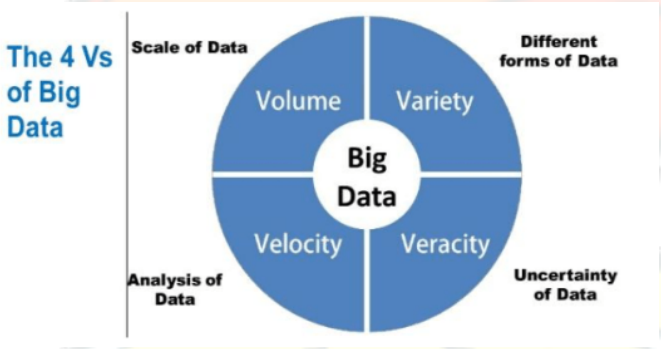
1.Big data is at the foundation of all the mega trends that are happening today, from social to mobile to the cloud to gaming. Comment.

Introduction

Big data is term for data sets that are so large or complex that traditional data processing application software is inadequate to deal with them. It refers to the use of predictive analytics, user behavior analytics, or certain other advanced data analytics methods that extract value from data.

Body



The advancement of technology has allowed companies to reap the benefits of streamlined processes and cost-efficient operations. But the one thing that has become a game changer for businesses of all sizes is the availability of data from every source imaginable – social media, sensors, business applications, and many more.

- **Big data in cloud computing**: Big data in cloud computing allows faster scalability, allows the lowering of cost of analytics. Also big data projects require immense infrastructure resources, which traditionally would also mean high on-premise capital expenditure (CAPEX) investments. But the cloud's Infrastructure-as-a-Service models have allowed companies to practically eliminate its biggest CAPEX expenses by shifting these into the operating expenditure (OPEX) column. So when you need to set up your database servers or data warehouses, you won't need to make massive upfront investments.
- **Governance**:
    - Big data can be analysed for targeted delivery if schemes, maintain a record of beneficiaries, analyse the response of the electorate to policies, predict future trends and demands of the population
    - Patterns of investment, savings and expenditure can be revisited with changing time and government can instil such changes in its policies
    - Geo-tagging in MGNREGA can help analyse the effectiveness of the policy geographically and bring in required changes

- The Digital India and Smart Cities initiatives of the government also include efforts to utilise data to design, plan, implement, manage, and govern programmes.

- **Businesses:**
  - Help to understand customers profile and needs, keep centralized data of sales, maintain the individual history of each customer and deliver customized services.
  - Uber uses big data in a big way to improve its customer service; when a customer requests for a cab, Uber analyzes real-time traffic conditions, availability of a driver nearby, estimated time for the journey, etc. and provides a time and cost estimate for improved engagement.
  - In a highly mobile world today, the mobile app has become the centerpiece of all communication strategies for every business. It is estimated that the mobile app market will reach $189 billion by 2020. Although thousands of companies across the world are building mobile apps every single day, it is through technologies like big data that you can really boost app-performance and fuel user engagement. Big data puts real-time data to work to offer personalized experiences that cater to the needs of the users in the most effective manner.
- **Antibiotic Resistance**
  Big data can provide insightful information about the unregulated sale of Antibiotics without prescription. The data generated can be used for developing statistical models to show the relationship between antibiotic consumption and associated resistance.
- **Urbanisation**
  Massive amounts of data generated by cities can be used to improve infrastructure and transport systems as Singapore has done.
- **Agriculture**
  - **Seed Selection** – Big-data businesses can analyse varieties of seeds across numerous fields, soil types, and climates and select the best.
  - **Weather** – Advanced analytics capabilities and agri-robotics such as aerial imagery, sensors help provide sophisticated local weather forecasts can help increasing global agricultural productivity over the next few decades.
  - **Insurance**: Crop-related ground data helps crop insurance companies for accurate assessment of risk and speedy settlement of claims.
- **Science and Technology:**
  Research data can be captured at more depth and analysed in a better way. For example, data at Large Hadron Collider for atomic research. In future we are moving to the Internet of Things which will be based on machine-to-machine communication and each machine will have several Gigabytes if data about itself and others for simulating processes.
- **Gaming**
  The gaming industry does $ 20 billion in annual revenue in America alone of which 2 billion in sub-category social games. The gaming industry uses Big

Data to drive customer engagement, make more money on advertising and optimize the gaming experience.

In social surveys also, now we can capture a larger sample of the population for evaluating trends and undercurrents. The use of information technology, open-source data, and proper governance will help in improving human development indices.

Conclusion

Big Data, Artificial Intelligence and Internet of things are going to change the world forever. Actively engaging policymakers and researchers is crucial to bring in cross-sectoral transformation.

2. What is Internet of Things (IoT)? What are its current and potential applications?

Introduction

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Body

Kevin Ashton, co-founder of the Auto-ID Center at MIT, first mentioned the internet of things in a presentation he made to Procter & Gamble (P&G) in 1999. IoT has evolved from the convergence of wireless technologies, microelectromechanical systems (MEMS), microservices and the internet.

Current applications:

- Healthcare: IoT has various applications in healthcare, which are from remote monitoring equipment to advance and smart sensors to equipment integration. Telemedicine is already being used and recently a remote-controlled heart surgery was done by a Gujarat doctor.
- Industrial automation: inter-connecting the different machines and devices in industries such as power generation, oil, gas etc., to smart handling of resources.
- Wearables: monitoring the physical activities like the health bands and also the smart watches with almost every possible functions of a mobile phone.
- Smart Grid: extract information on the behaviors of consumers and electricity suppliers in an automated fashion to improve the efficiency, economics, and reliability of electricity distribution.
- Smart home: connecting the different components like lights, electric devices to remotely control. Also, increasingly IOT is used in e-homes optimizing the power use.

- Car: Connected car technology with an extensive network of multiple sensors, antennas, embedded software, and technologies help making decisions with consistency, accuracy, and speed.
- Smart retail: across a number of applications that improve store operations, increasing purchases, reducing theft, enabling inventory management, and enhancing the consumer's shopping experience.
- Smart Supply Chain: like tracking of goods, helping suppliers exchange inventory information, communicate data about different parameters, such as pressure, temperature, and utilization of the machine, process workflow and change equipment settings to optimize performance.

Potential applications:

- Smart farming: often overlooked today has huge potential which includes smart monitoring of farm inputs, livestock maintenance and so on. Smart Greenhouse is a potential field which enhances the yield of crops by controlling environmental parameters.
- Healthcare: integrated with advanced nanotechnology have potential applications in Nano based drug delivery system, smart pills etc., Also, smart monitoring of patients acting as a bridge between collection and secured sharing, analysis, response of health data.
- Automobile: driverless car is a combination of IOT with AI and is a potential future application. Also, Tier Air Pressure Detection, smart display of information about different components are some potential applications.
- Smart Eye: Google's most ambitious project – The Glass. equipped with sensors and connectivity options from Wi-Fi to Bluetooth to provide numerous options and accessibility features right in front of our eye.
- Lighting control: the potential application includes lighting control with mesh networking to develop large scale, reliable, wireless lighting solutions to homes. The sensors embedded can also detect the presence of people and turn off the lights in their absence.
- Wearables innovation with potential applications like monitoring water level in body and reminder to drink water, monitor heart rate and automatically inform the emergency contact/hospital in case of accidents and so on. Also, Pulse Oximeter is a potential application which monitors the oxygen levels.
- Smart city: Though, at present IOT has been in use for smart cities, it has immense potential for future applications. The various components of city administration are connected and spans a wide variety of use cases, from water distribution and traffic management to waste management and environmental monitoring.

Conclusion

Internet of things is a field with literally unlimited possibilities in every field. Combined with Artificial Intelligence, IT changes the way of interaction with the real

and physical world and has immense potential for most advanced applications with high performance and optimal resource use.

3. How can machine learning and artificial intelligence help in good governance? Explain with the help of suitable examples.

Introduction

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. And, Machine Learning is a current application of AI based around the idea that we should really just be able to give machines access to data and let them learn for themselves.

Body

Applications of machine learning and artificial intelligence in good governance:

- Agriculture being a dominant occupation, there is huge potential to deal with crop failure and other agricultural issues using machine learning.
  Image recognition and deep learning models have enabled distributed soil health monitoring without the need of laboratory testing infrastructure. AI solutions integrated with data signals from remote satellites, as well as local image capture in the farm, have made it possible for farmers to take immediate actions to restore soil health.
- India being one of the largest consumers of telecommunication services, machine learning can be used in various socio-economic causes via telecommunication.
- Border management with hostile neighbourhood can be done through computer vision, including object recognition, etc. with minimal loss of life and property.
- Crime and investigations, huge pending cases are serious problem before Indian judiciary and administration. Machine learning can help in solving cases, bioinformatics and DNA profiling etc.
- Artificial Intelligence can expedite achievement of the SDGs. For example Population Foundation of India is carrying out a project in North India using AI to give adolescents access to sexual and reproductive health information.
- The Government of India has been making a series of large scale interventions to address India's
- Healthcare challenges, viz. transformation of 1.5 lakh Health and Wellness Centers, developing district hospitals to cater to long-term care for non-communicable diseases, Ayushman Bharat Mission, promoting e-Health etc. AI combined with robotics and Internet of Medical Things (IoMT) could

potentially be the new nervous system for healthcare, presenting solutions to address healthcare problems.

For example - Integrating AI capabilities to this device using Microsoft's retinal imaging APIs enables operators of 3Nethra device to get AI-powered insights even when they are working at eye checkup camps in remote areas with nil or intermittent connectivity to the cloud.

- Predictive tools to inform pre-emptive action for students predicted to drop out of school – For instance, in a recent preliminary experiment conducted in Andhra Pradesh, AI applications processed data on all students based on parameters such as gender, socioeconomic factors, academic performance, school infrastructure, teacher skills, etc., with the objective of helping the government identify students likely to drop out. Test results could inform suggestions to enroll students in vocational studies. Additionally, redressal mechanisms could be put in place to identify students whose performance can be improved by focus of existing schemes to their family.
- Cyber-attacks seem to pose a great threat to our institutions and public systems, today. AI technologies possess the capability to detect vulnerabilities and take remedial measures to minimise exposure of secure online platforms containing highly sensitive data from being targeted by unscrupulous social elements.
- Through the use of an intelligent traffic management system including sensors, CCTV cameras, automatic number plate recognition cameras, speed detection cameras, signalised pedestrian crossings and stop line violation detection systems and the use of AI, real time dynamic decisions on traffic flows such as lane monitoring, access to exits, toll pricing, allocating right of way to public transport vehicles, enforcing traffic regulations through smart ticketing etc. can be made.

Conclusion

India's unique challenges and aspirations, combined with the advancement in AI, and a desire to assume leadership in this nascent technology means India's approach towards AI strategy has to be balanced for both local needs and greater good. The way forward for India in AI has to factor in our current strengths in AI, or a lack there of, and thus requires large scale transformational interventions, primarily led by the government, with private sector providing able support.

4. Drones and robotics have the potential to revolutionize the supply chain in e-commerce. Do you agree? Substantiate with the help of suitable examples.

Introduction

The global drone and logistics market was worth US$24 million in 2018, a number that is expected to grow to $1.6 billion by 2027. Behind this growth is an ever-increasing need to transport goods more efficiently and in an environmentally friendly way.

Body

The boom in e-commerce has increased consumer expectation and this has meant goods have to move quicker than traditional methods allow. While drones and robotics are already utilized to transport high-value or emergency cargo, they could potentially revolutionize the supply chain in e-commerce –

- With the roads and seas highly congested, drones have the potential to increase efficiency, as well as cut emissions, costs and waste.
- Robots are showing up in last mile delivery, including drones, unmanned ground vehicles (UGV), the so-called "office refrigerator on wheels." Recently, startups, such as Marble and Dispatch, have commenced exploring the possibility of using Android like robots as delivery professionals in last mile logistics
- Autonomous trucks, "driverless trucks," are already a major player, with some companies valued at nearly $1 billion.
- Last mile automation through drones and robotics is the natural progression of the internet, electrification, sensing and actuation technology, and mobile apps.
- Logistics companies like DHL and organizations like Amazon and Google are developing and experimenting with drones to do just that, especially for lightweight consumer goods. Amazon is truly already practicing the effective use of robotics in logistics with the purchase of Kiva Systems, which was renamed to Amazon Robotics, just lat month.
- At a 1.2-million-square-foot warehouse in Tracy, Calif., about 60 miles east of San Francisco, Amazon this summer replaced four floors of fixed shelving with the robots

Some technology limitations also remain to be addressed. Battery life is limited, which constrains operational range. Most successful drone deliveries so far have been in rural areas as in urban areas, unmanned drones are more challenged to maneuver. Another concern is weather – will drones be able to operate in high winds or rain while keeping packages safe? If UAVs can only deliver in certain weather conditions, their impact on the last-mile of supply chain management may be limited.

Conclusion

From helping small store owners streamline their supply chains and increase stocking efficiency, to speeding up checkouts, drones and robotics is a massive jump beyond anything in use today.

5. Space is the next big frontier of technological revolution. Do you agree? What are those current trends that indicate towards a highly sophisticated and advanced future of space technology? Explain.

Introduction

Space technology has been one of the defining forces of the 20th and 21st century. The Soviet launch of Sputnik in October 1957 and the ensuing space race to the moon came to symbolize countries demonstration of their prowess and global influence. These bright moments, including the Apollo moon landing, were evidence of space technologies lighting a clear path to the future and in recent times, it is on the cusp of a great technological revolution.

Body

- Since the days of its heroic endeavours, space engineering has matured into a series of interconnected technologies that deliver exciting new space science missions which in the present times are rendering great technological advancement in space as well as use on earth.
- By democratizing access to space-based resources, we can create a more humane and just world. But realizing these benefits requires overcoming complex technical, legal, political and regulatory challenges.
- Present times is seeing a wave of start-ups driving dramatic and ongoing reductions in launch costs with innovations such as reusable boosters. The second is the development of nano sats that are dramatically smaller, lighter and less expensive to build and launch than those typically used by governments or industry.
- Space is stepping up to the connectivity challenge posed by the fourth industrial revolution. One of the driving forces of this change has been the introduction of next-generation high-throughput satellite (HTS) systems. HTS will enhance the end user experience much like the terrestrial move from dial-up to broadband access.
- Space is quickly becoming a place where the industries that power our global economy will conduct business. Like any major change, this sharing economy in space faces major legal, regulatory and technical hurdles.
- Further, this change is being led by private enterprises unlike earlier governmental efforts, which makes it conducive to exponential growth in light of unlimited resources that the space economy provides.
- Space industry leading the technological revolution is evident from earlier precedent when technologies developed for Apollo and other missions had a spill over effect on various industries in the world. In present times, reusable rockets help in revolutionising transportation on earth is one such example

- At the same time, there will also be need for mechanisms to track and control satellites to prevent their being used for criminal or terrorist purposes, as well as finding ways to safely destroy failed satellites so they don't cause damage to other satellites or space vehicles.

Following can be considered as some of the current trends that indicate a highly sophisticated and advanced future of space technology:

- The global mining industry has tumbled in recent years from a market value of more than $1.6 trillion in 2010, to $714 billion in 2016, but this may change quickly once the "global" definition of mining is transformed by the emerging space resource industry. Space resources can be extracted from celestial bodies, most notably asteroids and the Moon.
- Miniaturisation of technology has enabled a range of spacecraft sizes, such as the 100kg small satellites used for the Disaster Monitoring Constellation, which consists of a coordinated group of individual satellites. There are even compact 30x10x10cm CubeSats, satellites weighing a few kilograms, which can carry a range of different payloads.
- The ability to fabricate large, lightweight structures directly in orbit could have a huge impact on space technology, getting around the risky hurdle of launching delicate structures from the ground.
- Spirit and Opportunity were the two successful Mars rovers that helped humans with many discoveries on Mars and were advanced enough to be controlled from the Earth. Both of these rovers exceeded their 90-day expected lifetime by several years making them one of NASA's most successful inventions. Present missions are building upon these like Mars 2020 mission.
- Military and intelligence personnel have relied on satellite data for years to keep tabs on other nations and goings-on around the globe, but it was largely classified or otherwise restricted from the private sector. Now, looser regulations and lower costs are allowing companies to use that same kind of information for a variety of business reasons, such as near-real-time geospatial data visualizations of housing construction and other activity when planning new store locations.
- Space habitats will be launched from Earth initially, but as the resource supply chain expands and metals from asteroids and the Moon become available, this sector will also come to rely on resources sourced from space.
- In today's media-rich environment the concept of artificial intelligence is hard to miss, but its role in our space-based systems is easy to overlook. In fact, for some applications, it is already embedded. This will further help in the development of AI.

Conclusion

In the last few years, it has become clear that there is enormous potential to not only help bridge the technological shortcomings but to also create the means for

new space based technological dividends. As with other cases in the new technological Revolution, these benefits coincide with the latest innovations in software, data processing and other booming sectors and it will be from the combinations of those pieces that the really innovative solutions will emerge to further advance human civilization into space.