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"Unveiling Tech Horizons"

TECH-E-BYTES

TECHNICAL MAGAZINE

INSTITUTE **VISION**
To become a globally recognized Institution that develops professionals with integrity who excel in their chosen domain making a positive impact in industry, research, business, and society

CSE DEPARTMENT **VISION**
To acquire global excellence in the field of Computer Science and Engineering, nurturing in professionals, technical competence, innovative skills, professional ethics and social commitment.

DEPARTMENT OF
COMPUTER SCIENCE & ENGINEERING

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INSTITUTE OF SCIENCE & TECHNOLOGY

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INSTITUTE MISSION

» To provide the ambiance necessary to achieve professional and technological excellence at the global level.

» To undertake collaborative research that fosters new ideas for sustainable development.

» To instill in our graduate's ethical values and empathy for the needs of society.

DEPARTMENT MISSION

» To equip students with a strong foundation in the area of Computer Science and Engineering using effective teaching -learning practices.

» To provide state-of-the-art infrastructure to suit academic, industry and research needs at the global level.

» To engage students and faculty in interdisciplinary research that promotes innovative ideas for sustainable development.

» To incorporate skill enhancement programmes for students and faculty to cope with the contemporary developments in technology.

» To inculcate effective communication skills, professional ethics and social commitment among professionals through value added programs.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

Graduates of Computer Science & Engineering will

1. Evolve as globally competent computer professionals, researchers and entrepreneurs possessing collaborative and leadership skills, for developing innovative solutions in multidisciplinary domains.
2. Excel as socially committed computer engineers having mutual respect, effective communication skills, high ethical values and empathy for the needs of society.
3. Involve in lifelong learning to foster the sustainable development in the emerging areas of technology.

PROGRAM SPECIFIC OUTCOMES (PSO)

Students of the Computer Science and Engineering program will:

PSO1: Professional Skills: Attain the ability to design and develop hardware and software based systems, evaluate and recognize potential risks and provide creative solutions.

PSO2: Successful Career and Entrepreneurship: Gain knowledge in diverse areas of Computer Science and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies.

PROGRAM OUTCOMES (PO)

Engineering Graduates will be able to:

1.Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2.Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4.Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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V2X: AN OVERVIEW FOR BEGINNERS

Ayda Sara Shaji, S8 CSE

Vehicle-to-Everything (V2X) technology is a wireless communication system that allows vehicles to connect and communicate with one another, as well as with roadside infrastructure and other road users. The main goal for V2X technology is to provide safer roads and driving experiences by connecting all entities. When all entities on the road are connected, V2X gives drivers and road users a more complete picture of what is going on around them within a distance of up to 1km.

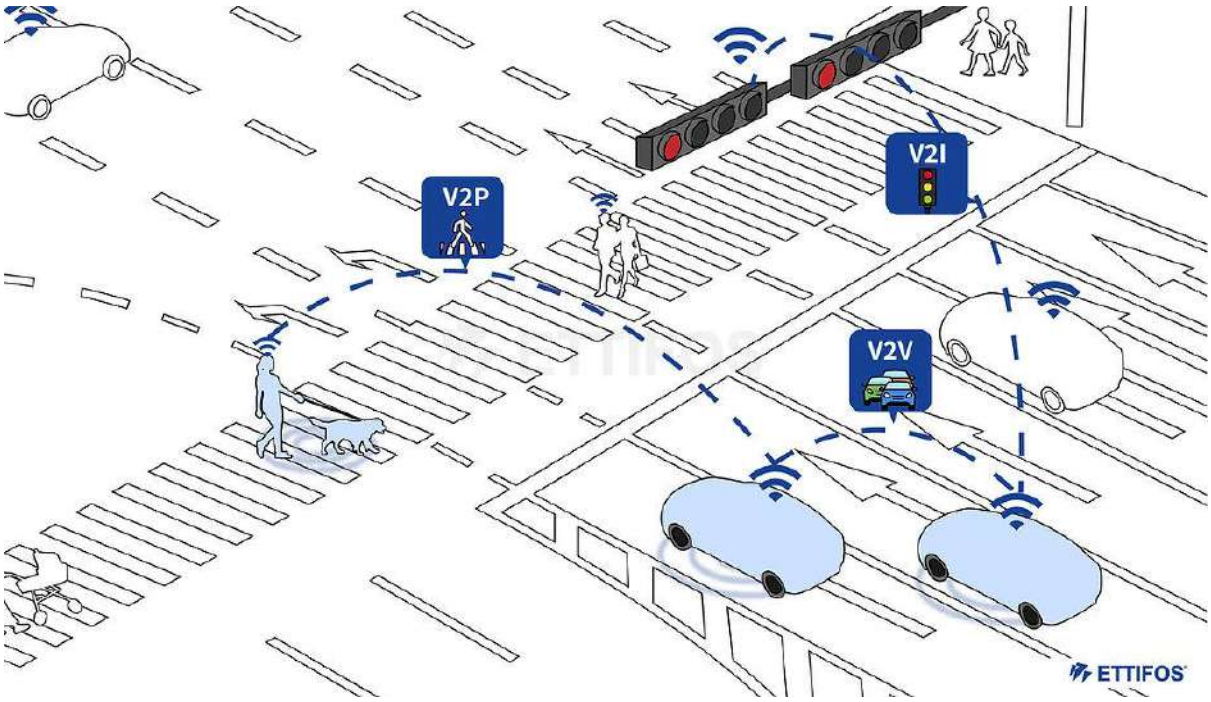
The information sent via V2X can include the speed and location of other cars or pedestrians, updates on traffic flow and congestion, accidents, roadworks, or even how much time is remaining before a traffic light turns red - also making the technology a key enabler for connected automated vehicles. Helping them to see what is not within their own range of sight, or any blind spots on the road, drivers can be alerted of any actual or potential hazards, allowing them to take the necessary action and helping them to choose the most efficient routes for their journeys.

To do this, V2X technology permits low-latency vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and vehicle-to-pedestrian (V2P) communication.

Vehicle-to-vehicle communication is the wireless communication directly between the vehicles on the road. This is the wireless communication that provides drivers with the situational awareness of other vehicles' location, speed or direction, as well as any sudden breaking by a vehicle. The importance of V2V communication is that it enables drivers to be more informed about the status of other vehicles with On-board units (OBU). Subsequently, drivers can make better decisions when they are on the road, take evasive action, and improve collision avoidance.

Vehicle-to-infrastructure communication allows vehicles to communicate with any infrastructure with a Roadside Unit (RSU). The messages that are shared are reliant on the infrastructure that is nearby. This can include messages between vehicles and cameras, street lights, traffic lights, signage, and more.

V2I communication not only improves safety on the road, but it also greatly improves efficiency of a vehicle and the road.



An illustration depicting vehicle-to-everything communication with all road entities connected via V2V, V2I and V2P communication.

Drivers can receive real-time updates about a range of road-related issues such as changing weather conditions, upcoming construction zones, road closures, and available parking spaces that help facilitate improved traffic management.

Vehicle-to-pedestrian (V2P) creates a direct link of communication between vehicles and pedestrians, or other individuals who may be on the roadside such as cyclists, those entering or exiting vehicles, or road maintenance workers. These individuals are entitled to the right of way, and must also be given the maximum amount of protection from vehicles on the road, therefore V2P communication allows drivers to be aware of the presence of any pedestrians or road users so that they can avoid them and eliminate any potential collisions that could occur.

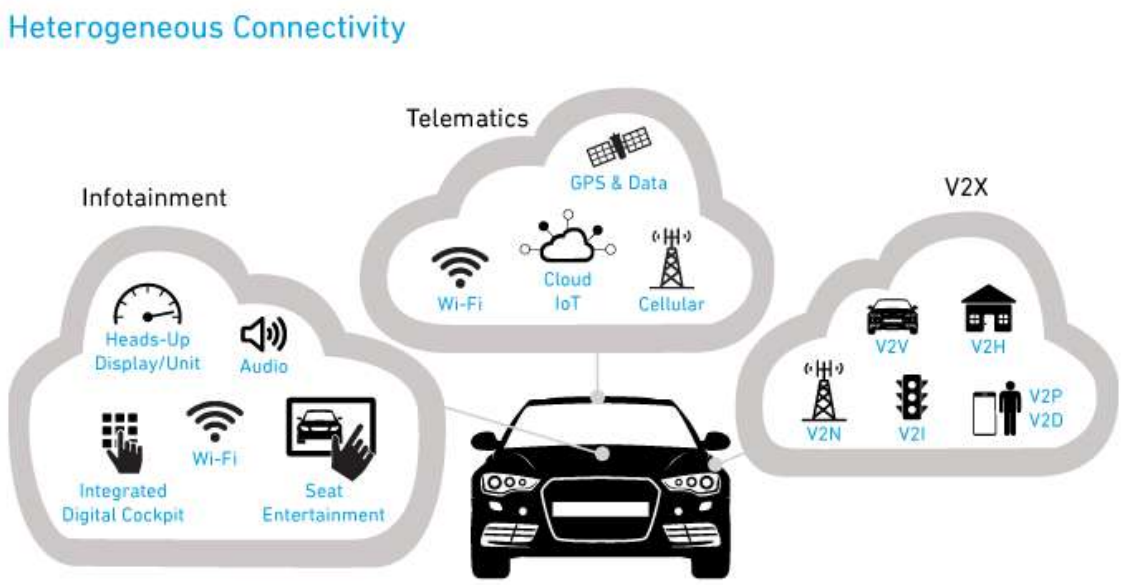
Whilst it is important to keep the most vulnerable road users safe, V2P communication is designed to provide safety for both the pedestrian and driver of the vehicle in turn. Within a vehicle, drivers are alerted to the presence and location of a pedestrian through an on-board V2X unit. For pedestrians, the presence of a vehicle or any other necessary updates can be communicated via V2P messages to a personal device such as a smartphone or wearable device. With its ability to connect everything on the road and send key information between each entity, V2X technology will transform the way we use the road

and our overall driving experience by making journeys safer, reliable and more efficient for all users.

Currently, V2X technology is being tested and deployed in a number of areas using both DSRC and Cellular Vehicle-to-Everything (C-V2X) protocols, most notably across the U.S., the EU, China, Japan and South Korea.

Whilst many manufacturers have already implemented V2X technology within their vehicles, public and private pilot initiatives are still being undertaken to further test real life applications and scenarios to enable a large-scale deployment of V2X technology across cities and countries.

For large-scale deployment to take place, a number of factors are being considered by regulators and manufacturers such as standardization of V2X protocols to ensure all entities can communicate despite their producer or origin country, investment in infrastructure such as road-side units and data centres, and regulatory frameworks that uphold the safety and privacy of V2X users.



RELIABILITY ISSUE IN CLOUD COMPUTING SOLVED USING BLOCKCHAIN

Vishnu Jayakumar, S8 CSE

Cloud computing has become a trend and everyone even the non tech person is aware of this technology. Cloud computing has become the foundation for development, artificial intelligence, and in emerging smart cities. Due to the increased number of users, the need for reliability and security also increases. Companies are working on the reliability of the cloud. In recent years the research has moved from reliability to security and other dimensions and like mobile computing, fog computing, and edge computing. Due to the heavy user, we are facing challenges regarding reliability, the requirements for reliability are different for different so the SLA (Service License Agreement) can't achieve it. Also, the cost and provider for the security are some of the other issues. The issue of privacy and reliability is only with the public cloud. To solve this problem blockchain technology has paved the way into it. Blockchain provides a decentralized without the interaction of the third party in distributed computing. Each block is combined in the form of a chain. Nodes participate in the blockchain based on the value exchange protocol. Idea of service computing is to find select specific service nodes in the distributed to join in the service. Quality of Service is the basic principle of the cloud computing system. QoS and SLA are important factors for the reliability of cloud computing. In cloud computing in order to maintain the indicators of the QoS, reliability, and trust the user will sign the agreement and a penalty will be made if the user violates it, this is known as SLA (Service License Agreement). Blockchain is operated and maintained by all the nodes present in the chain. Similarly, the serviced distributed service is dynamically scheduled and combined according to resource strategy. Both blockchain and cloud have consensus mechanisms. The main advantage of the blockchain is that it provides encapsulation of various consensus algorithms. It has a very

strong decentralized decision-making power. The consensus in the cloud is that if the QoS fails in some of the services it will update or reconstruct in a self-organizing manner. Cloud contains hardware devices like data center operating systems and servers. It also contains the market module and app verification to verify whether the changes are done according to the specification The transaction framework uses blockchain which increases security, and trust allowing to register and make payments through it. In this scenario. SLA is eliminated as there is no one-time agreement between the user and the providers. As the open market is on a blockchain network consumers get rewarded for it

Reference: Reliability Service Assurance in Public Clouds based on Blockchain Sa Meng, Liang Luo, Peng Sun, Yuan Gao School of Computer Science and Engineering University of Electronic Science and Technology of China Chengdu, China.

FOG COMPUTING

Najia Nazrin, S8 CSE

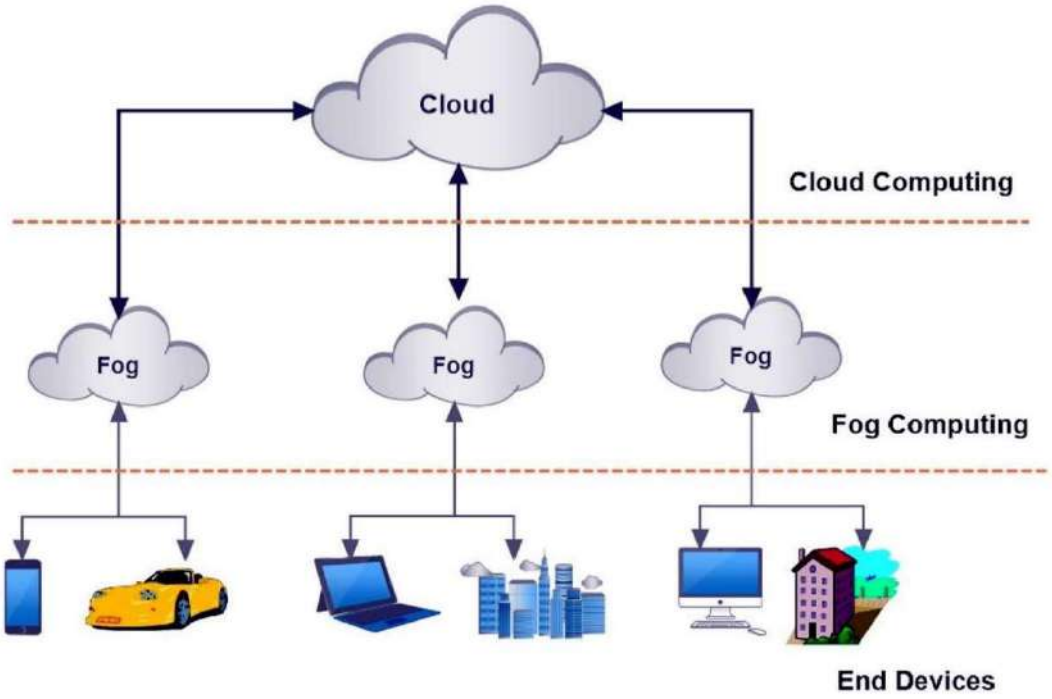
Fog computing is a service started by networking giant, CISCO. It would be very difficult to define fog computing without first defining cloud computing, since fog computing is basically an extension of the cloud. Cloud computing is the process of running ICT tasks and services and storing computer resources over the Internet. This makes it possible for people and businesses to make use of third-party hardware and software hosted online.

Cloud computing makes it quite easy to access information and computer resources from anywhere so far as internet connection is available. With the all-round availability of shared/pooled computing resources, cloud computing offers advantages over traditional onsite hosted services in terms of speed, cost, and efficiency. Fog computing can be implemented using a basic communication system as opposed to being implemented using a heavy backbone network. As a result, it has a denser coverage. This advantage makes it easier to run a real-time, big-data operation with the ability to support billions of nodes in highly dynamic, diverse environments. Hierarchical Fog Computing Architecture: The proposed architecture must either be application agnostic or application specific. The architecture can be broadly classified into three main layers:

1. Things layers.

2. Fog layer.

3. Cloud layer



1. Things layer :- It is also referred to as the perception layer and can be regarded as a point where the IoT structure starts with the generation and collection of data. It has network Things like Sensors objects and devices which have communication protocols allowing transmission of the generated data through nodes to the fog.

2. Fog layer :- It is supposed to have several decentralized nodes present in each location. This layer has the task of handling all the networks and the data received. The primary refining computation and processing of data is done here and after that, the IoT applications are enhanced by controlling the data transmission to the cloud layer and reducing the request response time taken for an IoT application.

3. Cloud layer: - The cloud layer or the data center's layer is regarded as IoT architecture's topmost layer. This layer has the function of allowing network access, conveniently and properly across all the shared resources in the IoT network. The storage and services areas of the IoT network requires heavy duty and is performed by the cloud layer.

Layered Fog Computing Architecture:

1. Physical and Virtualization Layer:- This layer comprises nodes (Physical and virtual). The nodes perform the primary task of capturing data and are located at different locations. Nodes usually involve sensing technology to capture their surroundings. Sensors used at this node collect data from the surroundings and collect data which is then sent to upper layers via gateways for further processing. A node can be a stand-alone device like a mobile phone or it can be a part of a large device like a temperature sensor fitted inside a vehicle

2. Monitoring Layer:- In this layer, we perform node monitoring related to various tasks. Nodes can be monitored for the amount of time they work, the temperature and other physical properties they are possessing, the maximum battery life of the device, etc. The performance of applications as well as their present state is also monitored. The fog nodes are checked for their energy consumption, the amount of battery power they consume while performing their tasks.

3. Pre-processing Layer :- This layer performs various data operations mainly related to analysis. Data is cleaned and checked for any unwanted data present. Data impurity is removed and only useful data is collected. Data analysis at this layer can involve mining meaningful and relevant information from a vast amount of data collected by the end devices. Data analysis is one of the essential features that should be taken into consideration before data is used for a specific purpose.

4. Temporary Storage :-This layer is associated with non-permanent distribution and replication of data. Storage virtualization like VSAN is used in this layer. Data is removed from the temporary layer once data is moved to the cloud, from this layer.

5. Security Layer:- This layer is involved with the privacy of data, the integrity of data, encryption, and decryption of data. Privacy in the case of fog computing data can include use-based privacy, data-based privacy, and location-based privacy. The security layer ensures secure and preservation of privacy for the data which is outsourced to the fog nodes.

6. Transport Layer:- The primary function of this layer is to upload partly processed and fine-grained secure data to the cloud layer for permanent storage. For efficiency purposes, the portion of data is collected and uploaded. The data is passed through smart-gateways before uploading onto the cloud. The communication protocols used are chosen to be lightweight, and efficient, because of the limited resources of fog computing.

Future Research Direction: Fog computing may be the next big thing for the Internet of things. The fog computing market, valued at $22.3 million in 2017, will expand at an explosive rate and grow to $203.5 million over the next five years, according to projections by Markets and Markets. IoT interconnectivity, machine to machine communication, real-time computing demand and demand for connected devices are driving the fog market's growth. Businesses impacted by these trends are turning to fog computing for greater efficiency, faster decision making processes and lowered operating costs.

Conclusion: Fog computing provides a convenient way to use data near to IOT locations for better control over actuators as well as solve the problem of exploding the data volume. Complete IOT network can work smoothly by using FOG as there is no extra

overhead of external traffic or computing. Fog computing accelerates awareness and response to events by eliminating a round trip to the cloud for analysis. It avoids the need for costly bandwidth of network traffic from the core network. It also protects sensitive IoT data by analyzing it inside company jurisdiction. Ultimately, organizations that adopt fog computing gain deeper and faster insights, leading to increased business agility, higher service levels, and improved safety. Fog Computing aims to reduce the processing burden of cloud computing. Fog computing is bringing data processing, networking, storage and analytics closer to devices and applications that are working at the network's edge. That's why Fog Computing is today's trending technology mostly for IoT Devices.

References: https://journalofbigdata.springeropen.com /articles/10.1186/s40537-020- 00372-z https://ieeexplore.ieee.org/stamp/stamp.j sp?arnumber=8026115 www.ieeexplore.ieee.org

NEXT-GENERATION VIRTUAL REALITY AND AUGMENTED REALITY TECHNOLOGIES

Reshma Ramesh, S8 CSE

Virtual Reality (VR) and Augmented Reality (AR) technologies have seen remarkable growth in recent years, and their application is increasingly becoming pervasive. This is due to the development of new, Next-Generation VR and AR technologies that can provide a more immersive and realistic experience than ever before. In this article, we will explore the latest advancements in VR and AR technologies, their benefits, and their applications.

Next-generation VR technologies are designed to deliver a more realistic and immersive experience to users. These technologies rely on advanced hardware and software

systems that provide users with a more natural and responsive experience. Some of the key features of next generation VR technologies include:

Higher Resolution Displays: Next-generation VR technologies use higher resolution displays that offer a clearer and sharper image. This enhances the visual experience and reduces the likelihood of visual fatigue.

Better Tracking: Next-generation VR technologies use advanced tracking systems that allow for more accurate and precise tracking of user movements. This allows for a more natural and realistic experience.

Improved Audio: Next-generation VR technologies use advanced audio systems that offer a more realistic and immersive audio experience. This includes better spatial audio, which can help to create a more immersive experience.

Haptic Feedback: Next-generation VR technologies use haptic feedback systems that provide users with a more realistic tactile experience. This can help to create a more immersive and realistic experience.

Next-generation AR technologies are designed to provide a more seamless and natural experience for users. These technologies rely on advanced hardware and software systems that offer improved tracking, more accurate positioning, and a more realistic visual experience. Some of the key features of next-generation AR technologies include:

Improved Tracking: Next-generation AR technologies use advanced tracking systems that allow for more accurate and precise tracking of user movements. This helps to create a more seamless and natural experience.

Better Positioning: Next-generation AR technologies use improved positioning systems that allow for more accurate placement of virtual objects in the real world. This enhances the realism and immersion of the experience.

More Realistic Visuals: Next-generation AR technologies use advanced display systems that offer a more realistic visual experience. This includes improved color accuracy, contrast, and brightness.

Improved Interaction: Next-generation AR technologies use advanced interaction systems that allow users to interact with virtual objects more naturally. This includes improved hand-tracking and gesture recognition. Applications of Next-Generation VR and AR Technologies:

Gaming: Next-generation VR and AR technologies are being used in the gaming industry to create more immersive and realistic gaming experiences.

Education: Next-generation VR and AR technologies are being used in education to create more engaging and interactive learning experiences.

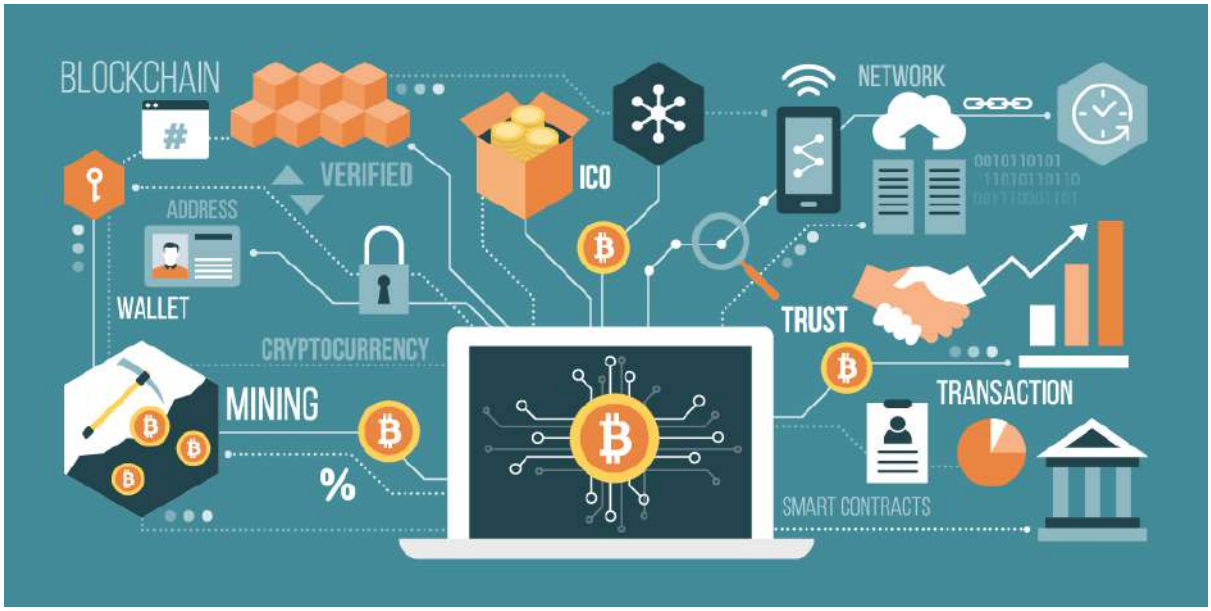
Healthcare: Next-generation VR and AR technologies arebeing used in healthcare to create more realistic simulations for training medical professionals and to provide therapy for patients.

Manufacturing: Next-generation VR and AR technologies are being used in manufacturing to create more efficient and effective training programs for employees.

Next-generation VR and AR technologies offer a more realistic and immersive experience for users. These technologies rely on advanced hardware and software systems that provide a more natural and responsive experience. The applications of these technologies are numerous and varied, ranging from gaming to healthcare. As these technologies continue to develop, we can expect to see even more exciting applications in the future.

BLOCKCHAIN TECHNOLOGY

Ashish Thomas, S8 CSE



Blockchain technology is one of the most innovative and transformative technologies of our time. Initially created for Bitcoin, it is now being used in various industries and sectors, including finance, supply chain, healthcare, and real estate, to name a few. Blockchain has the potential to revolutionize the way we do business and interact with each other.

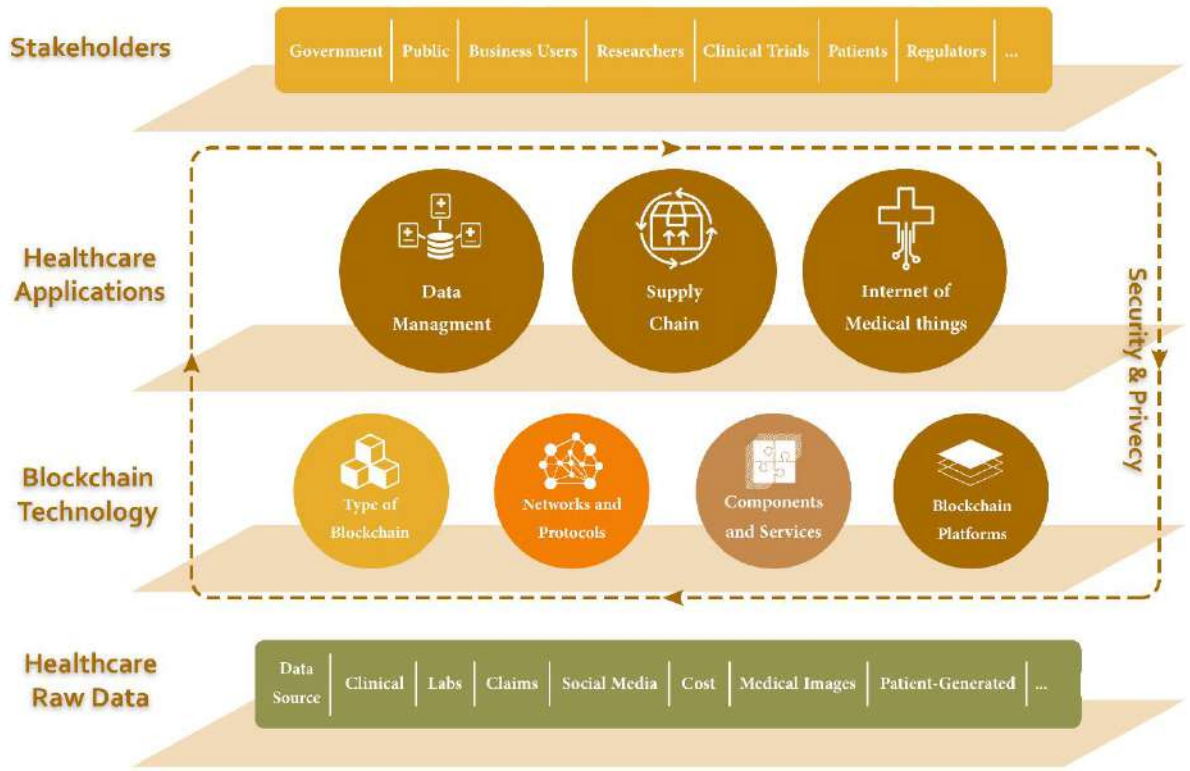
What is Blockchain? Blockchain is a digital ledger that records transactions on a decentralized network. It is a continuously growing list of records, called blocks, that are linked and secured using cryptography. Each block contains a cryptographic hash of the previous block, timestamp, and transaction data. Once a block is added to the chain, it cannot be altered or deleted. This ensures the integrity and immutability of the data stored on the blockchain.

Blockchain is an emerging technology with many advantages in an increasingly digital world:

Highly Secure
It uses a digital signature feature to conduct fraud-free transactions making it impossible to corrupt or change the data of an individual by the other users without a specific digital signature.

Decentralized System
Conventionally, you need the approval of regulatory authorities like a government or bank for transactions; however, with Blockchain, transactions are done with the mutual consensus of users resulting in smoother, safer, and faster transactions.

Automation Capability
It is programmable and can generate systematic actions, events, and payments automatically when the criteria of the trigger are met.



Structure and Design of Blockchain

A blockchain is a distributed, immutable, and decentralized ledger at its core that consists of a chain of blocks and each block contains a set of data. The blocks are linked together using cryptographic techniques and form a chronological chain of information. The structure of a blockchain is designed to ensure the security of data through its consensus mechanism which has a network of nodes that agree on the validity of transactions before adding them to the blockchain.

Blocks:
A block in a blockchain is a combination of three main components:

1. The header contains metadata such as a timestamp which has a random number used in the mining process and the previous block's hash.

2. The data section contains the main and actual information like transactions and smart contracts which are stored in the block.

3. Lastly, the hash is a unique cryptographic value that works as a representative of the entire block which is used for verification purposes.

Block Time:
Block time refers to the time taken to generate a new block in a blockchain. Different blockchains have different block times, which can vary from a few seconds to minutes or may be in hours too. Shorter block times can give faster transaction confirmations but the result has higher chances of conflicts but the longer block times may increase the timing for transaction confirmations but reduce the chances of conflicts.

Hard Forks:
A hard fork in a blockchain refers to a permanent divergence in the blockchain's history that results in two separate chains. It can happen due to a fundamental change in the protocol of a blockchain and all nodes do not agree on the update. Hard forks can create new cryptocurrencies or the splitting of existing ones and It requires consensus among the network participants to resolve.

Decentralization:
Decentralization is the key feature of blockchain technology. In a decentralized blockchain, there is no single central authority that can control the network. In decentralization, the decision-making power is distributed among a network of nodes that collectively validate and agree on the transactions to be added to the blockchain. This decentralized nature of blockchain technology helps to promote transparency, trust, and security. It also reduces the risk to rely on a single point of failure and minimizes the risks of data manipulation.

Finality:
Finality refers to the irreversible confirmation of transactions in a blockchain. If and when a transaction is added to a block and the block is confirmed by the network, it becomes immutable and cannot be reversed. This feature ensures the integrity of the data and prevents double spending, providing a high level of security and trust in Blockchain Types & Sustainability

Openness:
Openness in blockchain technology makes the blockchain accessible to anyone who intends to participate in the network. This implies that it is open for all and anyone can join the network, validate transactions, and can add new blocks to the blockchain, so long as they know the consensus rules. Openness promotes inclusivity, transparency, and innovation, as it allows for participation from various stakeholders.

Public Blockchain:
It is a kind of blockchain which is open for the public and allows everyone to join the network to perform transactions and to participate in the consensus process. Public blockchains are transparent, because all transactions are publicly recorded.

Blockchain is a combination of three leading technologies:

1. Cryptographic keys
2. A peer-to-peer network containing a shared ledger
3. A means of computing, to store the transactions and records of the network

Cryptography keys consist of two keys – Private key and Public key. These keys help in performing successful transactions between two parties. Each individual has these two keys, which they use to produce a secure digital identity reference. This secured identity is the most important aspect of Blockchain technology. In the world of cryptocurrency, this identity is referred to as 'digital signature' and is used for authorizing and controlling transactions.

The digital signature is merged with the peer-to-peer network; a large number of individuals who act as authorities use the digital signature in order to reach a consensus on transactions, among other issues. When they authorize a deal, it is certified by a mathematical verification, which results in a successful secured transaction between the two network-connected parties. So to sum it up, Blockchain users employ cryptography keys to perform different types of digital interactions over the peer-to-peer network.

Ref: https://www.simplilearn.com/tutorials/blockchain-tutorial/blockchain-technology

DATA SCIENCE - PRESENT AND FUTURE

Muhammed Rameez, S8 CSE

Without data, you are just another person with an opinion. -W. Edwards Deming

From the corporate world to tech giants, data is the driving force. If we go by statistics, roughly 2.5 quintillion bytes of data are produced each day (that's 2.5 followed by a staggering 18 zeros!). With every business shifting online, this number is also increasing with every passing second and we are in the need of efficient data management and manipulation more than ever. Data Science is not a new term in technology. But the rise in the need of it relatively is. The demand for skilled data science professionals has seen an upsurge, as organizations are on the constant lookout for data science professionals to resolve business complexities with efficient data analysis. Data Science in its simplest explanation is something that makes data useful. Data Science puts statistics, machine learning, artificial intelligence, analysis, and analytics under the same umbrella. It allows us to have some interesting insights about the data and draw some useful conclusions from it.

Over the past decade, we have seen a dramatic movement toward data-driven decision-making, in step with an explosion of available data sources. Point-of-sale data, the internet of things, cell phone data, text data from social networks, voice, and video are all automatically collected and reported. Coupled with advances in machine learning and artificial intelligence, these resources enable leaders and organizations to use analytics and data science for better-informed and improved decisions. The economic impact of COVID-19 is unprecedented, dramatically changing markets and prospects for economic growth. Supply chains, transportation, food processing, retail, e-commerce, and many other industries have transformed overnight. Unemployment in the world has reached levels unknown in recent memory. Data Science and Machine Learning models heavily make predictions by analyzing past data but the recent past we have witnessed is unforeseeable and is causing a seismic shift in data

The debate on the future of data scientists is going on for a long time and almost everyone has their opinion on it. Recently, KDNuggets conducted a poll on 'whether data scientists will extinct in 10 years or not? 'About 70% of readers think that the demand for Data Scientists will increase, and over 90% think the role of Data scientists will change. Many professionals across the world also believe that data science is not going anywhere for a long time. With Auto ML Tools like Auto- Keras, Auto-Sklearn, Amazon-Lex, etc, the role of data scientists and machine learning engineers is expected to be in danger.

While AutoML can carry some of the machine learning workflows without the need for data scientists, that doesn't mean the data science skillset will become obsolete.

Classically trained data scientists are just as important, if not more so, now that more organizations can access AutoML. The data scientists who embrace AutoML as an accelerator for their potential will be the real winners.

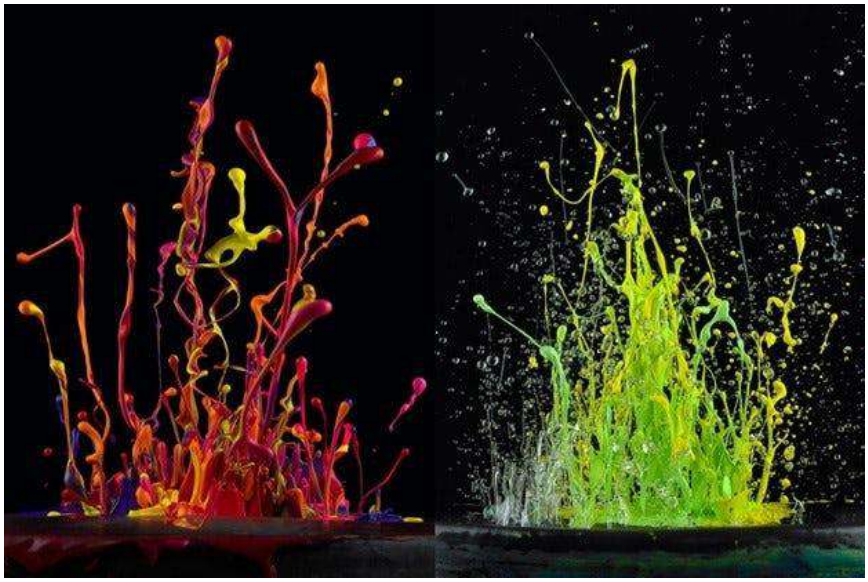
SOUND TECH

Nirmal Simon, S8 CSE

Sound engages the audience. It helps to deliver information. It emphasizes what's on the screen and helps to indicate someone's mood. And hearing sound helps to envision the surrounding. According to MIT's recent research, researchers have developed an ML (machine learning) technique that accurately captures and models the underlying acoustics of a scene from only a limited number of sound recordings. This ML system can simulate how a listener would hear a sound from any point in the room. This technique makes us imagine the booming chords from a pipe organ echoing the sanctuary of a big massive stone.

MIT's researchers and MIT-IBM Waston AI Lab's researchers are exploring the use of spatial acoustic information to help every machine show better groundwork results. They did develop a machine learning model that can capture how any sound in a room travels, enabling the model to simulate what a person will hear from different locations. researchers can use the acoustic information their system capture to make precise or accurate visual renderings of a room, like how humans use sound when estimating the properties of the environment. This technique helps AI agents to develop a better understanding of the surrounding. By modelling the acoustic properties of the sound in its environment, an underwater robot could sense things that are farther away than it could with vision alone.

Sound & Vision:



A machine learning model called an implicit neural representation model has been used to generate smooth, 3D scenes from images. These models save the neural network, which contains layers of interconnected nodes, or neurons that process data to complete any task. The MIT researchers employed the same type of model to capture how sound or waves travels through a scene continuously. But during research, they found that the vision model gets benefits from a property known as photometric consistency which does not apply to sound. With sound, change location and the sound one hears could be completely different due to distance and other obstacles and this makes audio very difficult to predicate. Later on, the researchers overcame this problem by incorporating two properties of acoustic into a model: the reciprocal nature of sound and the influence of local geometric features. To combine these two factors into the model called a neural acoustic field (NAF), the development of the neural network with a grid that captures objects and features includes the architecture of the scene.

Predicting sounds to visualize scenes: Researchers note the NAF visual information about the area and a few spectrograms that shows what a piece of audio sounds like when an emitter and listener are at a set distance in the room. The NAF shows impulse results, which capture how a sound should change as it propagates through the scene. Then researchers apply this result to different sound to listen and hear how those sounds changes as a person walk through a room. Likewise, if we play a song on a speaker at the center of a room, their prepared model will show how that sounds gets louder and louder as a person gets nearer to a speaker and becomes muffled as they walk out in another direction.

After time researcher compared their model technique to other methods that shape acoustic information and generate a more accurate sound model. Because of this, it learned local geometric information, and the model they worked on can be generalized to new locations. They also found that applying the acoustic information to their model learns to computer vision model which led to a better visual reconstruction. Researchers plan to continue working on the model so they can enhance the details. They want to apply this technique to more complex and larger scenes such as cities and towns.

MACHINE LEARNING ALGORITHM USED IN AUTONOMOUS DRIVING

Rohan Jose, S8 CSE

Autonomous cars are very closely associated with Industrial IoT. IoT combined with other technologies such as machine learning, artificial intelligence, local computing etc are providing the essential technologies for autonomous cars. Very inquisitive questions for many is how are these autonomous cars functioning. What actually is working inside to make them work without drivers taking control of the wheel. Very well known that these days cars are equipped with a lot of sensors, actuators, and controllers. These end devices are driven by software sitting on various function-specific software running on ECUs (Electronic Control Units). Machine learning software is also part of this set.

Machine learning is essential in self-driving cars because it continuously renders the surrounding environment and makes predictions of possible changes to those surroundings. Machine learning tasks in a self-driving car are mainly divided into four sub-tasks: object detection, object Identification or recognition, object classification, and object localization, and prediction of movement.

Machine learning algorithms can be loosely divided into four categories:
regression algorithms;
pattern recognition;
cluster algorithms;
decision matrix algorithms.

The type of regression algorithms that can be used for self-driving cars are:
a Bayesian regression;
neural network regression;
decision forest regression.
Regression Algorithms

In ADAS, images (radar or camera) play a very important role in localization and actuation, while the biggest challenge for self driving cars or for any algorithm is to develop an image-based model for prediction and feature selection. The type of regression algorithms that can be used for self-driving cars are a Bayesian regression, neural network regression, and decision forest regression, among others.

Pattern Recognition Algorithms (Classification):
In ADAS, the images obtained through sensors possess all types of environmental data; filtering of the images is required to recognize instances of an object category by ruling out the irrelevant data points. Pattern recognition algorithms are good at ruling out unusual data points. Recognition of patterns in a data set is an important step before classifying the objects. These types of algorithms can also be defined as data reduction algorithms.

These algorithms help in reducing the data set by detecting object edges and fitting line segments (polylines) and circular arcs to the edges. Line segments are aligned to edges up to a corner, then a new line segment is started. Circular arcs are fit to sequences of line segments that approximate an arc. The image features (line segments and circular arcs) are combined in various ways to form the features that are used for recognizing an object.

The support vector machines (SVM) with histograms of oriented gradients (HOG) and principal component analysis (PCA) are the most common recognition algorithms used in ADAS. The Bayes decision rule and K nearest neighbor (KNN) are also used.

Clustering:
Sometimes the images obtained by the system are not clear and it is difficult to detect and locate objects. It is also possible that the classification algorithms may miss the object and fail to classify and report it to the system. The reason could be low-resolution images, very few data points or discontinuous data. This type of algorithm is good at discovering structure from data points. Like regression, it describes the class of problem and the class of methods. Clustering methods are typically organized by modeling approaches such as centroid--based and hierarchical. All methods are concerned with using the inherent structures in the data to best organize the data into groups of maximum commonality. The most commonly used type of algorithm is K-means, Multi-class Neural Network.

Decision Matrix Algorithms:
This type of algorithm is good at systematically identifying, analyzing, and rating the performance of relationships between sets of values and information. These algorithms are mainly used for decision making. Whether a car needs to take a left turn or it needs to brake depends on the level of confidence the algorithms have on the classification, recognition, and prediction of the next movement of objects. These algorithms are models composed of multiple decision models independently trained and whose predictions are combined in some way to make the overall prediction while reducing the possibility of errors in decision making. The most commonly used algorithms are gradient boosting (GDM) and AdaBoosting.

COVID AND CRYPTOCURRENCIES

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Coronavirus or COVID-19 has created havoc in the history of humankind. It's no less than a disaster we are going through. Sustaining in this time seems the only way to survive. While the pandemic caused several commodities and assets to lose their value, the cryptocurrency market, on the other hand, was found immune to coronavirus. From approximately **$7000** in March 2020 to more than **USD 54,000** to date, Bitcoin has boomed and astonished the whole world. Investors have doubled or tripled their fortune. Some made millions in a year, and some became Billionaires.

It's absolutely inappropriate considering this global epidemic as the reason for the growth of the crypto market. It's important to look at the facts and figures and analyse every corner. So, let's see how COVID-19 has impacted the overall Crypto Market**.**

Positive Impacts of COVID-19 on Cryptocurrency

The volatility of the market is inevitable. Still, people were buying cryptocurrency that has made the crypto market appealing among the crowd. The prices had gone down to half in March 2020, alleviating as low as $ 3,780. Since then, Bitcoin has gained so much wealth and popularity in the pandemic.

Sentiments have been way too bullish that pumped the Bitcoins and Altcoins, surpassing several existing records. As of now, the market cap of Bitcoin has a staggering of **$1.1 TN,** comprising half of the cryptocurrency market, which is over $2 TN.

While other commodities were losing worth, cryptocurrencies, on the other hand, were proving themselves as a reliable asset in these tough times. Despite this deadly outbreak, Cryptocurrency exchanges in India kept on expanding their business and their figures. Also, this led to the opening of new Bitcoin Exchanges in India as well.

Months back, RBI had banned cryptocurrency since the illegality was the reason. But soon, the Supreme court of India quashed the ban stating that these aren't regulated yet but aren't illegal too. Despite the threat revolving over cryptocurrency, the volume in India itself is 8 million holdings up to 100 billion rupees corresponding to tokens held by Indian investors.

In the beginning, speculation analysis helped investors to book profits. But as time passed by, people realised that it's more secure and a safer means of exchange and can be a reliable asset in worst cases. Cryptocurrency Exchange in India like WazirX, CoinSwitchKuber started expanding their business and doubled their fortune. Several Bitcoin Exchanges in India opened up that allowed newbies to invest and trade Bitcoins

Negative Impacts of COVID-19 on Cryptocurrency

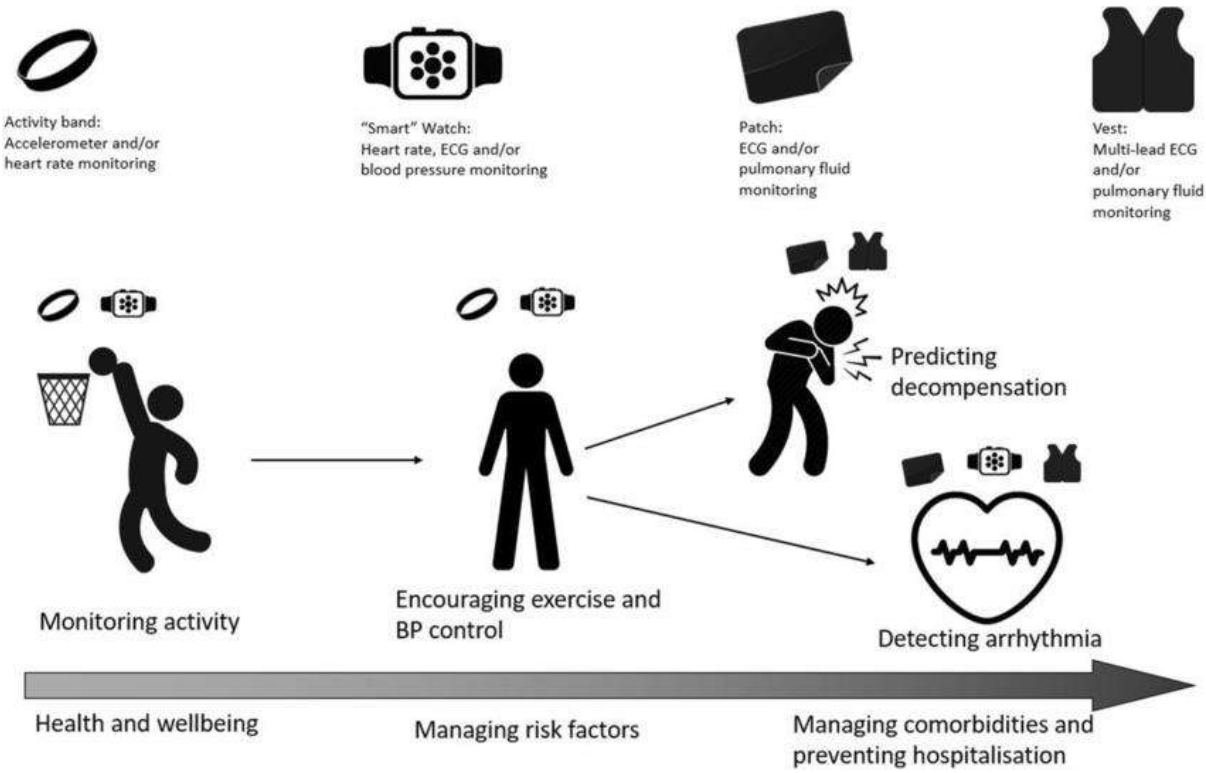
Well, no coin is single-faced. If the value and market had swelled up, there must be other things that have shrunk because of coronavirus. Indeed, the equities have increased since the outbreak. However, some analysts believe that this sudden spike won't last forever. Bitcoins are way far from a safe haven like Gold and Silver. The crypto is uncertain and unregulated in India yet. That is leading the sentiments to go on a negative note since the crypto market is experiencing this threat revolving over its head. Bitcoins are still yet to be accepted as a norm in many countries. Yes, it's still mainstream, but this unexpected outbreak has turned some moods against the Crypto investment.

The positive side of cryptocurrency is that the market is acting as a safe haven and a reliable investment. The market is quite nascent as of now. It's because the value and consideration had swelled amid the pandemic.

WEARABLE DEVICES TO PREDICT ILLNESS, INCLUDING COVID-19

Vivek Antony, S8 CSE

Stanford Medicine researchers and their collaborators, Fitbit and Scripps Research, are launching a new effort that aims to detect early signs of viral infection through data from smartwatches and other wearable devices. By using wearable devices to measure things such as heart rate and skin temperature, which are known to elevate when the body is fighting off an infection, the team seeks to train a series of algorithms that indicates when your immune system is acting up. If the algorithms succeed, the team hopes they could help curb the spread of viral infections, such as COVID-19 in future.



"Smartwatches and other wearables make many, many measurements per day — at least 250,000, which is what makes them such powerful monitoring devices," said Michael Snyder, PhD, professor and chair of genetics at the Stanford School of Medicine. "My lab wants to harness that data and see if we can identify who's becoming ill as early as possible — potentially before they even know they're sick."

Snyder, who holds the Stanford W. Ascherman, MD, FACS, Professorship in Genetics, and his team are recruiting participants for the study through his lab's Personal Health Dashboard. Fitbit, a company that makes wearable devices, will assist in that effort by raising awareness of the study with its users and offering them the option to participate. In addition, Fitbit plans to donate 1,000 smartwatches to Snyder's research. As part of this collaboration, scientists at Scripps Research will also work with Fitbit to try to track how infection spreads in a community.

Once the algorithms are developed and verified, Snyder said, they could help people keep tabs on their health. Devices with an algorithm could alert users when their heart rate, skin temperature or some other part of their physiology signals that their body is fighting an infection. When people come down with a cold or flu, there's usually a period just before symptoms set in when they wonder if they're actually getting sick. Even during that time, without heavy symptoms, a sick individual often can still spread the virus. "You might wonder, 'Are these sniffles allergies, or am I getting sick?' These algorithms could help people determine if they should stay home in case their body is fighting off an infection," Snyder said.

Watching for signs

Snyder's research will be based on an algorithm that he and former postdoctoral scholar Xiao Li, PhD, now an assistant professor in the Center for RNA Science and Therapeutics at Case Western Reserve University, created in 2017. The algorithm showed that it was possible to detect infection using data — specifically, data from a change in heart rate — from a smartwatch. Snyder's study showed that specific patterns of heart rate variation can indicate illness, sometimes even while the individual is asymptomatic. Li is also a collaborating principal investigator in the current study.

For this study, Snyder is collecting data from five different brands of wearable device, including a smart ring and a variety of smartwatches. Each participant will also fill out surveys that keep track of their health status. Snyder and his team will create five new algorithms — one for each of the different wearables — to potentially detect when someone is getting sick. How quickly they can develop and verify the algorithms will depend on the number of participants who sign up for the study, Snyder said.

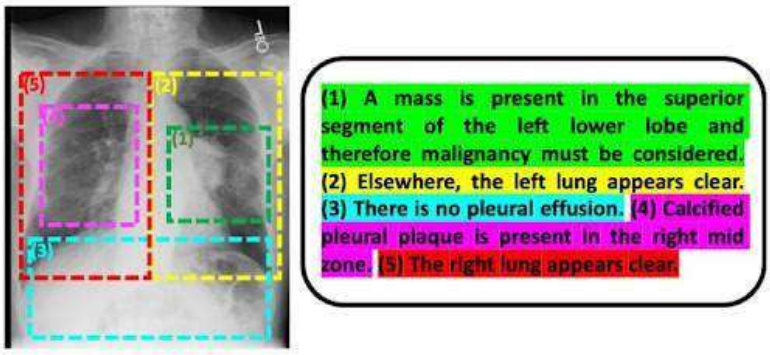
Although he's hopeful that these algorithms will be able to successfully flag a specific change in heart rate linked to viral infection, Snyder also foresees some kinks to work out. "It's possible that the algorithms could detect an elevated heart rate, but the user could be watching a scary movie or participating in some other activity that naturally elevates heart rate," he said. "An alert isn't a direct diagnosis, and it will be important for folks to be able to contextualize their situation and use some common sense." Snyder also adds that even as his team works to develop algorithms that can flag illness, the next step is to investigate whether those signals can be sorted to be able to differentiate between viruses. The study is an example of Stanford Medicine's focus on precision health, the goal of which is to anticipate and prevent disease in the healthy and precisely diagnose and treat disease in the ill.

"I feel confident based on our former study that we'll be able to detect some signal of infection based off of the wearables' data," Snyder said. "And I'm hopeful that as our study picks up, we may even have the granularity to anticipate the severity of viral infection based on smart device data. This tool may end up being a plus for both diagnosis and for prognosis."

USING AI AND OLD REPORTS TO UNDERSTAND NEW MEDICAL IMAGES

Richard Antonio Anet, S8 CSE

Getting a quick and accurate reading of an X-ray or some other medical images can be vital to a patient's health and might even save a life. Obtaining such an assessment depends on the availability of a skilled radiologist and, consequently, a rapid response is not always possible. For that reason, says Ruizhi "Ray" Liao, a postdoc and a recent PhD graduate at MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL), "we want to train machines that are capable of reproducing what radiologists do every day." Liao is first author of a new paper, written with other researchers at MIT and Boston- area hospitals, that is being presented at MICCAI 2021, an international conference on medical image computing.



Although the idea of utilizing computers to interpret images is not new, the MIT-led group is drawing on an underused resource — the vast body of radiology reports that accompany medical images, written by radiologists in routine clinical practice — to improve the interpretive abilities of machine learning algorithms. The team is also utilizing a concept from information theory called mutual information — a statistical measure of the interdependence of two different variables — in order to boost the effectiveness of their approach.

Here's how it works: First, a neural network is trained to determine the extent of a disease, such as pulmonary edema, by being presented with numerous X-ray images of patients' lungs, along with a doctor's rating of the severity of each case. That information is encapsulated within a collection of numbers. A separate neural network does the same for text, representing its information in a different collection of numbers. A third neural network then integrates the information between images and text in a coordinated way that maximizes the mutual information between the two datasets. "When the mutual information between images and text is high, that means that images are highly

predictive of the text and the text is highly predictive of the images," explains MIT Professor Polina Golland, a principal investigator at CSAIL.

Liao, Golland, and their colleagues have introduced another innovation that confers several advantages: Rather than working from entire images and radiology reports, they break the reports down to individual sentences and the portions of those images that the sentences pertain to. Doing things this way, Golland says, "estimates the severity of the disease more accurately than if you view the whole image and whole report. And because the model is examining smaller pieces of data, it can learn more readily and has more samples to train on."

While Liao finds the computer science aspects of this project fascinating, a primary motivation for him is "to develop technology that is clinically meaningful and applicable to the real world."

To that end, a pilot program is currently underway at the Beth Israel Deaconess Medical Center to see how MIT's machine learning model could influence the way doctors managing heart failure patients make decisions, especially in an emergency room setting where speed is of the essence.

The model could have very broad applicability, according to Golland. "It could be used for any kind of imagery and associated text — inside or outside the medical realm. This general approach, moreover, could be applied beyond images and text, which is exciting to think about."

Liao wrote the paper alongside MIT CSAIL postdoc Daniel Moyer and Golland; Miriam Cha and Keegan Quigley at MIT Lincoln Laboratory; William M. Wells at Harvard Medical School and MIT CSAIL; and clinical collaborators Seth Berkowitz and Steven Horng at Beth Israel Deaconess Medical Center.

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