



## International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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# Challenges and Opportunities of Quantum Computing

Mahesh Kumar Dubey

Department of Computer Science and Engineering, Galgotias University, Yamuna Expressway Greater Noida, Uttar Pradesh, India

Email Id: [mahesh.dubey@galgotiasuniversity.edu.in](mailto:mahesh.dubey@galgotiasuniversity.edu.in)

**ABSTRACT:** With the investigation of quantum computing in the computer field as of late, quantum computing and quantum algorithms have bit by bit been paid attention to by individuals in the business. Regardless of whether it is the improvement of quantum computers or the arrival of quantum cloud stages, or AI, quantum mindfulness, Quantum simulation and different viewpoints have given some assistance. This article is about the job of quantum computing in the field of computer science, just as circumstances and difficulties. There is a huge difference between conventional computers and quantum computers on the basis of speed and accuracy. The quantum computers are much faster than that of the conventional computers. The existence of the bits in superposition is a basic reason of the exponentially increasing speed of the quantum computers. Quantum computers works on the basis of quantum mechanics which is far different from the computers based on semiconductors.

**KEYWORDS:** Quantum computers, Quantum mechanics, and Quantum behavior.

### I.INTRODUCTION

The rule of quantum computing follows the guideline of quantum mechanics. The standard of superposition of quantum mechanical states permits the condition of quantum data units to be in a condition of superposition of different conceivable outcomes, bringing about quantum data handling more effective than traditional data preparing and having extraordinary potential. The computer would thus be able to accomplish equal computing, in this way improving the computational effectiveness[1], [2]. The register can store the superposition condition of these four states simultaneously, and increment the capacity limit of the computer. IBM built up a five-digit quantum computer in May 2016 and turned into an IBM Quantum Experience. Notwithstanding building a full-scale computer, there is a major test - how to take care of programming issues. On May 19, 2017, the second open beta, 16-piece qubit stage, then, they guaranteed it to arrive at 50 qubits in the following barely any years. In December 2017, Microsoft discharged Quantum Development Suite Quantum Computing Programming Language Q#, supporting Windows, macOS, and Linux. Q# which can call Python code. It permits checking the quantum state (impractical for the quantum state, on the grounds that checking it breaks the wave work and compelling it to an interesting worth) and the scaling and execution dissemination of the quantum program[3]–[5].

Google propelled Open Fermion, an open source quantum computing stage, in October 2017. It was the principal open source stage to change over the issues in science and materials science into quantum circuits that can run on existing stages. It might get leaps forward the field of accomplished dependent on qBLAS enhancement; the dimensionality decrease of information and yield information of HHL algorithm, and so on. The computational intensity of quantum computing is completely reflected. The strategy for AI is on a very basic level a simulation of the human cerebrum's learning procedure and establishes a monstrous neural system. The idea of quantum cognizance is one of the supporting hypotheses for the cautious investigation of the mind itself. The translation of cognizance by quantum awareness is the breakdown of the Bose-Einstein gathering wave work that emerges from the ensnarement of electrons in the mind. After the breakdown, awareness is shaped and the mind discernment is framed. People total the learning procedure and

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invigorate feelings (Fig. 1). The procedure includes the expansion of complex feelings and passionate computing[6], [7].



**Fig. 1: Google's quantum supremacy.**

Quantum knowledge accepts awareness as a sort of vitality change that can be characterized. It imagines that it has quantum properties. Quantum behavior happens during the time spent cognizance age. The perception strategies for this vitality, the consequent computation and incorporation algorithm for a lot of information, and the evaluation criteria for these techniques despite everything should be created. After the approach is full grown, it will fundamentally affect the investigation of assumption estimations in arrange exhibitions, music gratefulness, etc. In quantum computing, reference to the quantum likelihood should be made by us. The arbitrariness of quantum likelihood will likewise give critical assistance in exhibiting assorted variety of imaginative arrangements. Utilizing the essential standards of quantum ensnarement and stacking, in the parts of story contents, story age, scene creation, and music determination, each character in the content has various characters, for example, great and terrible, great and wickedness, magnificence and grotesqueness, etc. superimposed compound and cognizant (Fig. 2). The association between various jobs will prompt the advancement of a's character[8]–[10].

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**Fig. 2: Quantum computing leaps.**

Natural change will likewise affect character. This includes a mind boggling count process and the benefits of quantum computing are completely reflected. The use of quantum likelihood is a more extravagant, more good and bad times of the content, and the result is much increasingly unforeseen. Moreover, as a specialist in the reproduction business, they said that the investigation of quantum computing will assume an explicit job in the foundation of a military reenactment system. Its exceptional computing capacity and capacity limit will infuse new imperativeness into military simulations in technique age, fight harm evaluation and different perspectives. At this stage, the precision of counts and the security of information transmission are guaranteed. Consistent enhancement of quantum algorithms can make the methods for reproduction more advanced and the outcomes progressively dependable, eventually accomplishing the motivation behind exact, down to earth, and imagined simulation information, photovoltaic, power supplies, new materials, pharmaceuticals, and pharmaceuticals. Super conductivity Quantum algorithm examine, while advancing the improvement of quantum computers and the arrival of quantum cloud stages. It can likewise keep on spreading to more fields and assumes a significant job[11]. This article primarily talks about a few parts of the computer field, including AI, quantum mindfulness, imaginative age, military simulation, etc.



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## *Applications:*

- Encryption Technology
- Improved error correction and error detection
- Ultra-secure and super dense communications
- Molecular simulations
- True randomness
- Cryptography
- Searching
- Simulating
- Factorization

## *Advantages:*

- Ability to solve scientific and commercial problems
- Could process massive amount of complex data
- Capability to convey more accurate answers
- Process data in a much faster speed
- These are used to protect secure web pages, encrypted email, and many other types of data.

## *Disadvantages and Problems:*

- Complex hardware schemes like superconductors
- Difficult to build
- Expensive
- Hard to control
- Lots of heat
- Not suitable for word processing and email
- Problem of it need of a nouse free & cool environment

## II.DISCUSSION

This part presents a portion of the territories where quantum computing can assume a job, and dissects the challenges it faces, as appeared in the figure underneath. Yet, not every one of them are simply to talk about with perusers. The Application of Quantum Computing in Quantum Simulation Machine learning has experienced bottlenecks, and the number and nature of information handled are confronted with numerous issues (Fig. 3). The computing intensity of existing computers is as yet restricted, and the expansion in information volume and the high prerequisites for information exactness, fineness, and distinguishing proof have not been adequate to completely meet existing necessities. The development of quantum computing and quantum algorithms may turn into a compelling way to break these bottlenecks. Quantum computer (head segment investigation) is more effective than conventional computer exponential.



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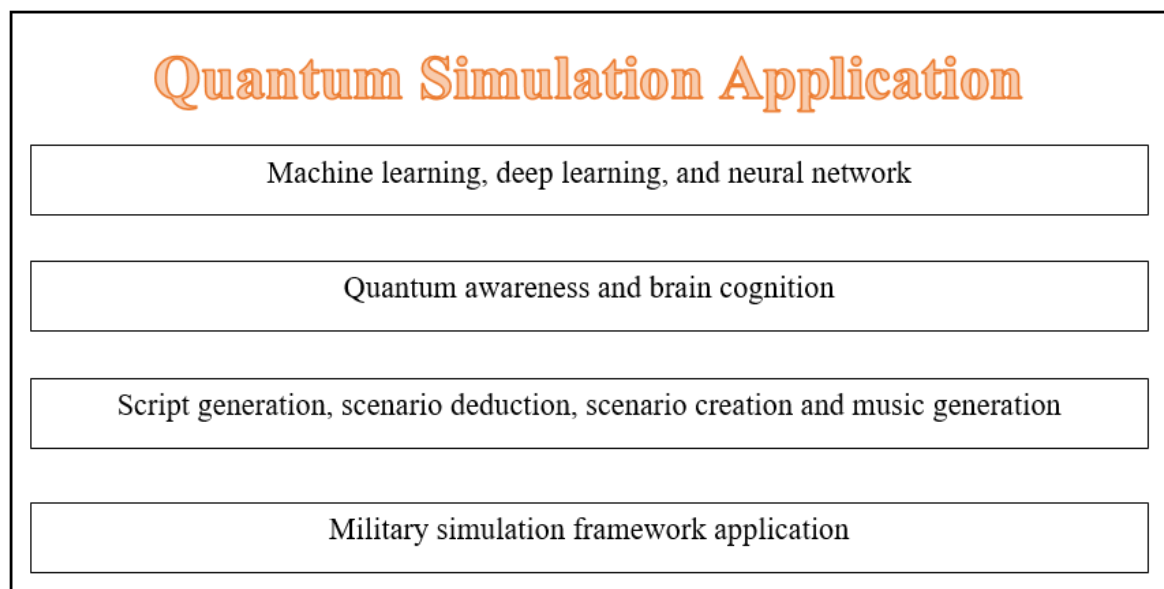


Fig. 3: Quantum Simulation Application

### III.CONCLUSION

Quantum computing has entered the advancement arrange. Significant organizations including IBM, Google, Microsoft, and Intel are contributing a ton of human and material assets in R&D. Prior to the coming of develop quantum computers, the use of quantum computing and quantum algorithms will bring individuals boundless desires. Regardless of whether it is AI, inside and out learning, neural system research, or quantum cognizance, another translation of the mind, from the production of stage innovativeness under quantum probabilities to the redefinition of military simulation structure, quantum computing will be irreplaceable. Consequently, computers are likewise anticipating viable research. At present, there are numerous open doors for quantum computing, however to genuinely understand the ubiquity, there are as yet numerous difficulties that analysts need to survive. In any case, quantum computing will clearly involve a spot in this field.

### REFERENCES

- [1]M. Ali, S. U. Khan, and A. V. Vasilakos, "Security in cloud computing: Opportunities and challenges," Inf. Sci. (Ny)., 2015, doi: 10.1016/j.ins.2015.01.025.
- [2]C. L. Philip Chen and C. Y. Zhang, "Data-intensive applications, challenges, techniques and technologies: A survey on Big Data," Inf. Sci. (Ny)., 2014, doi: 10.1016/j.ins.2014.01.015.
- [3]W. Shi, J. Cao, Q. Zhang, Y. Li, and L. Xu, "Edge Computing: Vision and Challenges," IEEE Internet Things J., 2016, doi: 10.1109/JIOT.2016.2579198.
- [4]Q. Zhang, L. Cheng, and R. Boutaba, "Cloud computing: State-of-the-art and research challenges," J. Internet Serv. Appl., 2010, doi: 10.1007/s13174-010-0007-6.
- [5]C. Kloeffer and D. Loss, "Prospects for Spin-Based Quantum Computing in Quantum Dots," Annu. Rev. Condens. Matter Phys., 2013, doi: 10.1146/annurev-conmatphys-030212-184248.
- [6]Y. Wei and M. B. Blake, "Service-oriented computing and cloud computing: Challenges and opportunities," IEEE Internet Comput., 2010, doi: 10.1109/MIC.2010.147.
- [7]R. Biswas et al., "A NASA perspective on quantum computing: Opportunities and challenges," Parallel Comput., 2017, doi: 10.1016/j.parco.2016.11.002.
- [8]C. Yang, Q. Huang, Z. Li, K. Liu, and F. Hu, "Big Data and cloud computing: innovation opportunities and challenges," International Journal of Digital Earth. 2017, doi: 10.1080/17538947.2016.1239771.
- [9]Y. Ma et al., "Remote sensing big data computing: Challenges and opportunities," Futur. Gener. Comput. Syst., 2015, doi: 10.1016/j.future.2014.10.029.



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- [10]J. G. Lee and M. Kang, “Geospatial Big Data: Challenges and Opportunities,” Big Data Res., 2015, doi: 10.1016/j.bdr.2015.01.003.
- [11]M. V. Kovalenko, “Opportunities and challenges for quantum dot photovoltaics,” Nature Nanotechnology. 2015, doi: 10.1038/nnano.2015.284.
- Balamurugan S, Visalakshi P, “Hybrid Firefly Algorithm Harmony Search for Feature Selection with BCNF for Multiple Subtables and EM-GMM for Top Down Initial Partitioning”, Asian Journal of Research in Social Sciences and Humanities Year : 2016, Volume : 6, Issue : 8, 2016
  - Balamurugan S, Visalakshi P, “Privacy-Preserving Data Mining of Query Logs with Multiple Log Subtables in Conditional Functional Dependencies”, Asian Journal of Research in Social Sciences and Humanities Year : 2016, Volume : 6, Issue : 8, 2016
  - Balamurugan S, Visalakshi P, “Boyce-Codd Normal Form Based Privacy Preserving Multiple Subtables with Conditional Functional Dependencies”, Asian Journal of Information Technology Vol 15, Issue : 12, 2016
  - Vishal Jain, Mahesh Kumar Madan, “Implementation of Knowledge Mining with Ontology”, International Journal of Computer Science & Engineering Technology (IJCSET), Vol. 3 No. 7, July 2012, page no. 251-253, having ISSN 2229-3345.
  - Vishal Jain, Mahesh Kumar Madan, “Information Retrieval through Multi-Agent System with Data Mining in Cloud Computing”, International Journal of Computer Technology and Applications (IJCTA) Volume 3 Issue 1, January-February 2012, page no. 62-66, having ISSN 2229-6093 .
  - Vishal Jain, Mahesh Kumar Madan, “Multi Agent Driven Data Mining for Knowledge Discovery in Cloud Computing”, International Journal of Computer Science & Information Technology Research Excellence Vol. 2, Issue 1, Jan-Feb 2012, page no. 65-69, having ISSN 2250-2734.