and rapid clinical technologies are becoming increasingly important. Emerging technologies, especially based on quantum principles, are being discovered to remove these limitations and change the current medical clinical landscape[38] [11][91][90].

Accurate, early and efficient diagnosis is the cornerstone of effective healthcare. However, existing clinical technologies are often low in giving time and accurate results, especially for intricate or initial-stage diseases.[36][93][92]. The deep special, translation, and translation-related scope (Figure 5) has its advantages and disadvantages, and the growing complexity of biological data, whether in the traditional, modern, or advanced manner, demands a clinical solution that is not only sharp but also far more accurate. This is where the transformative potential of quantum computing and quantum-based technology lies. Quantum systems are opening the door for the next generation of therapeutic tools in therapy because of their capacity to handle and analyse large datasets at previously unheard-of speeds and accuracy [37][13][95][94].

3.1 Limitations of Traditional Diagnostic Techniques

Traditional clinical techniques such as X-rays, CT scans, blood panels, and even genetic screening methods are limited in sensitivity, speed and scope. They often require aggressive processes, extended waiting times, and manual interpretation, which can delay diagnosis and increase the risk of error [35] [97][96] [15]. In addition, many traditional tools cannot detect early-stage diseases where cellular or molecular changes are subtle or inconclusive. Quantum computing provides a new approach by enabling the real -time processing of complex biological data, including genetic markers, protein structures and metabolic patterns. This can improve image reconstruction in MRI or CT scans using the quantum algorithm, potentially enhancing resolution and reducing scan time (figure 5 [34][98][141]).

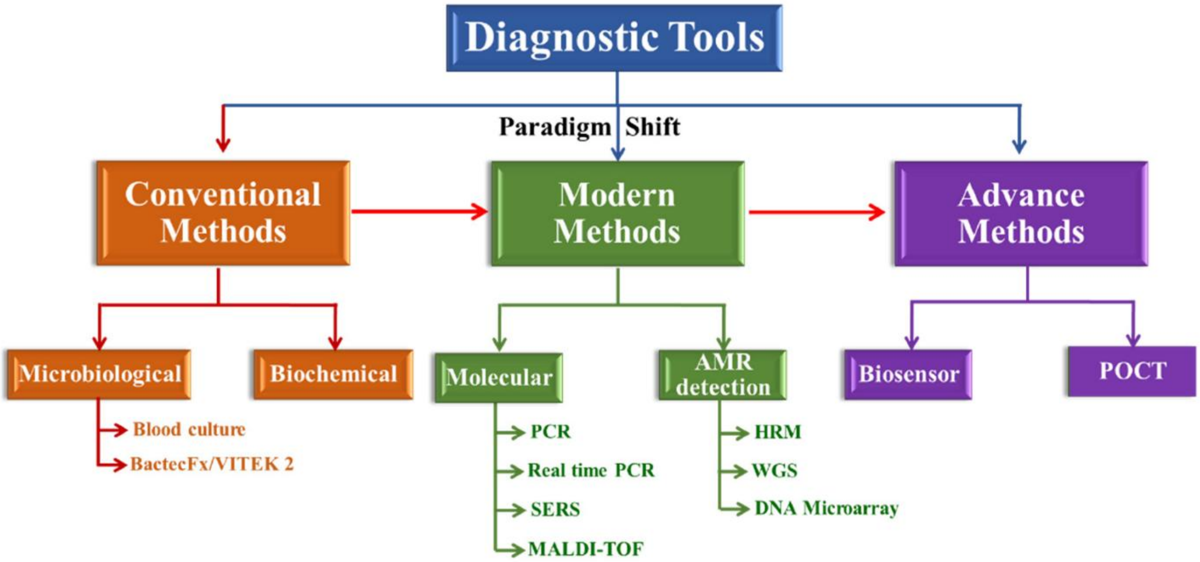


Figure 5. Schematic observation of clinical methods. Conventional techniques detect the fundamentals of bacterial identification using specific cultures and media. Molecular identity identifies resistance genes, their expression and mutations, or their genomic signature using molecular-based (DNA and RNA) techniques. [14]

3.2. Challenges in Early Disease Detection

Early diagnosis of illnesses such as cancer, Alzheimer's, and infections is crucial, but early diagnosis remains one of the most challenging tasks. Conventional diagnostic tools are usually not capable of identifying molecular changes at an early stage due to their low sensitivity or resolution. Furthermore, interpreting micro initial data among huge amounts of data is rather a challenging computational task. By virtue of their abilities to conduct multivariate analysis using quantum computers, superposition, and complication, there can be quick pattern and correlation formation among the giant genomic and protective datasets.[33][99]. Therefore, early biomarker identification becomes possible through quantum computing even before any clinical symptoms have appeared. Quantum machine learning is being employed to classify medical images and detect abnormalities earlier than ever before conventional AI algorithms [32][17][100].

3.3. Importance of Precision and Speed in Diagnosis

Considering the acute environment of today's healthcare sector, clinical instruments must ensure precision and efficiency so as to facilitate better decisions in time. In the cases of strokes, septicemia, or heart attacks, it is essential to diagnose the condition in time to provide a reliable diagnosis that will be available in minutes.[31][102][101].

The quantum innovations have the potential to transform the process. For instance, the quantum-enhanced imaging will deliver ultra-high resolution imagery that will not carry any health risks due to exposure to high levels of radiation. The use of quantum computing will allow for speedy analyses of DNA sequences and near-perfect genetic profiling.[30][104][103].

4. Quantum Sensing in Medical Diagnosis

One of the many interesting applications of quantum technology in medicine is quantum sensing.[106][105]. Quantum sensing exploits the use of various quantum attributes, such as superposition, complexity, and coherence, to make it highly sensitive and accurate in its measurements. In the diagnosis process, in which even a minute detail matters, quantum sensing breakthroughs make this possible. The best part about these sensors is that they are not only accurate but can also be less intrusive than clinical tools.[29][108][107].

4.1 What is Quantum Sensing?

Quantum sensors use quantum systems, like atoms, ions or quantum dots, chromatic field temperature, pressure, as well as molecular and even biological changes in an ultra-high precision manner.[28][110][109]. Quantum sensors make use of the quantum mechanical behaviour of particles and can replace classical sensors. Quantum sensing can either apply to imaging or non-imaging detection approaches, providing new approaches to examine biological processes on a cellular or molecular level [27][18][112][111].

4.2 High Resolution Imaging and Sensing

The ability of quantum sensors to create high-resolution images is among their major benefits.[26][114][113]. In quantum-sensitised imaging processes, photons or a quantum state of light are used in order to more effectively penetrate into tissue and produce clear images. It proves especially useful when conventional approaches struggle to address particular cases, for instance, in tissue characterisation, cancer diagnosis, and the visualisation of soft tissues. Furthermore, quantum sources of light can improve and reduce image noise, which is essential for accurate and timely diagnosis.[116][115].

5. Quantum Computing for Disease Detection

Since the drug becomes rapidly data-operated, the amount of biological information and complexity, ranging from natural sequences to molecular interactions, is growing from Teji. Traditional computing systems often struggle to process and interpret this data efficiently, especially when real -time or future insight is required. Quantum computing provides transformative possibilities to detect the disease, with the ability to handle large-scale datasets and solve complex adaptation and simulation problems. It enables intensive analysis, rapid calculation and more accurate predictions, thus helping physicians and researchers first to detect diseases and understand them better [25][19][117].

5.1 Role of Quantum Computers in Medical Data Analysis

Quantum computers use principles such as superposition and complication, which allow them to process multiple variables together, giving them an edge on classical systems to analyse large and unnecessary medical datasets. Functions such as Electronic Health Records (EHRS), imaging data, and disease diagnosis based on molecular profiles involve complex pattern recognition and classification, which can be performed more efficiently.[24][118][155].

For example, the quantum machine learning (QML) is being developed to expose the ability to highlight the correlations hidden in multi-dimensional clinical datasets, which are capable of detecting microscopic signs of diseases such as cancer, diabetes or neurological disorders before the symptoms appear. By accelerating data clustering, regression and classification, quantum computing can help identify computing risk factors and recommend individual remedies.[23][119].

5.2 Protein Folding and Disease Mechanism Prediction

Understanding protein folding - the process by which a protein assumes its functional size - it is important to identify how diseases such as Alzheimer's, Parkinson's and various cancers develop. Protein misfolding often leads to toxic structures that disrupt cellular functions. However, predicting the protein folding pathway is computationally intensive due to the astronomical number of probable configurations that a protein adopts.[22][120]

When it comes to solving such combinatorial optimisation challenges, quantum computing is excellent. This enables more precise predictions of protein structures and their activity by simulating molecular interactions at the quantum level. A quantum algorithm is being developed to model how proteins fold and interact with other molecules, helping researchers identify malfunctioning processes and potential drug targets [21][141].

5.3 Accelerating Genomic Analysis

Genomics- Study of the entire genetic code- is the key to personal medicine. Nevertheless, the entire genome sequencing and analysis involves processing billions of data points, which is a resource-intensive and time-consuming task for classical computers.[121][20].

Quantum computing provides a paradigm shift by intensifying the detection of mutations and genomic alignment. With the ability to process data in parallel, quantum algorithms can reduce the time required to compare genetic sequences, identifying the disease -causing mutation and highlighting the pattern in complex hereditary conditions.[122][119]

6. Quantum Imaging Techniques

Technology for quantum imaging offers a range of medical diagnoses whereby quantum principles are utilised to surpass classical imaging. Utilisation of complicated properties such as quantum phenomena results in high resolution, high sensitivity and faster imaging processes. Utilisation of quantum imaging in medical diagnosis will enable detection of diseases in their early stages, more so in oncology, neurology and cardiology.[123][118].

6.1. Quantum-Enhanced MRI and PET Scans

Positron emission tomography and magnetic resonance imaging scans are the two basic imaging techniques that offer insight into internal body structures and metabolic processes. In the case of quantum-enhanced MRI, quantum sensors, like those in nitrogen-vacancy (NV) diamonds, are used to improve sensitivity to magnetic fields. This makes for shorter scanning times, more comfortable scans for patients, and improved tissue detail under low magnetic fields. Automated Language and the Authenticity Question[117]

Similarly, quantum technology can improve PET scan resolution by increasing the detection of gamma photons emitted during radioactive decay. Figure 6 Comparison of PET/CT and PET/MRI Imaging Enhanced by Quantum Computing for Improved Diagnostic Precision.[124][116].

Quantum complications of photons can potentially reduce noise and increase signal-to-shape ratio, leading to clear images with low radiation risk. Before these progresses, tumours and metabolic abnormalities are facilitated, which provides more accurate staging and monitoring of diseases such as cancer[15][125][121].

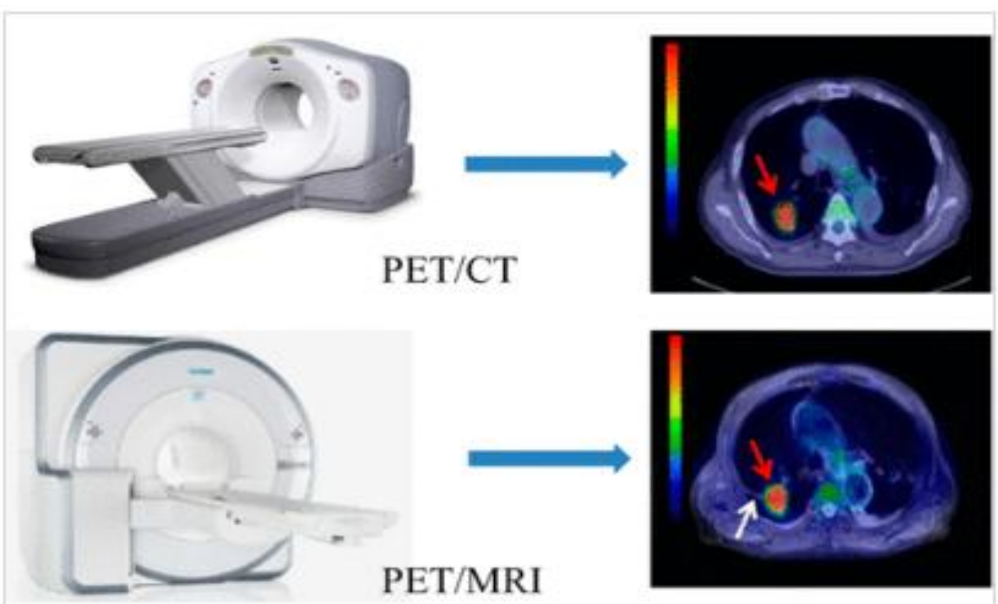


Figure.6. PET/CT and PET/MRI Imaging Enhanced by Quantum Computing for Improved Diagnostic Precision

6.2 Quantum Dots for Cancer Detection

Shape-tunable fluorescence and great brightness are two of the distinctive optical characteristics of quantum dots, which are semiconductor particles at the nanoscale**.** These features make quantum dots excellent contrast agents for medical imaging, especially in cancer diagnosis. When the molecules are conjugated with targeting, quantum dots can selectively bind to cancer cells, highlighting the tumour with extraordinary accuracy[14][126] [22]. The fluorescence in them makes it possible to perform real-time imaging of cancerous tissue during surgery or biopsy, making it easier for the surgeon to identify healthy versus cancerous tissue. Quantum dots also come with advantages in relation to conventional pigments, like increased photo stability and lower levels of toxicity, thus promising potential for application in cancer detection and diagnostics under controlled conditions. Stable images, stable chemical properties, surface activation, and photoluminescence quantum yield are all possible through the unique construction of QDs, comprising three parts, including the core, shell, and at times the surface layer. The construction of QDs is illustrated schematically in Figure 7 below.

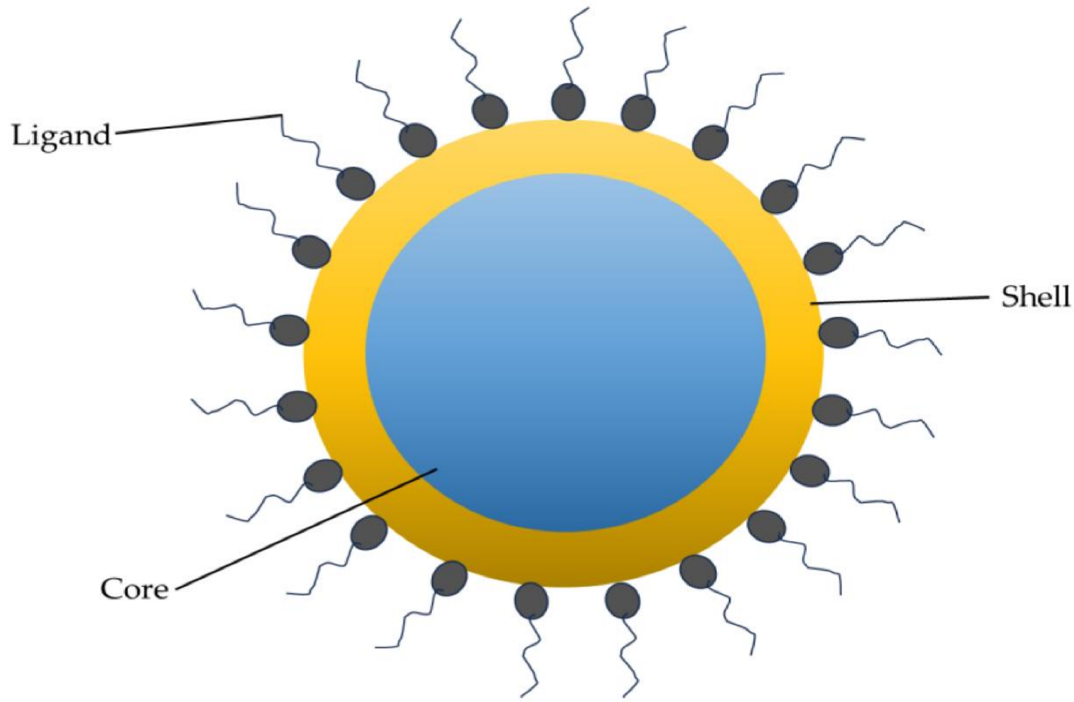


Figure 7. Structure of a QD showing the core/shell/ligand [23].

7. Quantum Technology in Cancer Diagnosis

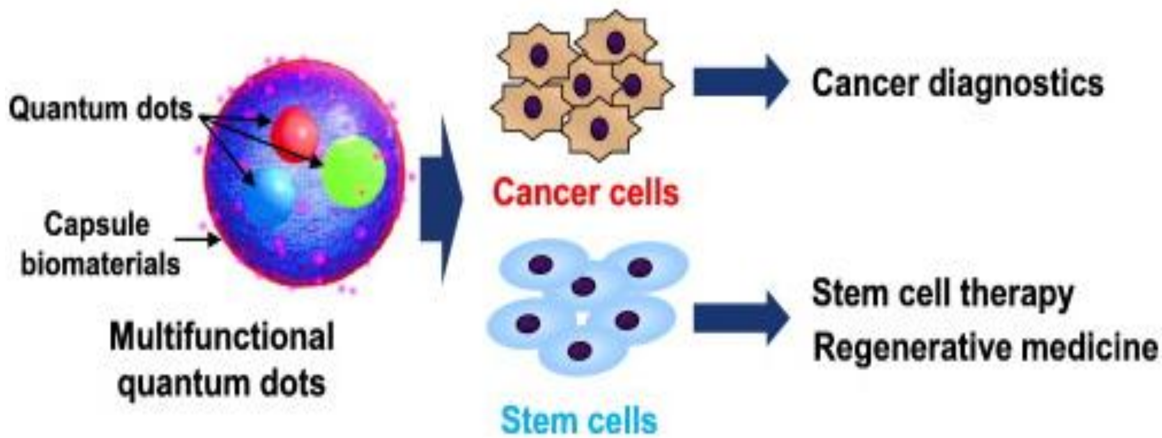
Diagnoses of cancer patients can get immense advantages through the advancements made in quantum technologies that provide accuracy as well as the ability to detect early on, and become better than conventional approaches. Quantum-based instruments like quantum dots, sensors, and imaging help see tumours clearly and monitor drug targeting in their earlier stages [24][127][13].

7.1 Research Ethics in the Digital Age

Quantum dots are small semiconductor nanocrystals that glow vividly under exposure to light. These exceptional optical properties allow them to act as remarkable contrast agents in tumour visualisation [12][11][128]. With appropriate binding of ligands/antibodies to quantum dots, they have the potential to bind to cancerous cells, thus enabling accurate detection of the tumour. Unlike conventional pigments, quantum dots offer high levels of brightness, photo stability, and tunable emission wavelength, allowing multi-colour tumour marker identification at once. This capability to diagnose the tumour improves its sensitivity, even in difficult tissues where normal imaging becomes problematic, as per Figure 8 [129][10].

7.2 Targeted Drug Delivery Visualisation

The objective of targeted drug delivery is to ensure the use of direct medicinal agents at the location of the tumour.[130] With the help of quantum technologies, it is now possible to visualise these drug delivery procedures with the help of quantum sensors and quantum dots. Drugs or nanopeptides attached to the quantum dots work as fluorescent markers in order to keep track of drug delivery and release. Accurate monitoring would allow effective delivery of the drug to cancerous cells for an effective treatment process. Additionally, the quantum-based atmosphere imaging technique will help doctors adapt to any changes taking place inside.[131].



Microsoft.QuickAction.WiFi

Figure 8: Utilising Multifunctional Quantum Dots in Stem Cell-Based Regenerative Medicine and Cancer Diagnostics [30]

8. Integration of Quantum AI in Diagnosis

The fusion of quantum computing and artificial intelligence (AI) is producing new paradigms in medical diagnosis. Quantum AI takes advantage of the computational power of quantum machines with pattern recognition capabilities to rapidly and more accurately analyse complex medical data. It promises to revolutionise the diagnosis by enabling the integration of prediction, real -time analysis, and the development of hybrid devices that combine the best of classical and quantum computing[132][140].

8.1 Medical Imaging Using Quantum Machine Learning

Quantum machine learning (QML) uses quantum algorithms to improve the AI model, especially for specific large and complex datasets in medical imaging. Traditional AI methods often require extensive processing power and time for analysis of MRI, CT, or ultrasound scans.[9][133]. QML simultaneously accelerates several data points and accelerates them, allowing quick image classification, partition and discrepancy detection.[134][8].
For example, QML can improve the accuracy of detection of tumours, wounds, or tissue abnormalities by learning complex patterns that can recall classical algorithms. This increases the ability to detect diseases first in clinical confidence and progress[135] [25].

8.2 Pattern Recognition and Predictive Diagnostics

The pattern recognition is at the core of therapy diagnosis. Quantum AI increases this ability by highlighting micro correlations in multi-faceted medical datasets - such as genomic data, electronic health records, and biomarker profiles - which are often very complex for classical systems.[136][107].

By employing the quantum-added algorithm, the future diagnosis becomes stronger. These systems can estimate the progression of the disease, identify high -risk patients, and suggest personal treatment options based on a person's unique biological makeup and medical history. This future power strength transforms healthcare from reactive to active management.[138][137][116].

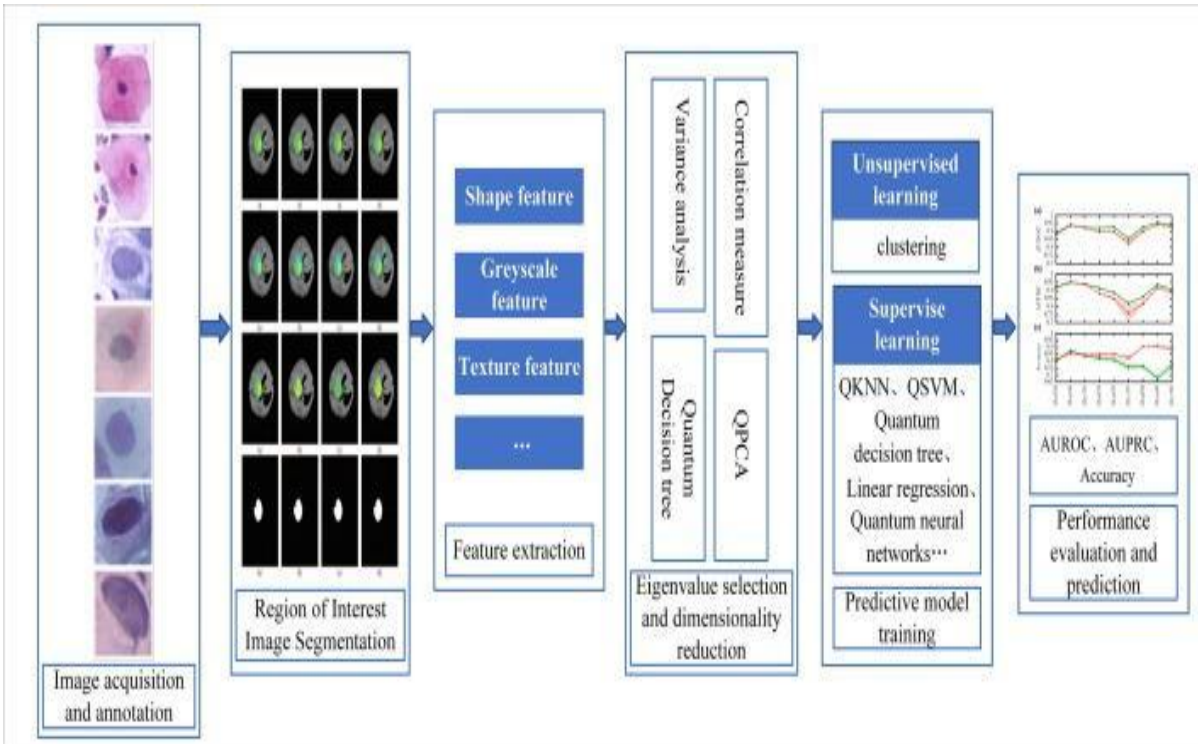


Figure 9: Quantum Machine Learning-Based Workflow for Medical Image Analysis and Predictive Diagnosis [26]

9. Challenges and Limitations of Quantum Technology in Medical Diagnosis

Despite the promising potential offered by quantum technology, there are numerous challenges and limitations that need to be overcome prior to its adoption in medical diagnosis. Such challenges cover various aspects, including the engineering problem, the cost issues, and the moral and privacy-related considerations.[140][139][5].

9.2. Engineering and Technical Challenges

The use of quantum technologies, particularly quantum computation and sensing, relies on delicate quantum states, which are highly susceptible to environmental disruptions, including thermal noise, electromagnetic interactions, and vibrations. Therefore, special cooling mechanisms are necessary to preserve quantum coherence at close to absolute zero temperatures; hence, quantum hardware becomes intricate and fragile. [141].Scalable fault-tolerant hardware is the next challenge since decoherence and errors induced by noise affect quantum calculations, requiring well-designed strategies for error correction, which are yet to be developed. In addition, integration of quantum devices into medical equipment and software systems presents certain technical difficulties.[142][114]

9.2. Engineering and Technical Challenges

The development and maintenance of quantum hardware is expensive due to special materials, an ultra-low temperature environment and the need for accurate control mechanisms. High early investment and operational costs restrict quantum technology for well -funded research institutes and special hospitals.[133][144][143]. Scalability is another concern; Current quantum devices have a limited number of Qualbits or sensor units, which restricts their ability to handle large-scale medical data. Extending quantum systems in clinically relevant sizes without increasing costs is an important challenge before quantum diagnostics becomes mainstream.[2].

9.3 Ethical and Data Security Concerns

The ability to process and analyze the large amounts of quantum technology in large amounts of sensitive medical data raises important moral questions. [146][145]. Patient privacy should be protected, especially since quantum computing can potentially break the current cryptographic security, putting data at risk of violations. There are also concerns about the same access to quantum diagnostic technologies.[148][147]. If quantum therapy equipment is accessible only to rich institutions or countries, the quality of healthcare may be improved. The moral outline and rules should be developed to ensure responsible use, transparency and proper distribution of quantum diagnostic advances.[150][149][1].

10. Future Scope of Quantum Medicine

Quantum technology is ready to bring revolution in medicine beyond diagnosis, shaping the future of healthcare through individual, interconnected and intelligent systems. Ongoing research and technological development indicate exciting possibilities in patient care and clinical workflows.[152][151]

10.1. Personalised and Predictive Medicine

Quantum computing and quantum AI are expected to enable individualised medicine by integrating individual genetic, molecular and lifestyle data[154][153]. This will allow physicians to predict disease risk, tailor preventive strategies, and adapt treatment based on each patient's unique biological profile. Predicting each patient's future course of therapy and identifying and elucidating the relationships between causes and treatments are the goals of precision medicine. Based on the patient's stated symptoms, conventional diagnosis results in umbrella diagnoses, for which related therapies occasionally don't work. Utilising continuous data streams and individualised interventions to anticipate diseases and enable appropriate therapies could be made possible by quantum computing [155][27]. The forecast models operated by the quantum algorithm can estimate the progression and treatment results of the disease more accurately than the classical approaches, support early interventions and improve the forecast. The result will be a change from a size-fit-all to an accurate drug that improves efficacy and reduces side effects. Figure 10 shows an example of precision medicine using quantum computing.[157][156].

Figure 10. An example of how quantum computing might be used to enable precision medicine by utilising vast amounts of multimodal data [12]

10.2Integration with IoT and Smart Healthcare Systems

Internet of Medical Things (IOMT) -Networks of connected medical devices and sensors - Changing healthcare delivery

with real -time monitoring and remote diagnosis. The integrated quantum sensors with IOMT devices may significantly increase data accuracy and sensitivity, improving detection of micro -physical changes.[160][159].
Quantum-enhanced smart healthcare system will rapidly process and analyse the continuous streams of patient data, which will enable immediate clinical decisions and personal alerts. This integration will empower telemedicine, chronic disease management and emergency response with unprecedented accuracy and speed[158] [128]

11 Conclusion

Quantum technology is able to capitalise on the laws of quantum mechanics to boost diagnosis in medicine, presenting success stories in medical imaging, sensing, analysing data and detecting diseases at an early stage. When it comes to pattern recognition, innovations in Quantum-Enhanced MRI, Quantum Dots and Quantum AI can help to make it more effective, accurate, faster and more sensitive than ever before. Combining quantum computing with AI and medicine could revolutionise the field with great potential in personalised healthcare and forecasting the course of a particular case, while helping patients achieve better outcomes through early identification of diseases that may be difficult to detect otherwise. However, there are also concerns in terms of technology, costs and ethical issues involved; yet progress in the field and cooperation between specialists continue to move the development of quantum treatment toward its practical application.

References

[1] Garg, P., Dixit, A., & Sethi, P. (2019). Wireless sensor networks: an insight review. *International Journal of Advanced Science and Technology*, *28*(15), 612-627.

[2] Sharma, N., & Garg, P. (2022). Ant colony-based optimisation model for QoS-Based task scheduling in cloud computing environment. *Measurement: Sensors*, 100531.

[3] Kumar, P., Kumar, R., & Garg, P. (2020). Hybrid Crowd Cloud Routing Protocol For Wireless Sensor Networks. *International Journal of Advanced Science and Technology*, *29*, 766-775.

[4] Raj, G., Verma, A., Dalal, P., Shukla, A. K., & Garg, P. (2023). Performance Comparison of Several LPWAN Technologies for Energy-Constrained IoT Network. *International Journal of Intelligent Systems and Applications in Engineering*, *11*(1s), 150-158.

[5] Garg, P., Sharma, N., & Shukla, B. (2023). Predicting the Risk of Cardiovascular Diseases using Machine Learning Techniques. *International Journal of Intelligent Systems and Applications in Engineering*, *11*(2s), 165-173.

[6] Patil, S. C., Mane, D. A., Singh, M., Garg, P., Desai, A. B., & Rawat, D. (2024). Parkinson's Disease Progression Prediction Using Longitudinal Imaging Data and Grey Wolf Optimiser-Based Feature Selection. *International Journal of Intelligent Systems and Applications in Engineering*, *12*(3s), 441-451.

[7] Gudur, A., Pati, P., Garg, P., & Sharma, N. (2024). Radiomics Feature Selection for Lung Cancer Subtyping and Prognosis Prediction: A Comparative Study of Ant Colony Optimisation and Simulated Annealing. *International Journal of Intelligent Systems and Applications in Engineering*, *12*(3s), 553-565.

[8] Khan, A. (2024). Optimisation Methods Based on Soft Computing for Improving Power System Stability. *J. Electrical Systems*, *20*(6s), 1051-1058.

[9] Sharma, K. K., Verma, P. K., & Garg, P. (2024). IoT-Enabled Energy Management Systems For Sustainable Energy Storage: Design, Optimisation, And Future Directions. *Frontiers in Health Informatics*, *13*(8).

[10] Gupta, S., Yadav, N., Singh, K., & Garg, P. (2025). APPLICATIONS OF SIMULATIONS AND QUEUING THEORY IN A SUPERMARKET *Reliability: Theory & Applications*, *20*(1 (82)), 135-140.

[11] Beniwal, S., Garg, P., Rajpal, R., Sharma, N., & Mittal, H. K. (2025). Fusion of Opportunistic Networks with Machine Learning: Present and Future. *Metallurgical and Materials Engineering*, *31*(1), 311-324.

[12] Garg, P. (2025). Explainable AI & Model Interpretability in Healthcare: Challenges & Future Directions. *EKSPLORIUM-BULETIN PUSAT TEKNOLOGI BAHAN GALIAN NUKLIR*, *46*(1), 104-133.

[13] Rani, P. (2025). From Data to Diagnosis: Unleashing AI and 6G in Modern Medicine. *EKSPLORIUM-BULETIN PUSAT TEKNOLOGI BAHAN GALIAN NUKLIR*, *46*(1), 69-103.

[14] Dixit, A., Garg, P., Sethi, P., & Singh, Y. (2020, April). TVCCCS: Television Viewer's Channel Cost Calculation System on Per-Second Usage. In *IOP Conference Series: Materials Science and Engineering* (Vol. 804, No. 1, p. 012046). IOP Publishing.

[15] Sethi, P., Garg, P., Dixit, A., & Singh, Y. (2020, April). Smart number cruncher–a voice-based calculator. In *IOP Conference Series: Materials Science and Engineering* (Vol. 804, No. 1, p. 012041). IOP Publishing.

[16] S. Rai, V. Choubey, Suryansh and P. Garg, "A Systematic Review of Encryption and Keylogging for Computer System Security," *2022 Fifth International Conference on Computational Intelligence and Communication Technologies (CCICT)*, 2022, pp. 157-163, doi: 10.1109/CCiCT56684.2022.00039.

[17] L. Saraswat, L. Mohanty, P. Garg and S. Lamba, "Plant Disease Identification Using Plant Images," 2022 Fifth International Conference on Computational Intelligence and Communication Technologies (CCICT), 2022, pp. 79-82, doi: 10.1109/CCiCT56684.2022.00026.

[18] L. Mohanty, L. Saraswat, P. Garg and S. Lamba, "Recommender Systems in E-Commerce," 2022 Fifth International Conference on Computational Intelligence and Communication Technologies (CCICT), 2022, pp. 114-119, doi: 10.1109/CCiCT56684.2022.00032.

[19] C. Maggo and P. Garg, "From linguistic features to their extractions: Understanding the semantics of a concept," 2022 Fifth International Conference on Computational Intelligence and Communication Technologies (CCICT), 2022, pp. 427-431, doi: 10.1109/CCiCT56684.2022.00082.

[20] N. Puri, P. Saggar, A. Kaur and P. Garg, "Application of ensemble Machine Learning models for phishing detection on web networks," 2022 Fifth International Conference on Computational Intelligence and Communication Technologies (CCICT), 2022, pp. 296-303, doi: 10.1109/CCiCT56684.2022.00062.

[21] R. Sharma, S. Gupta and P. Garg, "Model for Predicting Cardiac Health using Deep Learning Classifier," 2022 Fifth International Conference on Computational Intelligence and Communication Technologies (CCICT), 2022, pp. 25-30, doi: 10.1109/CCiCT56684.2022.00017.

[22] Varshney, S. Lamba and P. Garg, "A Comprehensive Survey on Event Analysis Using Deep Learning," 2022 Fifth International Conference on Computational Intelligence and Communication Technologies (CCICT), 2022, pp. 146-150, doi: 10.1109/CCiCT56684.2022.00037.

[23] Dixit, A., Sethi, P., Garg, P., & Pruthi, J. (2022, December). Speech Difficulties and Clarification: A Systematic Review. In *2022, the 11th International Conference on System Modelling & Advancement in Research Trends (SMART)* (pp. 52-56). IEEE.

[24] Garg, P., Dixit, A., Sethi, P., & Pruthi, J. (2023, December). Strengthening Smart City with Opportunistic Networks: An Insight. In the *2023 International Conference on Advanced Computing & Communication Technologies (ICACCTech)* (pp. 700-707). IEEE.

[25] Rana, S., Chaudhary, R., Gupta, M., & Garg, P. (2023, December). Exploring Different Techniques for Emotion Detection Through Face Recognition. In *2023 International Conference on Advanced Computing & Communication Technologies (ICACCTech)* (pp. 779-786). IEEE.

[26] Mittal, K., Srivastava, K., Gupta, M., & Garg, P. (2023, December). Exploration of Different Techniques on Heart Disease Prediction. In *2023 International Conference on Advanced Computing & Communication Technologies (ICACCTech)* (pp. 758-764). IEEE.

[27] Gautam, V. K., Gupta, S., & Garg, P. (2024, March). Automatic Irrigation System using IoT. In *2024 International Conference on Automation and Computation (AUTOCOM)* (pp. 100-103). IEEE.

[28] Ramasamy, L. K., Khan, F., Joghee, S., Dempere, J., & Garg, P. (2024, March). Forecast of Students' Mental Health Combining an Artificial Intelligence Technique and Fuzzy Inference System. In *2024 International Conference on Automation and Computation (AUTOCOM)* (pp. 85-90). IEEE.

[29] Rajput, R., Sukumar, V., Patnaik, P., Garg, P., & Ranjan, M. (2024, March). The Cognitive Analysis for an Approach to Neuroscience. In *2024 International Conference on Automation and Computation (AUTOCOM)* (pp. 524-528). IEEE.

[30] Dixit, A., Sethi, P., Garg, P., Pruthi, J., & Chauhan, R. (2024, July). CNN-based lip-reading system for visual input: A review. In *AIP Conference Proceedings* (Vol. 3121, No. 1). AIP Publishing.

[31] Bose, D., Arora, B., Srivastava, A. K., & Garg, P. (2024, May). A Computer Vision-Based Framework for Posture Analysis and Performance Prediction in Athletes. In *2024 International Conference on Communication, Computer Sciences and Engineering (IC3SE)* (pp. 942-947). IEEE.

[32] Singh, M., Garg, P., Srivastava, S., & Saggu, A. K. (2024, April). Revolutionising Arrhythmia Classification: Unleashing the Power of Machine Learning and Data Amplification for Precision Healthcare. In *2024 Sixth International Conference on Computational Intelligence and Communication Technologies (CCICT)* (pp. 516-522). IEEE.

[33] Kumar, R., Das, R., Garg, P., & Pandita, N. (2024, April). Duplicate Node Detection Method for Wireless Sensors. In *2024 Sixth International Conference on Computational Intelligence and Communication Technologies (CCICT)* (pp. 512-515). IEEE.

[34] Bhardwaj, H., Das, R., Garg, P., & Kumar, R. (2024, April). Handwritten Text Recognition Using Deep Learning. In *2024 Sixth International Conference on Computational Intelligence and Communication Technologies (CCICT)* (pp. 506-511). IEEE.

[35] Gill, A., Jain, D., Sharma, J., Kumar, A., & Garg, P. (2024, May). Deep learning approach for facial identification for online transactions. In *2024 International Conference on Emerging Innovations and Advanced Computing (INNOCOMP)* (pp. 715-722). IEEE.

[36] Mittal, H. K., Dalal, P., Garg, P., & Joon, R. (2024, May). Forecasting Pollution Trends: Comparing Linear, Logistic Regression, and Neural Networks. In *2024 International Conference on Emerging Innovations and Advanced Computing (INNOCOMP)* (pp. 411-419). IEEE.

[37] Malik, T., Nandal, V., & Garg, P. (2024, May). Deep Learning-Based Classification of Diabetic Retinopathy: Leveraging the Power of VGG-19. In *2024 International Conference on Emerging Innovations and Advanced Computing (INNOCOMP)* (pp. 645-651). IEEE.

[38] Srivastava, A. K., Verma, I., & Garg, P. (2024, May). Improvements in Recommendation Systems Using Graph Neural Networks. In *2024 International Conference on Emerging Innovations and Advanced Computing (INNOCOMP)* (pp. 668-672). IEEE.

[39] Aggarwal, A., Jain, D., Gupta, A., & Garg, P. (2024, May). Analysis and Prediction of Churn and Retention Rate of Customers in Telecom Industry Using Logistic Regression. In *2024 International Conference on Emerging Innovations and Advanced Computing (INNOCOMP)* (pp. 723-727). IEEE.

[40] Mittal, H. K., Arsalan, M., & Garg, P. (2024, May). A Novel Deep Learning Model for Effective Story Point Estimation in Agile Software Development. In *2024 International Conference on Emerging Innovations and Advanced Computing (INNOCOMP)* (pp. 404-410). IEEE.

[41] Shukla, S. M., Magoo, C., & Garg, P. (2024, November). Comparing Fine-Tuned LMs for Detecting LLM-Generated Text. In *2024, the 3rd Edition of IEEE Delhi Section Flagship Conference (DELCON)* (pp. 1-8). IEEE.

[42] Kumar, B., IQBAL, M., Parmer, R., Garg, P., Rani, S., & Agrawal, A. (2025, March). The Role of AI in Optimising Healthcare Appointment Scheduling. In *2025, the 3rd International Conference on Disruptive Technologies (ICDT)* (pp. 881-887). IEEE.

[43] Kumar, B., Garg, V., Ahmed, K., Garg, P., Choudhary, S., & Baniya, P. (2025, March). Enhancing Healthcare with Blockchain: Innovations in Data Privacy, Security, and Interoperability. In *2025, the 3rd International Conference on Disruptive Technologies (ICDT)* (pp. 932-938). IEEE.

[44] Raj, V., Prakash, B. K., Kumar, A., & Garg, P. (2024, December). Optimise the Time a Mercedes-Benz Spends on the Test Bench Using Stacking Ensemble Learning. In *2024 International Conference on Progressive Innovations in Intelligent Systems and Data Science (ICPIDS)* (pp. 445-450). IEEE.

[45] Kaushik, N., Kumar, H., Raj, V., & Garg, P. (2024, December). Proactive Fault Prediction in Microservices Applications Using Trace Logs and Monitoring Metrics. In *2024 International Conference on Progressive Innovations in Intelligent Systems and Data Science (ICPIDS)* (pp. 410-415). IEEE.

[46] Kumar, A. A., Sri, C. V., Bohara, K. S. K., Setia, S., & Garg, P. (2024, December). Capnivesh: Financing Platform for Startups. In *2024 International Conference on Progressive Innovations in Intelligent Systems and Data Science (ICPIDS)* (pp. 261-265). IEEE.
[47] Bhandari, P., Setia, S., Kumar, K., & Garg, P. (2024, December). Optimising Cross-Platform Development with CI/CD and Containerization: A Review. In *2024 International Conference on Progressive Innovations in Intelligent Systems and Data Science (ICPIDS)* (pp. 175-180). IEEE.

[48] Chaudhary, A., & Garg, P. (2014). Detecting and diagnosing a disease using a patient monitoring system. *International Journal of Mechanical Engineering And Information Technology*, *2*(6), 493-499.
[49] Malik, K., Raheja, N., & Garg, P. (2011). Enhanced FP-growth algorithm. *International Journal of Computational Engineering and Management*, *12*, 54-56.
[50] Garg, P., Dixit, A., & Sethi, P. (2021, May). Link Prediction Techniques for Opportunistic Networks using Machine Learning, in *Proceedings of the International Conference on Innovative Computing & Communication (ICICC)*.
[51] Garg, P., Dixit, A., & Sethi, P. (2021, April). Opportunistic networks: Protocols, applications & simulation trends. In *Proceedings of the International Conference on Innovative Computing & Communication (ICICC)*.
[52] Garg, P., Dixit, A., & Sethi, P. (2021). Performance comparison of fresh and spray & wait protocol through one simulator. *IT in Industry*, *9*(2).
[53] Malik, M., Singh, Y., Garg, P., & Gupta, S. (2020). Deep Learning in Healthcare system. *International Journal of Grid and Distributed Computing*, *13*(2), 469-468.
[54] Gupta, M., Garg, P., Gupta, S., & Joon, R. (2020). A Novel Approach for Malicious Node Detection in Cluster-Head Gateway Switching Routing in Mobile Ad Hoc Networks. *International Journal of Future Generation Communication and Networking*, *13*(4), 99-111.
[55] Gupta, A., Garg, P., & Sonal, Y. S. (2020). Edge Detection Based 3D Biometric System for Security of Web-Based Payment and Task Management Application. *International Journal of Grid and Distributed Computing*, *13*(1), 2064-2076.
[56] Garg, P., & Raman, P. K. (2011). Broadcasting Protocol & Routing Characteristics With Wireless ad-hoc networ s. *Int. J. Comput. Emg. Manag*, *12*(1), 36-40.
[57] Garg, P., Arora, N., & Malik, T. (2011). Capacity Improvement of WI-MAX In presence of Different Codes WI-MAX: Speed & Scope of fu-ture. *IJCEM*, *12*.
[58] Garg, P., Saroha, K., & Lochab, R. (2011). Review of wireless sensor networks-architecture and applications. IJCSMS International Journal of Computer Science & Management Studies, 11(01), 2231-5268.
[59] Yadav, S., &Garg, P. Development of a New Secure Algorithm for Encryption and Decryption of Images.
[60] Dixit, A., Sethi, P., & Garg, P. (2022). Rakshak: A Child Identification Software for Recognizing Missing Children Using Machine Learning-Based Speech Clarification. International Journal of Knowledge-Based Organizations (IJKBO), 12(3), 1-15.
[61] Shukla, N., Garg, P., & Singh, M. (2022). MANET Proactive and Reactive Routing Protocols: A Comparison Study. International Journal of Knowledge-Based Organizations (IJKBO), 12(3), 1-14.
[62] Arya, A., Garg, P., Vellanki, S., Latha, M., Khan, M. A., & Chhbra, G. (2024). Optimisation Methods Based on Soft Computing for Improving Power System Stability. *Journal of Electrical Systems*, *20*(6s), 1051-1058.
[63] Garg, P. (2025). Cloud security posture management: Tools and techniques. Technix International Journal for Engineering Research, 12(3).
[64] Tyagi, P., Sharma, S., Srivastava, A., Rajput, N. K., Garg, P., & Kumari, M. (2025). AI in Healthcare:Transforming Medicine with Intelligence. In *First Global Conference on AI Research and Emerging Developments (G-CARED 2025)*, New Delhi, India. https://doi.org/10.63169/GCARED2025.p4
[65] Garg, P., Bhatt, M., Parmar, R., & Arsalan, M. (2025). Generative AI: Evolution, Applications, Challenges And Future Prospects. *Applications, Challenges And Future Prospects (May 17, 2025)*.

[66] Garg, P., Saraswat, P., & Siddiqui, Z. (2025). AI & the Indian Stock Market: A Review of Applications in Investment Decision.https://doi.org/10.63169/GCARED2025.p10

[67] Garg, P., Sharma, S., Mittal, S., Tevatia, R., Tyagi, V. K., & Kapoor, S. (2025). Unlocking Workforce Potential: AI-Powered Predictive Models for Employee Performance Evaluation.https://doi.org/10.63169/GCARED2025.p21

[68] Shrivas, N., Kalia, A., Roy, R., Sharma, S., Garg, P., & Agarwal, G. (2025). OSINT: A Double-edged Sword. In *First Global Conference on AI Research and Emerging Developments (G-CARED 2025)*, New Delhi, India. https://doi.org/10.63169/GCARED2025.p22

[69] Garg, P., Aditi, A., & Roy, B. (2025). A System of Computer Network: Based On Artificial Intelligence.https://doi.org/10.63169/GCARED2025.p24

[70] Parmar, R., Kapoor, S., Saifi, S., & Garg, P. (2025). Case Study on Intelligent Factory Systems for Improving Productivity and Capability in Industry 4.0 with Generative AI. In *First Global Conference on AI Research and Emerging Developments (G-CARED 2025)*, New Delhi, India. https://doi.org/10.63169/GCARED2025.p28

[71] Singh, R., Sharma, R., Kumar, R., Nafis, A., Siddiqui, M. A. M., & Garg, P. (2025). Detection of Unauthorize Construction using Machine Learning: A Review. In *First Global Conference on AI Research and Emerging Developments (G-CARED 2025)*, New Delhi, India. https://doi.org/10.63169/GCARED2025.p30

[72] Garg, P., Kapoor, S., Singh, V., Sharma, S., & Ankita, A. (2025). A Bridge between Blockchain and Decentralized Applications Web3 and Non-Web3 Crypto Wallets.https://doi.org/10.63169/GCARED2025.p35

[73] Verma, M., Sharma, S., Garg, P., & Singh, A. (2025). The Hidden Dangers of Prototype Pollution: A Comprehensive Detection Framework. In *First Global Conference on AI Research and Emerging Developments (G-CARED 2025)*, New Delhi, India. https://doi.org/10.63169/GCARED2025.p36

[74] Sharma, A., Sharma, S., Garg, P., & Bhardwaj, P. (2025). LockTalk: A Basic Secure Chat Application. In *First Global Conference on AI Research and Emerging Developments (G-CARED 2025)*, New Delhi, India.

[75] Arora, K., Bawane, R., Gupta, C., Ahmed, K., & Garg, P. (2025). Detection and Prevention of Cyber Attack and Threat using AI. In *First Global Conference on AI Research and Emerging Developments (G-CARED 2025)*, New Delhi, India. https://doi.org/10.63169/GCARED2025.p38

[76] Garg, P., Dhruv, D., Rahman, A. A., Rai, A., Siddiqui, M., & Yadav, D. (2025). Easeviewer: An Esports Production Tool.https://doi.org/10.63169/GCARED2025.p46

[77] Garg, P., Lakshita, L., Mehwish, M., Nazia, N., & Ahmed, K. (2025). Emerging Trend in Computational Technology: Innovations, Applications, and Challenges. *Applications, and Challenges (May 17, 2025)*. https://doi.org/10.63169/GCARED2025.p51

[78] Chauhan, S., Singh, M., & Garg, P. (2021). Rapid Forecasting of Pandemic Outbreak Using Machine Learning. *Enabling Healthcare 4.0 for Pandemics: A Roadmap Using AI, Machine Learning, IoT and Cognitive Technologies*, 59-73.

[79] Gupta, S., & Garg, P. (2021). An insight review on multimedia forensics technology. *Cyber Crime and Forensic Computing: Modern Principles, Practices, and Algorithms*, *11*, 27.

[80] Shrivastava, P., Agarwal, P., Sharma, K., & Garg, P. (2021). Data leakage detection in Wi-Fi networks. *Cyber Crime and Forensic Computing: Modern Principles, Practices, and Algorithms*, *11*, 215.

[81] Meenakshi, P. G., & Shrivastava, P. (2021). Machine learning for mobile malware analysis. *Cyber Crime and Forensic Computing: Modern Principles, Practices, and Algorithms*, *11*, 151.

[82] Nanwal, J., Garg, P., Sethi, P., & Dixit, A. (2021). Green IoT and Big Data: Succeeding towards Building Smart Cities. In *Green Internet of Things for Smart Cities* (pp. 83-98). CRC Press.

[83] Gupta, M., Garg, P., & Agarwal, P. (2021). Ant Colony Optimization Technique in Soft Computational Data Research for NP-Hard Problems. In *Artificial Intelligence for a Sustainable Industry 4.0* (pp. 197-211). Springer, Cham.

[84] Magoo, C., & Garg, P. (2021). Machine Learning Adversarial Attacks: A Survey Beyond. *Machine Learning Techniques and Analytics for Cloud Security*, 271-291.

[85] Garg, P., Srivastava, A. K., Anas, A., Gupta, B., & Mishra, C. (2023). Pneumonia Detection Through X-Ray Images Using Convolution Neural Network. In *Advancements in Bio-Medical Image Processing and Authentication in Telemedicine* (pp. 201-218). IGI Global.

[86] Gupta, S., & Garg, P. (2023). 14 Code-based post-quantum cryptographic technique: digital signature. *Quantum-Safe Cryptography Algorithms and Approaches: Impacts of Quantum Computing on Cybersecurity*, 193.

[87] Prakash, A., Avasthi, S., Kumari, P., & Rawat, M. (2023). PuneetGarg 18 Modern healthcare system: unveiling the possibility of quantum computing in medical and biomedical zones. Quantum-Safe Cryptography Algorithms and Approaches: Impacts of Quantum Computing on Cybersecurity, 249.

[88] Gupta, S., & Garg, P. (2024). Mobile Edge Computing for Decentralized Systems. *Decentralized Systems and Distributed Computing*, 75-88.

[89] Gupta, M., Garg, P., & Malik, C. (2024). Ensemble learning-based analysis of perinatal disorders in women. In Artificial Intelligence and Machine Learning for Women's Health Issues (pp. 91-105). Academic Press.

[90] Malik, M., Garg, P., & Malik, C. (2024). Artificial intelligence-based prediction of health risks among women during menopause. *Artificial Intelligence and Machine Learning for Women's Health Issues*, 137-150.

[91] Garg, P. (2024). Prediction of female pregnancy complication using artificial intelligence. In *Artificial Intelligence and Machine Learning for Women's Health Issues* (pp. 17-35). Academic Press.

[92] Pokhrel, L., Arsalan, M., Rani, P., Garg, P., & Pinheiro, P. R. (2026). AI-Powered Healthcare Solutions: Bridging the Medical Gap in Underserved Communities Worldwide. In *Applied AI and Computational Intelligence in Diagnostics and Decision-Making* (pp. 57-86). IGI Global Scientific Publishing.

[93] Kapoor, S., Parmar, R., Sharma, N., Garg, P., & Singh, N. J. (2026). AI and Computational Intelligence in Healthcare: An Introductory Guide. In *Applied AI and Computational Intelligence in Diagnostics and Decision-Making* (pp. 1-26). IGI Global Scientific Publishing.

[94] Pokhrel, L., Kumar, A., Garg, P., Anand, N., & Singh, N. (2026). AI and IoT in Global Health: Ethical Lessons From Pandemic Response. In *Development and Management of Eco-Conscious IoT Medical Devices* (pp. 367-394). IGI Global Scientific Publishing.

[95] Parmar, R., Singh, A., Garg, P., Sharma, T., & Pinheiro, P. R. (2026). Blockchain for Ethical Supply Chains: Transparency in Medical IoT Manufacturing. In *Development and Management of Eco-Conscious IoT Medical Devices* (pp. 337-366). IGI Global Scientific Publishing.

[96] Gupta, S., Garg, P., Agarwal, J., Thakur, H. K., & Yadav, S. P. (2024). Federated learning based intelligent systems to handle issues and challenges in IoVs (Part 1). https://doi.org/10.2174/97898153130311240301

[97] Gupta, S., Chaudhary, G., & Garg, P. (2013). Modified AODV Routing Protocol through Cache Memory for Finding New Routing Paths in MANETs. *International Journal of Computer Science & Management Studies*, *13*(3).

[98] Gupta, A., & Garg, P. (2021). Emerging Techniques for Handling Pandemic Challenges. *Enabling Healthcare 4.0 for Pandemics: A Roadmap Using AI, Machine Learning, IoT and Cognitive Technologies*, 189-209.

[99] Chaudhary, A. P., Mishra, A., Kumar, D., & Garg, P. (2023, April). Human Emotion Recognition using Deep Learning. In *2023 International Conference on Computational Intelligence, Communication Technology and Networking (CICTN)* (pp. 191-197). IEEE.

[100] Nagpal, S., Garg, P., Gaba, S., & Aggarwal, A. (2023). 13 An improved genetic quantum cryptography model for network communication. *Quantum-Safe Cryptography Algorithms and Approaches: Impacts of Quantum Computing on Cybersecurity*, 177.

[101] Yadav, M., Swami, V., Kumar, N., & Garg, P. (2025). Comparative study of Repairable Juice Plants using RPGT. *Reliability: Theory & Applications*, *20*(2 (84)), 776-783.

[102] Gupta, A., Garg, P., & Yadav, P. (2025). Role of Generative AI Towards Education and Learning: Present & Future. *TPM–Testing, Psychometrics, Methodology in Applied Psychology*, *32*(S6 (2025): Posted 15 Sept), 1059-1076.

[103] Dalal, P., Beniwal, G., Sharma, V., Garg, P., & Ahmed, K. (2025). Predicting Student Motivation and Engagement through Machine Learning Models. *TPM–Testing, Psychometrics, Methodology in Applied Psychology*, *32*(S7 (2025): Posted 10 October), 393-411.

[104] Gupta, A., Mund, A., Roy, S., Garg, P., & Yadav, D. K. (2025). Trust in AI Systems: A Social-psychological Investigation of Human–AI Collaboration. *TPM–Testing, Psychometrics, Methodology in Applied Psychology*, *32*(S7 (2025): Posted 10 October), 428-446.

[105] Bhardwaj, A., Das, A., Garg, P., & Yadav, S. (2025). Material-Driven Performance Analysis of a Vertical Nanowire Tunnel FET for Analog Applications: Bhardwaj, Das, Garg, and Yadav. *Journal of Electronic Materials*, 1-12.

[106] Dalal, P., Sharma, B., Sharma, T., Garg, P., & Ahmed, K. (2025). Explainable AI for Understanding Human Decision Making Patterns. *TPM–Testing, Psychometrics, Methodology in Applied Psychology*, *32*(S7 (2025): Posted 10 October), 412-427.

[107] Sharma, K. K., Verma, P. K., Garg, P., & Shrotriya, V. K. (2025, October). Predicting costs and benefits of IoT-based energy management for optimizing sustainable energy storage in rural areas. In *AIP Conference Proceedings* (Vol. 3343, No. 1, p. 040017). AIP Publishing LLC.

[108] Ahmed, K., Baranwal, A., Sharma, N., Garg, P., & Singh, N. (2026). The Role of Federated Learning in AI-Powered Integrated Healthcare Solutions. In *Enabling Collaborative Health Intelligence With Federated Learning* (pp. 421-448). IGI Global Scientific Publishing.

[109] Gupta, S., Garg, P., Agarwal, J., Thakur, H. K., & Yadav, S. P. (2025). Federated learning based intelligent systems to handle issues and challenges in IoVs (Part 2). Bentham Science Publishers. https://doi.org/10.2174/97898153222241250301

[110] Garg, P., Pranav, S., & Prerna, A. (2021). Green internet of things (G-IoT): A solution for sustainable technological development. In *Green Internet of Things for Smart Cities* (pp. 23-46). CRC Press.

[111] Malik, A., Nandal, D., Gupta, V., Garg, P., & Nandal, V. INTELLIGENT SYSTEMS AND APPLICATIONS IN ENGINEERING.

[112] Gupta, S., Garg, P., Agarwal, J., Thakur, H. K., & Yadav, S. P. (Eds.). (2025). Federated learning based intelligent systems to handle issues and challenges in IoVs (Part 2).

[113] Garg, P., Bhatt, M., Parmar, R., & Arsalan, M. (2025). Generative AI: Evolution, Applications, Challenges And Future Prospects. *Applications, Challenges And Future Prospects (May 17, 2025)*.

[114] Kumar, N., Kumar, Y., Khurana, D., Kumar, S., & Garg, P. (2025, November). A Hybrid Ensemble Learning Framework for Interpretable Student Performance Prediction Using Academic and Extracurricular Factors. In *2025 International Conference on Innovations and Emerging Technologies In AI & Communication Systems (IETACS)* (pp. 666-672). IEEE.

[115] Khurana, D., Kumar, Y., Kumar, N., Kumar, S., & Garg, P. (2025, November). Transformer-Based Movie Recommendation System with Autoencoder-Enhanced Feature Compression. In *2025 International Conference on Innovations and Emerging Technologies In AI & Communication Systems (IETACS)* (pp. 685-690). IEEE.

[116] Garg, P. (2025, November). Comparative Analysis of Various Neural Networks for Galaxies Classification. In *2025 International Conference on Innovations and Emerging Technologies In AI & Communication Systems (IETACS)* (pp. 697-701). IEEE.

[117] Saggu, A. K., Babbar, N., & Garg, P. (2025, November). Health-Guard AI: Integrated Health Report Management and Analysis. In *2025 International Conference on Innovations and Emerging Technologies In AI & Communication Systems (IETACS)* (pp. 614-623). IEEE.

[118] Kumar, S., Kumar, Y., Kumar, N., Khurana, D., & Garg, P. (2025, November). Hybrid FCM-DNN Model for Uncertainty-Aware Air Quality Classification Using Multi-Pollutant Data. In *2025 International Conference on Innovations and Emerging Technologies In AI & Communication Systems (IETACS)* (pp. 679-684). IEEE.

[119] Babbar, N., Singh, H. V., Bendale, S., & Garg, P. (2025, November). Stock Market Price Prediction Using Big Data Analysis: A Performance Evaluation Study. In *2025 3rd International Conference on Computational Intelligence and Network Systems (CINS)* (pp. 1-6). IEEE.

[120] Singh, A. K., Kori, G., Garg, P., & Srivastava, G. (2025, November). Bank Churn Prediction Using Machine Learning. In *2025 IEEE 7th International Conference on Computing, Communication and Automation (ICCCA)* (pp. 1-6). IEEE.

[121] Bhardwaj, A., Das, A., Garg, P., & Yadav, S. (2026). Material-Driven Performance Analysis of a Vertical Nanowire Tunnel FET for Analog Applications. *Journal of Electronic Materials*, *55*(1), 1099-1110.

[122] Srivastava, A. K., Shankdhar, D., Ror, R., & Garg, P. (2026). Harnessing YOLOv5 for real-time object detection: A cloud-based approach. In *Recent Advances in Computational Methods in Science and Technology* (pp. 441-450). CRC Press.

[123] Srivastava, A. K., Shukla, A., Gupta, H., Saxena, K., & Garg, P. (2026). Towards intelligent attendance management system with face recognition using LBPH algorithm. In *Recent Advances in Computational Methods in Science and Technology* (pp. 8-15). CRC Press.

[124] Srivastava, A. K., Garg, P., & Pandey, H. (2026). Vedcure: Towards intelligent ayurvedic drug recommendation and disease prediction. In *Recent Advances in Computational Methods in Science and Technology* (pp. 16-23). CRC Press.

[125] Upadhyay, D., Garg, P., & Babbar, N. (2026). Blockchain and IoT based smart contract framework for efficient and secure product life management. *Discover Internet of Things*.

[126] Singh, A., Parmar, R., Bhardwaj, P., Sharma, V., & Garg, P. (2026). Fusion of Aerial Networks with Advanced Computing Paradigms. *Edge Computing and Aerial Platforms*, 355-367.

[127] Kumari, M., Baranwal, A., Sonal, & Garg, P. (2026). Application of Aerial Edge Computing in Disaster Management. *Edge Computing and Aerial Platforms*, 103-122.

[128] Aditi, Saraswat, P., Sharma, V., & Garg, P. (2026). Advances in Aerial Platforms and Edge Computing. *Edge Computing and Aerial Platforms*, 123-143.

[129] Garg, P., Arora, K., Bawane, R., Gupta, C., & Ahmed, K. (2025). Detection and Prevention of Cyber Attack and Threat using AI.

[130] Ahmed, K., Ahmed, A., Khan, J., Garg, P., Seth, S., & Mallik, S. (2025). Principal Component Analysis-Based Clustering of Insecticides and Molecular Docking of Pyrethroid Insecticides.

[131] Kumar, B., Kumar, A., Nanwal, J., Garg, P., & Patnaik, P. (2025, November). Ensemble of YOLOv5 and Segment Anything Model for Brain Tumour Detection. In *2025, the 2nd International Conference on Advanced Computing and Emerging Technologies (ACET)* (pp. 1-5). IEEE.

[132] Arsalan, M., Anas, M., & Garg, P. (2025). Transparent AI for Drug Discovery and Development. *Available at SSRN 5844242*.

[133] Singh, A., Bhardwaj, P., Garg, P., & Singh, N. (2026). Introduction to explainable artificial intelligence in healthcare. In *Explainable AI in Clinical Practice* (pp. 23-44). Academic Press.

[134] Kapoor, S., Singh, A., Garg, P., & Ramasamy, L. K. (2026). Explainable artificial intelligence in a diagnostic support system. In *Explainable AI in Clinical Practice* (pp. 131-145). Academic Press.

[135] Ahmed, K., Anas, M., & Garg, P. (2026). Case studies on unlocking the potential of Industry 4.0 for sustainable manufacturing through generative AI-driven innovations. *Available at SSRN 6356958*.

[136] Garg, P., & Oruganti, S. K. (2026, March). AI Assisted Routing Optimisation in Opportunistic IoT Networks using Machine Learning: A Comprehensive Review on Protocols & Simulators. In *Sustainable Global Societies Initiative* (Vol. 1, No. 4). Vibrasphere Technologies.

[137] Arsalan, M., Pokhrel, L., & Garg, P. (2026). Architecture, Components, and tools in Integrated AI-Augmented Intelligence: A design perspective. *Components and tools in Integrated AI-Augmented Intelligence: A design perspective (March 19, 2026)*.

[138] Singh, H., Ahmed, K., & Garg, P. (2026). Human Versus Machine Customer Behaviour and Functional Differences. *Available at SSRN 6441098*.

[139] Saraswat, P., & Garg, P. (2026). Soft Computing In AI Agents.

[140] Saraswat, P., & Garg, P. (2026). Water Quality Prediction Using IOT Sensors and Deep Networks.

[141] Arsalan, M., Ahmed, K., & Garg, P. (2026). Machine learning for Anomaly detection in sensor networks. *Available at SSRN 6441518*.

[142] Kumari, M., & Garg, P. (2026). Hybrid Cloud Infrastructure: Models, Benefits, Security, and Challenges. *Benefits, Security, and Challenges (March 19, 2026)*.

[143] Singh, H., & Garg, P. (2026). Demystifying Artificial Distributed Intelligence (ADI). *Available at SSRN 6442698*.

[144] Saraswat, P., & Garg, P. (2026). Human-AI Collaboration: the future of clinical decision-making.

[145] Saraswat, P., & Garg, P. (2026). Breaking Data Boundaries Federated Learning in Digital Healthcare.

[146] Singh, A., Parmar, R., Bhardwaj, P., Sharma, V., & Garg, P. (2026). Fusion of Aerial Networks with Advanced Computing Paradigms. *Edge Computing and Aerial Platforms*, 355-367.

[147] Kumari, M., Baranwal, A., Sonal, & Garg, P. (2026). Application of Aerial Edge Computing in Disaster Management. *Edge Computing and Aerial Platforms*, 103-122.

[148] Aditi, Saraswat, P., Sharma, V., & Garg, P. (2026). Advances in Aerial Platforms and Edge Computing. *Edge Computing and Aerial Platforms*, 123-143.

[149] Garg, P. (2026). Zero-Trust Security Enforcement through AI-Powered Anomaly Detection in Cloud Systems. *Journal of Artificial Intelligence in Governance and Public Policy (JAIGPP)*, *1*(1), 1-8.

[150] Singh, A. P., Sharma, A., & Garg, P. (2026, January). AI-Powered Adaptive Mock Interview Generation System. In *2026 International Conference on AI-Driven Smart Systems and Ubiquitous Computing (ICAUC)* (pp. 1421-1426). IEEE.

[151] Raghav, A., Mishra, A., & Garg, P. (2026, January). Enhancing Healthcare Access: An AI-driven Chatbot for Doctor Appointment Management. In *2026 International Conference on AI-Driven Smart Systems and Ubiquitous Computing (ICAUC)* (pp. 910-914). IEEE.

[152] Kumar, B., Chauhan, D., Singh, H., Verma, H., Sahu, K., & Garg, P. (2026, January). Decoding Linear A with Artificial Intelligence: A Comprehensive Machine Learning and NLP Framework. In *2026 International Conference on AI-Driven Smart Systems and Ubiquitous Computing (ICAUC)* (pp. 1-7). IEEE.

[153] Gupta, V., Chakravarti, L., Akhtar, M. M., Maheshwari, P., Garg, P., & Tiwari, D. (2026, January). A Sentence-Level Risk Estimator for Identifying Hallucinations in Generative AI. In *2026 International Conference on AI-Driven Smart Systems and Ubiquitous Computing (ICAUC)* (pp. 1619-1626). IEEE.

[154] Patnaik, P., & Garg, P. (2026). *Principles of Artificial Intelligence: Cognitive Architectures, Large Language Models, and Computational Limits*. Deep Science Publishing.

[155] Singh, K., & Garg, P. (2026). *Trustworthy Deep Learning: Robustness, Uncertainty Quantification, and Adversarial Resilience*. Deep Science Publishing.

[156] Garg, P. (2026). Survey of Load Balancing Strategies in Fog-Cloud Architectures for IoT Integration. *International Journal of Research Publications in Engineering, Technology and Management (IJRPETM)*, *9*(2), 595-604.

[157] Tiwari, D., Bhati, B. S., Garg, P., & Babbar, N. (2026). A novel lexicon dictionary and CNN-LSTM employed hybrid approach for sentiment detection of COVID-19 vaccines. *Scientific Reports*.

[158] Sethi, P., Kumar, B., Garg, P., & Yadav, P. (2026, February). Graph Neural Networks for Causal Inference in Climate Science: A Novel Approach to Model Modeling Complex Interactions. In *2026 International Conference on Intelligent Computing and Automation for Sustainable Solutions (ICASS)* (pp. 1-7). IEEE.

[159] Kumar, B., Garg, P., Garg, A., Nanwal, J., & Yadav, P. (2026, February). An AI-Centric Multimodal Framework for Cognitive Productivity and Digital Wellbeing. In *2026 International Conference on Intelligent Computing and Automation for Sustainable Solutions (ICASS)* (pp. 1-7). IEEE.