

Emerging Innovations in 2021: What's next?

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▪ **Quantum Computing (1)**

Quantum computing could eventually transform medicine, break formerly reliable encryption, and revolutionize communications and artificial intelligence. While the Fourth Industrial Revolution has been built on technologies at a molecular level by integrating the physical, biological, and digital worlds, the advent of quantum computing means that the fifth wave of technology may largely take place at an atomic scale. However, despite recent advances, only a handful of quantum algorithms exist – and it remains an open question whether quantum computers will truly outshine their classical peers.

▪ **Advanced Materials (2)**

From the Stone Age to the Bronze Age, and to the Iron Age, every major advancement for human civilization has been driven by development in materials. In today's Silicon Age, semiconducting materials underpin the microelectronic devices and information technologies that enable much of modern living. Now, new materials are needed – to improve our collective quality of life, and to ensure greater environmental sustainability for the planet. Materials science and engineering research are constantly moving forward to help address these goals.

- Advanced Materials for big data.
- Ink-jet printed graphene.
- Fluorescent Carbon-Based Nanostructures for Bioimaging Applications.

▪ **Internet of Things (IoT) (3)**

The Internet of Things, or "IoT," surrounds us with networks of smart, web-connected

devices and services capable of sensing, interconnecting, inferring, and acting. It is enabling the development of new products and business models while creating ways for governments to deliver more useful services and better engage with the public. Some of the most important issues related to IoT include technology architecture and standardization, safety and security risks, threats to privacy and trust, potentially missed opportunities for broad social benefits – and a need for responsible governance.

- **Bio Big Data and Biotechnology (4)**

The automated analysis of increasingly large sets of genetic data promises to transform health care. Biomedical science is transforming into big-data science. Currently, archived datasets represent only a small fraction of the genome-related big data yet to be produced, as sequencing capacity will continue to grow.

- **Data Science & Machine Learning (5)**

The era of data is upon us. It is proliferating at an unprecedented pace, reflecting every aspect of our lives and circulating from satellites in space through the phones in our pockets. The data revolution creates endless opportunities to confront the grand challenges of the 21st century. Yet, as the scale and scope of data grow, so must our ability to analyze and contextualize it.

Large-scale machine learning systems need to be integrated with vast computing infrastructure for deep learning, one of the most promising branches of artificial intelligence, to help better enable the navigation of big data and detect things that are impossible to catch manually. Machine learning could facilitate the mining of gene-to-gene interaction, the classification of cellular images, and finding links between datasets.

- **Behavioral Sciences (6)**

behavioral sciences are a powerful tool that can be wielded to engender responsible decision-making and improve the quality of life. Behavioral sciences have a significant role to play in smoothing society's path amid the dramatic changes accompanying the Fourth Industrial Revolution.

- **Blockchain (7)**

Blockchain can enable greater trust and transparency through decentralization, cryptography, and the creation of new incentives. The financial sector is investigating blockchain as a means to replace expensive and inefficient payment systems. It could also reshape supply chains – particularly in combination with the Internet of Things and artificial intelligence – while boosting the practical, day-to-day use of smart contracts, digital currencies, and digital identities.

- **5G (8)**

5G is next-generation wireless network technology that's expected to change the way people live and work. It will be faster and able to handle more connected devices than the existing 4G LTE network, improvements that will enable a wave of new kinds of tech products.

References

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