UNIT 8 EMERGING TECHNOLOGIES

Objectives

After studying this unit you will be able to:

- Understand the concept of Emerging Technologies.
- Discuss various aspects of emerging technologies.
- Appreciate the application of data and analytics principles.
- Understand various techniques of analytics data visualization to make better business decisions for Return On Investment (ROI).
- Describe various visualization techniques such as Bubble charts, Geo-maps, Gauge charts, Treemaps, Heat maps, and Motion charts.

Structure

8.1 INTRODUCTION

Banking and Financial services in India have witnessed tremendous transformation in the era of "Digital India", and the trend is continuing. Various factors, such as new governmental policies and customer expectations, have contributed to the shift. However, technological Innovation is the main factor that has had the maximum impact on this sector.

The development and advancement of several technological innovations have helped the Banks to grow and meet increasing customer expectations. Products and Services offered in the banking sector have undergone many changes with the large-scale adoption of new technologies. The partnership between new technologies in the financial sector and banking services has

revolutionized traditional money-handling methods. This collaboration is expected to grow, paving the way for further shifts in the financial services sector in the coming days.

What is an Emerging technology

Emerging technology refers to innovative technologies in the initial stages of development that are not yet widely available or widely known. These technologies are often characterized by their potential to disrupt and transform existing industries and create new markets. Emerging technologies can include various fields, including information technology, biotechnology, nanotechnology, materials science, and energy. Emerging technologies are often portrayed as having the ability to alter the status quo.

While emerging technologies can be disruptive during the emergence phase, they are often uncertain and ambiguous. In short, Emerging technology or processes are innovative technologies that can be broadly characterized by major Innovation, rapid growth, huge impact, coherence, uncertainty, and ambiguity.

Examples of emerging technologies include artificial intelligence, machine learning, blockchain, the Internet of Things, virtual and augmented reality, and quantum computing which are still being researched and developed, and their full potential has not yet been realized. However, they are already having a significant impact on various industries and are expected to continue to shape the future.

The adoption of emerging technologies has the potential to enhance the customer experience, reduce costs, and increase the efficiency of the banking industry.

8.2 EMERGING TECHNOLOGIES IN THE BANKING SECTOR

There are many emerging technologies in the field of computing, including:

1) Artificial Intelligence (AI)
2) Machine Learning
3) Blockchain
4) Big data Analytics
5) Robotic Process Automation (RPA)
6) Virtual reality (VR) and Augmented reality (AR)
7) Internet of Things (IoT)
8) Voice Assistants, Chatbots
9) Wearable technology
10) API Banking

There are many potential use cases for emerging technologies in the banking industry, including:

Artificial intelligence: AI can be leveraged to analyze customer data to provide personalized recommendations and improve the customer experience. It can also detect and prevent fraud and automate routine tasks such as data entry.

Blockchain: Banks can use blockchain technology to securely and transparently record and process financial transactions. This can help mitigate the risk of fraud and errors and improve the efficiency of financial processes.

Cloud computing: Banks can use cloud-based services to store and process large amounts of data more cheaply and quickly. This can lead to cost savings and allow banks to offer new services to customers.

Internet of Things: Banks can use IoT devices to offer customers new services, such as making payments using smartwatches or other wearable devices.

Virtual assistants: Banks can use virtual assistants, such as chatbots, to provide customer service and handle simple tasks, freeing up human customer service representatives to handle more complex issues.

Biometrics: Banks can use biometric technologies, such as fingerprint scanners or facial recognition software, to improve the security of financial transactions and protect against fraud.

Fintech business solutions and Internet / Mobile banking services offered by Banks are well-known examples of growing technological trends in the banking and financial services space. They herald the beginning of a journey towards achieving a cashless society, total digital transformation and the rowing rise of Fintech in the country.

Emerging technology trends in Banks

For the past few years, Banks in India have been aggressively investing in technologies to promote digital banking, offering innovative, robust, and secure solutions optimized to meet the expectations of tech-savvy customers and deliver enhanced customer experience.

Digitalization led to branch-less banking through channels of Internet banking, Digital wallets, Mobile banking, Chatbots, etc. While some technologies enhance the customer experience, other technologies intelligently analyze the customer behaviour and requirements for the banks, enabling the focused development of both business and products. The term emerging is relative, as technology considered emerging in one field may be well established in other fields.

The requirements and expectations of customers' Banking experience vary depending on the touchpoints they use to transact. Banks have an Omnichannel presence and should ensure that customers have a seamless experience across various channels/touchpoints.

Some emerging technologies/products will be described briefly in this chapter, followed by a detailed discussion in some relevant units.

8.3 ARTIFICIAL INTELLIGENCE

Artificial intelligence is a computer science branch that focuses on developing and managing technology that can learn to make decisions and carry out actions autonomously on behalf of humans and create intelligent machines and software that work and react like humans. Some of the focused areas in the use of artificial intelligence are speech recognition, cognitive analytics, deep learning, planning, and problem-solving.

AI can transform customer experiences and bring entirely new business models to banking. Tapping this potential requires collaboration between humans and machines to offer a humanized experience customized to individual customers.

Artificial Intelligence can learn from customer behaviour and offer personalized services for all customers focused on their specific requirements. The key components of AI are machine learning, computer vision, natural language progression, and natural language generation.

8.3.1 Types of Artificial Intelligence

The three generic types of Artificial intelligence (AI) are :

1. Narrow or weak Artificial Intelligence (ANI)
2. General or strong Artificial Intelligence
3. Artificial superintelligence (ASI)

1. Narrow or weak Artificial Intelligence (ANI): Narrow AI, also known as weak AI or limited AI, refers to artificial intelligence systems designed to accomplish a specific task or set of tasks. Narrow AI systems are typically highly specialized and incapable of learning or adapting to new tasks beyond their programmed capabilities.

   Examples of narrow AI include:

   Virtual assistants: These AI systems are designed to handle simple tasks such as answering frequently asked questions or scheduling appointments.

   Speech recognition software: These AI systems are designed to transcribe spoken words into written text or to understand and respond to spoken commands.

   Image recognition software: These AI systems are designed to identify objects, people, or other features in images or videos.

   Language translation software: These AI systems are designed to translate text or speech from one language to another.

   Spam filters: These are AI systems that are designed to identify and block unwanted email messages.

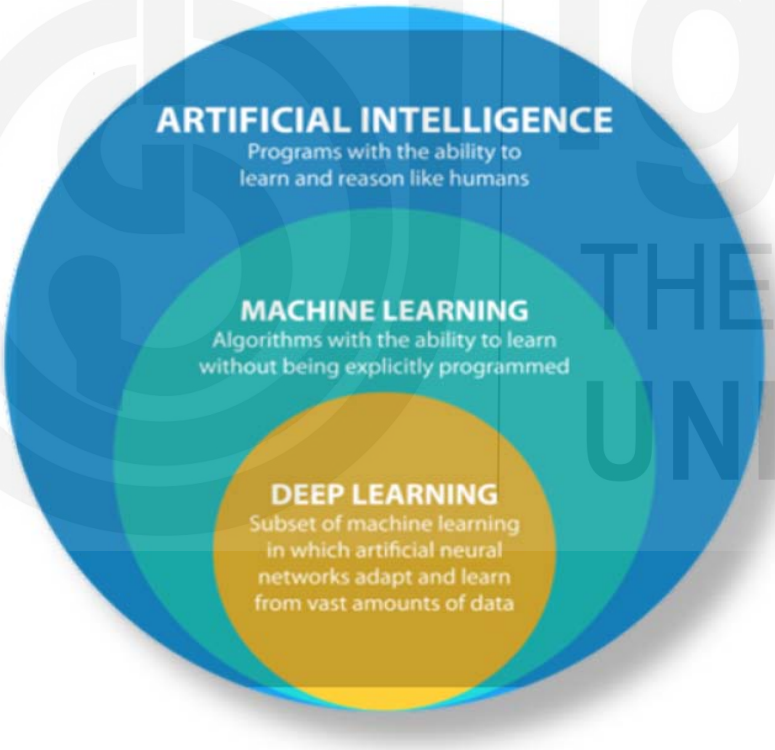
   Self-driving cars: These are AI systems that are designed to navigate roads and traffic without human input.

In the modern world, most artificial intelligence (AI) is powered by relatively simple algorithms. These artificial intelligence systems are not very advanced, but they are used in things like IBM Watson and Apple's Siri and Amazon's Alexa and self-driving cars.

2. General or strong Artificial Intelligence**:** Artificial general intelligence (AGI) or general artificial intelligence (GAI) describes a scenario in which a machine possesses an intellect comparable to humans. Artificial intelligence that possesses general intelligence can think, understand, and behave in a manner that is difficult to differentiate from that of a human in any given circumstance. It would be capable of problem-solving, learning, and making plans for the future.

3. Artificial superintelligence (ASI): "artificial superintelligence" refers to an intellect significantly more intelligent than the most intelligent human brain in various domains, including scientific creativity, general wisdom, and social abilities. Artificial superintelligence (is to achieve a level of intelligence and capability superior to that of the human brain.

Figure 8.1: Artificial intelligence, Machine Learning and Deep Learning



8.3.2 Differentiation of AI, ML and DL

Artificial intelligence refers to a set of technologies that allow machines — computers or robotic systems — to process information the way humans would.

Machine learning is the process of programming computers to learn from historical data, and practitioners use a combination of computer programming and statistical techniques to create software models that learn from historical data to make predictions on new data.

Deep Learning is a subset of machine learning that operates on large volumes of unstructured data such as human speech, text, and images. A deep learning model is an artificial neural network that comprises multiple layers of mathematical computation on data, where results from one layer are fed into the next layer to classify the input data and/or make a prediction.

8.3.3 Branches of Artificial Intelligence

There are several branches of artificial intelligence (AI), including the following:

Machine learning involves training algorithms on data to enable prediction or make decisions without being explicitly programmed to do so.

Computer vision involves using AI to analyze and understand images and videos.

Natural language processing (NLP) involves using AI to understand and process human language.

Robotics: This involves using AI to design and control robots that can perform tasks in the real world.

Neural networks use AI to model how the human brain recognizes patterns and makes decisions.

Expert systems involve using AI to build systems that mimic a human expert's decision-making abilities in a particular field.

Deep learning: This machine learning type involves training algorithms on large amounts of data and using multiple layers of artificial neural networks to analyze and understand it.

Today, AI systems are being put to use in a variety of different ways in the real world. Some examples of the most common types of AI applications are in the areas:

1. **Speech recognition:** Alexa, Cortana, Google Assistant, and Siri makes it easier to send and receive messages.

2. **Customer service:** Online virtual agents respond to frequently asked questions (FAQs) concerning shipping, customized advice, cross-selling items, and sizing recommendations. Some examples are messaging applications such as Slack and Facebook Messenger, messaging bots that contain virtual agents.

3. **Computer vision:** computer vision enables computers to view the real world, analyze visual data to make decisions or understand the environment and the situation, and view it all from their perspective. Computer vision enables computers and other systems to extract meaningful information from digital photos, videos, and other visual inputs and then act on that information. The information can come from various sources, including digital cameras, smartphones, and computer monitors. Computer vision, which is powered by convolutional neural

networks, has a variety of applications. It stands out from other jobs that involve picture recognition because of its ability to provide suggestions. Some of these applications include radiological imaging, photo tagging in social media, and autonomous vehicles.

4. **Recommendation engines:** A recommendation engine, which may also be referred to as a personalization engine, recommendation software, or simply a recommendation engine, is a piece of software that assists businesses in determining which product or service would be most beneficial to recommend clients.

   In order to be considered a recommendation engine, a service or product must have the capacity to generate customized recommendations for users based on the information they provide.

5. **E-commerce:** Video streaming services, audio streaming platforms, and other similar areas are some of the use cases for recommendation engines. Many examples include Amazon, Alibaba, Netflix, YouTube, and Spotify.

AI algorithms can help discover data trends that can be used to design more successful cross-selling strategies by using primary consumption behaviour data. During the checkout process, this is also utilized to provide customers with relevant recommendations regarding add-on items. These strategies can be used to design more profitable cross-selling strategies.

AI-driven banking mobile apps are used to meet the user's expectations with personal, contextual, and predictive services. AI is being used in Banks for predictive analysis, voice recognition, Risk management, fraud prevention, Wealth management, etc. AI can also enhance data security, decision-making speed and accuracy, and employee output. Banks can also use machine learning to re-engineer back-office processes.

Some important examples of day-to-day AI applications are :

1, Advanced web search engines. (Google, TinEye, DuckDuckGo) .
2. Recommendation systems (Amazon, Netflix, and YouTube).
3. Smart Voice assistants that understand human speech (Siri, Alexa, OK Google).
4. Self-driving cars (Tesla).
5. Robo-advisors (Fincite, Ginmon)
5. Automated decision-making and strategic game systems (chess and Go).
7. Conversational bots (Endurance, Casper)
8. Email spam filters (Gmail, Yahoo, Outlook)

8.4 MACHINE LEARNING

Machine learning is deployed in various fields, from customer service to product development. Machine learning enables businesses to visualize the industry's customer behaviour trends and hidden operating patterns and

support the development of new innovative products. Many popular entities like Facebook, Google, and Uber extensively exploit machine learning.

8.4.1 Types of Machine Learning

Machine learning can be categorized into four types based on the learning style and method adopted:

Supervised learning involves training an algorithm on a labelled dataset, where the correct output is provided for each example in the training set. The algorithm then makes predictions based on this training data.

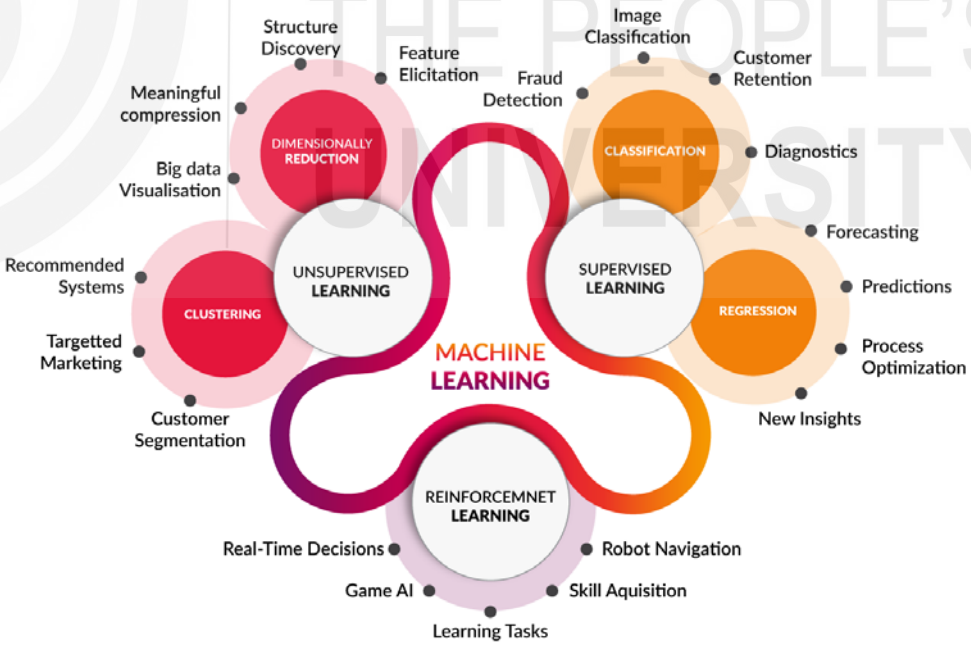
Unsupervised learning involves training an algorithm on an unlabeled dataset where the correct output is not provided. The algorithm must discover the underlying patterns and structure in the data.

Semi-supervised learning involves training an algorithm on a partially labelled and unlabeled dataset. This can be useful when labelled data is scarce or expensive to obtain.

Reinforcement learning involves training an algorithm to make decisions in an environment to maximize a reward. The algorithm learns through trial and error, adjusting its actions based on the feedback it receives.

The following diagram depicts the types of machine learning, the types of algorithms used and the domains of potential use.

Figure 8.2: Types of machine learning and areas of application



8.5 BLOCKCHAIN

A Blockchain is based on distributed ledger technology (DLT) that stores transactions in "blocks" and then links and sequences the transactions using cryptography. Distributed Technologies enable real-time access to immutable data from any network node. Blockchain is a peer-to-peer network with

redundant blocks and consensus processes to prevent tampering. In a blockchain, every transaction is traceable, and instead of rather than one-to-one interactions, peer-to-peer interactions are established.

Blockchain technology involves cryptographically signed, immutable transactional records shared by all participants in a network using distributed ledger technology with shared control.

Banks are exploring and implementing blockchain to address the increased need to secure and manage transactions across the Internet. Blockchain technology can be used in banking activities like secure document management, reporting, payments, treasury & securities, and trade finance. The banking industry can benefit from Blockchain technology as it helps in fraud prevention, increases the Bank's IT infrastructure's resilience, and increases the integrity and transparency of processes.

Blockchain is a distributed database that allows the stakeholders to record and verify transactions without the need for a central authority. It uses advanced cryptographic techniques to ensure the security and integrity of the data stored on the blockchain.

8.5.1 Transaction flow in a Blockchain

In a blockchain, a transaction is a record of an exchange of value between two parties. When a transaction is initiated, it is broadcast to the network, which is verified by multiple nodes (computers) to ensure that the sender has the necessary funds and that the transaction is valid.

Once the transaction is verified, it is added to a block, a collection of transactions that the network has recently verified. The block is then added to the chain of blocks that make up the blockchain, a decentralized and distributed database that is stored on multiple computers (nodes) around the world.

In the context of cryptocurrency, "mining" refers to the process of solving complex mathematical problems to validate transactions on a blockchain network. Miners use special software to solve these problems, and when they successfully validate a transaction, they are paid a reward in terms of cryptocurrency.

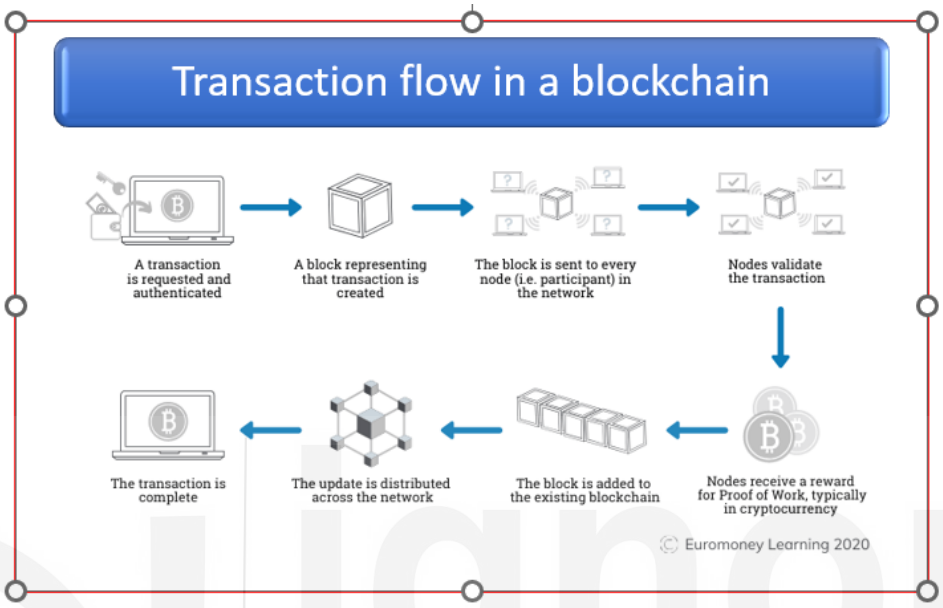
The process of mining helps to secure the blockchain network by ensuring that transactions are valid and can't be tampered with. It also serves as a way to introduce new units of cryptocurrency into circulation.

As miners compete to solve the mathematical problems and validate transactions, the difficulty of the problems increases to ensure that the rate at which new blocks are added to the blockchain remains constant. This process is known as "mining difficulty."

Mining is the method of verifying and adding transactions to a block. It is typically done by specialized nodes called "miners. Miners use powerful computers to solve complex mathematical problems, and the first miner to solve a problem is rewarded with a small amount of cryptocurrency (such as Bitcoin).

Once a block has been added to the blockchain, its transactions are considered complete and irreversible, ensuring the integrity and security of the blockchain, as it is extremely difficult for a transaction to be altered or removed once it has been added to the chain.

Figure 8.3: Transaction Flow in a Blockchain



Courtesy: https://www.euromoney.com

8.5.2 Consensus mechanisms in a Blockchain

What is consensus?

A consensus mechanism is a process to achieve agreement among the nodes in a blockchain network. It is used to ensure that all nodes in the network have a copy of the same database and to prevent unauthorized changes to the database.

The goal of a consensus mechanism is to achieve distributed consensus, which is the agreement of all nodes on the network about the current state of the blockchain. This is necessary to ensure the integrity and security of the blockchain, as it prevents any one node from making unauthorized changes to the database.

Several different consensus mechanisms can be used in a blockchain network, including Proof of Work (PoW), Proof of Stake (PoS), and Delegated Proof of Stake (DPoS). Each of these mechanisms has its unique set of rules and requirements, and the specific mechanism used can depend on the needs and goals of the blockchain network.

(PoW) Proof of Work and (PoS) Proof of Stake algorithms are used to achieve distributed consensus in a blockchain network.

Proof of Work (PoW)

In a PoW system, miners use their computing power to solve complex mathematical problems, and the miner to solve the problem first is rewarded

with a small amount of cryptocurrency (such as Bitcoin). The difficulty of the problems is adjusted over time to ensure that miners can add a new block to the blockchain roughly every 10 minutes, on average.

Proof of Stake (PoS)

In a PoS system, the creator of a new block is determined based on his stake (how many coins they hold) in the network. The more coins a miner holds, the higher the probability they will be chose to create the next block. PoS systems do not require miners to perform complex mathematical calculations, so they are generally more energy efficient than PoW systems.

The main difference between PoW and PoS is the way in which the creator of a new block is chosen. In a PoW system, miners compete to solve mathematical problems, while in a PoS system, the creator of a new block is decided based on his stake in the network. Both systems have their strengths and weaknesses, and which one is used can depend on the specific needs and goals of a particular blockchain network.

8.5.3 Cryptocurrency

Cryptocurrency is a digital or virtual currency using cryptography for carrying out secure financial transactions. Cryptocurrencies are decentralized systems that use distributed ledger technology, also known as a blockchain, to maintain a secure and transparent record of transactions. Cryptocurrencies are decentralized, which means no single entity, such as a government or financial institution, controls them. Instead, they operate on a peer-to-peer network, allowing users to send and receive payments directly without needing a third party.

Cryptocurrencies use cryptography to secure their transactions and to control the creation of new units. Cryptography is a technique of storing and transmitting data which can only be read by the intended receiver, making it secure and difficult to counterfeit.The technology behind cryptocurrencies is called a blockchain. Blockchain technology allows for creation of a secure, transparent, and immutable record of transactions, making it a popular choice for use in the financial industry and beyond.

Some examples of cryptocurrencies are:

Bitcoin: Bitcoin is the first and most popular cryptocurrency. It was created in 2009 and has since gained a reputation as a store of value and a means of exchange.

Ethereum: Ethereum is a cryptocurrency launched in 2015. It is famous for introducing self-executing smart contracts, with the terms of the buyer-seller agreement written directly into lines of code.

Litecoin: Litecoin is a cryptocurrency created in 2011 as a fork of Bitcoin. It is intended to be faster and lighter than Bitcoin, with a shorter block generation time and a larger maximum coin supply.

XRP: XRP is a cryptocurrency created by the company Ripple Labs. It is meant to be used as a global payment system and focuses on speed and scalability.

Monero: Monero is a privacy-focused cryptocurrency created in 2014. It uses advanced cryptographic techniques to obscure the details of transactions, making it a popular choice for those looking for increased privacy.

There are many other cryptocurrencies, each with its unique features and uses.

Blockchain vs Cryptocurrencies

One of the primary uses of blockchain technology is to create and maintain a permanent, public, transparent ledger of cryptocurrency transactions. This allows for creation of secure and decentralized digital currencies, such as Bitcoin, Ethereum, and others. These cryptocurrencies can be used to send and receive payments, store value, and perform various other functions.

In short, blockchain is the underlying technology that enables the existence of cryptocurrencies, while cryptocurrencies are digital assets built on top of the blockchain.

8.5.4 Uses of Blockchain in Banking

In the banking industry, blockchain technology has the potential to revolutionize the way that financial transactions are conducted. Some potential uses of blockchain in banking include:

Cross-border payments: Blockchain technology can facilitate the quick and secure transfer of funds between countries without the need for intermediaries like banks.

Trade finance: Blockchain can be used to securely track the movement of goods and the payment of invoices, reducing the risk of fraud and errors.

Identity verification: Blockchain can be used to store and verify identity documents, enabling banks to onboard new customers more efficiently.

Loan origination: Blockchain can be used to automate the loan origination process, reducing the time and cost of processing loan applications.

Asset custody: Blockchain can securely track the ownership of assets like stocks and bonds, reducing the risk of errors and fraud.

8.6 BIG DATA ANALYTICS

8.6.1 Structured and Unstructured Data

Structured data is organized in a well-defined format, such as a database table or spreadsheet. It is easy to search, sort, and analyze and is often used for business operations and decision-making. Examples of structured data include:

1) Customer records in a CRM system

2) Inventory data in an enterprise resource planning (ERP) system
3) Financial transactions in a banking system

Unstructured data does not have a pre-specified format and is difficult to analyze using traditional data processing tools. It can include text, images, audio, and video and is often generated by sources such as social media, emails, and sensors. Examples of unstructured data include:

1) Social media posts and comments
2) Emails and email attachments
3) Images and videos
4) Audio recordings, such as voice messages

Semi-structured data has some structure but not as much as fully structured data. It may contain structured and unstructured elements and can be stored in various formats, such as XML, JSON, or CSV. Examples of semi-structured data include:

1) Web logs
2) Electronic medical records
3) Customer reviews on e-commerce websites

According to some estimates, unstructured data accounts for as much as 80% of organizations' data. This includes data such as text documents, emails, audio and video files, and social media posts.

Unstructured data analysis allows organizations to gain insights and make decisions based on data that would otherwise be difficult or impossible to analyze.

Structured data, on the other hand, typically make up a smaller portion of an organization's data but is often considered more valuable because it is easier to analyze and extract insights from.

8.6.2 What is big data?

Big data refers to large, complex data sets that are too huge and complex to be processed and analyzed using traditional data processing tools. These data sets are often generated by a variety of sources, such as social media, sensors, and scientific instruments, and can contain a wide range of data types, including structured, unstructured, and semi-structured data.

The objective of big data analytics is to discover patterns, trends, and relationships in data that can be used to inform decision-making and drive business value. To work with big data, organizations often use specialized tools and technologies, such as Hadoop and Spark, which are designed to handle large volumes of data and perform distributed processing across multiple servers.

Big data is a collection of various data sets which are huge and more complex, particularly those derived from new types of data sources. These data sets are so extensive that conventional data processing software cannot

process them. However, these huge quantities of data may be utilized to solve business challenges which otherwise were unable to address.

8.6.3 5Vs' of big data

There are"5Vs" of big data that refer to five key characteristics of big data viz Volume, Variety, Velocity, Variety, and Veracity, making big data distinct from standard data sets:

Volume: Big data is characterized by the extremely large size of the datasets it involves. These datasets may be petabytes or even exabytes in size, making them too large to be handled using old-fashioned data processing tools.

Variety: Big data often comes from various sources, including social media, sensors, and transactional data. This data may be structured (such as a database table), semi-structured (such as an XML file), or unstructured (such as a tweet or a blog post).

Velocity: Big data is often generated in real-time at high speeds. For example, social media platforms generate vast amounts of data every minute, which needs to be processed and analyzed quickly to be useful.

Veracity: Big data can be complex and noisy, with many errors and inconsistencies. Therefore, ensuring the accuracy and reliability of big data is a key challenge.

Value: The ultimate goal of big data analytics is to extract value from the data by uncovering insights and trends that can inform business decisions.

The 5Vs of big data represent the unique challenges and opportunities that big data presents, and they highlight the need for specialized tools and approaches to process and analyze these large and complex datasets.

Some examples of big data:

Big data analytics is the process of analyzing large and complex datasets to discover hidden patterns, correlations, and other insights. Some common use cases of big data analytics include:

Marketing and customer analytics: Companies can use big data analytics to understand customer behaviour, preferences, and buying patterns and to develop targeted marketing campaigns.

Fraud detection: Big data analytics can identify unusual patterns or transactions that may indicate fraud or other types of financial crime.

Supply chain optimization: Companies can use big data analytics to optimize their supply chain operations by analyzing demand, inventory, and logistics data.

Healthcare: Big data analytics can identify trends and patterns in patient data, improving the accuracy of diagnoses and enabling the development of personalized treatment plans.

Predictive maintenance: Companies can use big data analytics to predict when the equipment will fail, enabling them to perform maintenance before a breakdown occurs.

Financial risk analysis: Financial institutions can use big data analytics to identify and mitigate risks in their portfolio, such as credit risk or market risk.

8.6.3 Data Analytics

Data analytics involves the exercise of analyzing raw data to help in decision-making. Since raw data is voluminous, processing such vast data is done through mechanical processes using algorithms. Use cases show that Data Analytics help organizations to significantly enhance their efficiency levels and help in achieving the ultimate goal of customer delight.

Several types of analytics are used in various fields, including:

Descriptive analytics: This type of analytics involves looking at data that has already been collected and summarizing it meaningfully. It helps to describe what has happened in the past.

Diagnostic analytics: This type of analytics involves looking at data to identify patterns and relationships that can help explain why something happened.

Predictive analytics: This type of analytics uses data mining, machine learning, and statistical analysis techniques to identify patterns and relationships in data and to make predictions about future events.

Prescriptive analytics: This type of analytics involves making predictions about future events and providing recommendations or suggestions for how to take action based on those predictions.

Big data analytics: This type of analytics involves using specialized tools and techniques to process and analyse Big data in order to identify patterns and trends that might not be apparent in smaller data sets.

Real-time analytics: This type of analytics involves processing and analyzing data as it is being generated in order to make timely decisions or take immediate action.

For example**, unstructured** data analysis can be used to:

Identify trends and patterns: By analyzing unstructured data, organizations can identify trends and patterns that might not be apparent from structured data alone. This can be used for purposes such as identifying customer sentiment or predicting future events.

Improve customer service: By analyzing customer feedback and social media posts, organizations can identify problems or issues with their products or services and take steps to address them.

Enhance security: Unstructured data analysis can identify threats and suspicious activity, such as cyber-attacks or insider threats.

Enhance research and development: By analyzing unstructured data, organizations can identify new research opportunities and ways to improve existing products and services.

Overall, unstructured data analysis can help organizations make better-informed decisions and improve their operations by providing insights that would otherwise be hidden in unstructured data.

Banks have been tapping the potential of big data for the last few years. Big-data analytics empowers banks in various banking areas, from optimizing cash management to unravelling customer behaviour and improving the bottom line.

Big Data allows banks to comprehensively understand customers, products/services, markets, industry regulations, competitors, etc. One of the significant areas of application of big data in banking is improving customer insight and engagement to the ultimate level.

Digitization of financial products and services enables customers to easily interact with banks by using digital platforms conveniently. Big Data technologies can analyze the digital data received from various digital channels to enhance the quality of their products/services as they can gain insights into the customers' problems, preferences, and needs. Such customer insights are critical for improving the customer experience and staying ahead of the competition in the market.

Big data can transform many industries, including healthcare, finance, and retail, by providing previously unavailable insights. For example, big data analytics can be used to identify trends, predict outcomes, and optimize business processes.

To effectively analyze big data, specialized tools and technologies are often required, such as distributed storage systems and parallel processing frameworks. The field of big data also includes the development of algorithms and machine learning models that can analyze and extract valuable insights from large datasets.

Big Data can help enhance the employee experience by exploiting numerous Big Data tools and algorithms. Banks can track, monitor, and assess their employee's performance to identify the best performers and the weak or unhappy performers. Banks can reward the top performers and take initiatives to improve the skill sets/motivation of nonperforming employees, paying the way for increased output and good employee culture.

8.7 ROBOTIC PROCESS AUTOMATION (RPA)

Robotic process automation (RPA) is a type of software that uses artificial intelligence (AI) and machine learning to automate routine, repetitive tasks typically performed by humans. RPA is designed to mimic the actions of a human user, such as clicking, typing, and manipulating data, so that it can perform these tasks without human intervention. RPA is used in different industries to streamline processes, improve efficiency, and reduce errors.

Some popular use cases for RPA include data entry, transaction processing, customer service, and compliance.

Robotic process automation uses software robots to automate routine business tasks. Software robots do things like process transactions, manage IT, and act as automated online assistants. Robotic process automation uses artificial intelligence to build software robots that can do tasks like customer service and IT management, that used to be done by people.

Robotic Process Automation (RPA) is often used to do boring and repetitive tasks so that bank employees can focus on more complex tasks that require human interaction and decision-making. For example, we can teach a robot to read emails, send standard replies, or make purchase orders by giving it a set of rules.

Some of the biggest benefits of RPA include working 24x7x365 basis without getting tired, saving time and money, not making typos or copy/paste mistakes, and being compliant. Banks can create a "Virtual Workforce" by combining RPA with AI to automate processes by deploying custom applications. AI is all about using smart algorithms to fix inefficiencies and improve the customer experience at every point of contact. RPA is used in banking tasks like Know Your Customer (KYC), Getting a Loan, and more.

8.7.1 Characteristics of RPA

Robotic Process Automation (RPA) is a form of technology that allows software bots to automate repetitive tasks that humans normally perform. RPA systems are designed to mimic the actions of a human user, such as logging into applications, entering data, and clicking buttons.

Some characteristics of RPA are:

Automation: RPA systems are designed to automate repetitive tasks, allowing employees to focus on more complex and value-added work.

Speed: RPA systems can perform tasks much faster than humans, resulting in increased efficiency and productivity.

Accuracy: RPA systems can be programmed to follow the rules and procedures exactly, resulting in improved accuracy compared to human workers.

Scalability: RPA systems can be easily scaled up or down to meet changing business needs.

Integration: RPA systems can be easily integrated with other systems and applications to process data from a variety of sources.

Cost savings: RPA systems can help reduce labour costs by automating tasks that humans normally perform.

Compliance: RPA systems can help ensure compliance with rules and regulations by following established procedures.

8.7.2 Uses of RPA in Banking

Robotic Process Automation has the following use cases in the banking industry:

Account opening: RPA can automate the account opening process by gathering and verifying customer information, completing necessary forms, and verifying documentation.

Loan processing: RPA can automate loan processing by gathering and verifying customer information, completing necessary forms, and verifying documentation.

Fraud detection: RPA can help detect fraudulent activity by analyzing transactions and identifying patterns that may indicate fraudulent activity.

Customer service: RPA can facilitate the automation of routine customer service jobs such as responding to frequently asked questions and resolving simple customer issues.

Compliance: RPA can help banks ensure compliance with various regulations and policies by automating the process of reviewing and verifying customer information and transactions.

Data entry: RPA can automate data entry into various systems, mitigating the risk of errors

Reporting: RPA can automate the process of generating reports by pulling data from various systems and presenting it in a clear and concise format.

8.7.3 RPA Software Platforms

Many different RPA software platforms are available with their unique features and capabilities. Some popular RPA software platforms include:

UiPath: UiPath is a leading RPA platform that offers a wide range of features and integrations.

Blue Prism: Blue Prism is a well-known RPA platform widely used in the financial and healthcare industries.

Automation Anywhere: The automation Anywhere RPA platform offers a variety of tools and features for automating business processes.

WorkFusion: WorkFusion is an RPA platform that uses artificial intelligence and machine learning to automate business processes.

Softomotive: Softomotive is an RPA platform that offers a range of tools for automating business processes and integrating them with other systems.

Pega Robotic Automation: Pega Robotic Automation is an RPA platform specifically designed for the financial services industry.

Nice: Nice is an RPA platform which offers a range of tools and features for automating business processes.

8.8 VIRTUAL REALITY (VR) AND AUGMENTED REALITY (AR)

Virtual Reality (VR), Augmented Reality (AR), and Extended Reality (ER) are the newest outstanding technological trends. While AR improves the environment, VR immerses the user in it. Even though up until now, this technology trend has mostly been utilized for gaming and training.

AR and VR are often used in conjunction with some other cutting-edge technologies. They have huge potential for use in marketing, training, entertainment, education, and even post-injury rehabilitation. Either may be used to improve theme parks, train surgeons to do surgery, give museum visitors a richer experience, or even improve marketing, as in the case of this Pepsi Max bus shelter. These technologies will become much more embedded into our lives in the future.

Augmented reality (AR) is an enhanced representation of the physical world created by delivering digital visual components, sound, or other sensory inputs through technology. It is a developing trend among organizations engaged in mobile computing and, in particular, commercial apps. The real-world objects are enhanced by computer-generated perceptual information using multiple sensory modalities like visual, auditory, haptic, somatosensory, and olfactory. This experience is so seamlessly linked with the physical world that it is regarded as an integral part of it.

Virtual reality replaces the user's real-world environment with a simulated one, whereas augmented reality affects one's continuous perspective of a real-world environment. Mixed reality and computer-mediated reality are two phrases that are nearly synonymous with augmented reality.

Extended reality is a term that refers to all of the technologies that replicate reality, such as Virtual Reality, Augmented Reality, and Mixed Reality, amongst others. This technology is extremely popular among gaming experts, medical professionals, retail professionals, and modelling professionals since it simulates realism without the need for a physical presence. It is an important development in technological practice at the moment, as we all have a strong desire to break free from the physical world's supposed constraints.

Banks can improve their operational efficiency and employee productivity using

Virtual reality, Augmented Reality, and Mixed Reality. To create new, winning business models, Banks need to create a strong application programming interfaces (API) strategy to deliver relevant data in real-time to the various service layers that connect ecosystem players.

8.9 INTERNET OF THINGS (IOT)

The Internet of Things (IoT) is a group of physical devices, vehicles, buildings, and other objects connected to the Internet and capable of

collecting and exchanging data. IOT devices are equipped with sensors, software, and connectivity to transmit data over a network without requiring human interaction. IOT devices can be monitored and The IoT has the potential to transform a wide range of industries, including healthcare, agriculture, transportation, and manufacturing.

The IoT has the potential to transform a wide range of industries by enabling the real-time collection and analysis of data collected from connected devices. This can improve efficiency, cost savings, and new business opportunities. For example, in the healthcare industry, IoT devices such as wearable fitness trackers and smart pill bottles can help patients manage their health, while in the transportation industry, connected cars and smart traffic systems can improve safety and reduce congestion.

However, the increasing number of connected devices raises data privacy and security concerns. As more personal and sensitive data is collected and transmitted by IoT devices, there is a risk that unauthorized parties could access this information. Ensuring the security of IoT devices and the data they collect is a critical issue that needs to be addressed.

In today's world, many gadgets have WiFi capabilities. They can connect to the Internet and to one another. The Internet of Things is the future wave, and it has already made it possible for gadgets, home appliances, cars, and many other things to connect to the Internet and exchange data.

New technologies like 5G are anticipated to propel market expansion in the upcoming years. According to projections, there will be 50 billion Internet of Things (IoT) gadgets in use worldwide by 2030, building a vast network of interconnected devices that will include everything from smartphones to kitchen appliances.

The Internet of things (IoT) is the world of physical devices connected through the Internet. IOT devices are embedded with electronics, Internet connectivity, and other forms of hardware like sensors. These devices communicate and interact with other devices over the Internet and are remotely monitored and controlled.

The Internet of things (IoT) links billions of devices to the Internet and uses billions of data points, all of which must be protected. IoT security and privacy are identified as important problems due to their larger attack surface.

IoT can be used in the banking industry in many ways, including:

Fraud detection: Banks can use IoT devices to monitor customer accounts for unusual activity and alert customers if they detect potential fraud.

Customer service: Banks can use IoT devices such as chatbots and virtual assistants to provide immediate assistance to customers who have questions or need help with their accounts.

Personal finance management: Banks can use IoT devices such as wearable fitness trackers and smart home devices to help customers manage their finances by tracking their spending and finding ways to save money.

Credit scoring: Banks can use data collected from IoT devices to assess the creditworthiness of potential borrowers. For example, data from a connected car could be used to assess the borrower's driving habits and predict their likelihood of defaulting on a loan.

Risk management: Banks can use data collected from IoT devices to better understand and manage risks in their business. For example, data from connected industrial equipment could be used to identify and predict maintenance needs, reducing the risk of costly equipment failures.

Voice Assistants, Chatbots

Voice assistants are software programs that use artificial intelligence (AI) to understand and respond to voice commands. They assist users with tasks, answer questions, and perform various other functions using natural language processing (NLP) technology. Voice assistants can be accessed on devices such as smartphones, smart speakers, and smart home devices. Some examples of popular voice assistants include Amazon's Alexa, Apple's Siri, and Google's Assistant.

Some examples of popular voice assistants are:

Amazon's Alexa: This voice assistant is available on a range of devices, including Amazon's Echo smart speakers and Fire TV devices. Alexa can be used to control smart home devices, play music, answer questions, and more.

Apple's Siri: This voice assistant is available on all Apple devices, including iPhones, iPads, and Macs. Siri can send messages, make phone calls, set reminders, and more.

Google's Assistant: This voice assistant is available on a range of devices, including Android smartphones and tablets and Google's Home smart speakers. Google Assistant can control smart home devices, play music, answer questions, and more.

Chatbots are designed to simulate conversation with human users, especially over the Internet. They can be used to answer questions, provide customer service, or assist with online transactions. Chatbots use NLP to understand and respond to user input, and they can be accessed through a variety of channels, including messaging apps, websites, and social media platforms.

Some examples of popular chatbots are:

Facebook Messenger: This messaging platform allows businesses to build chatbots to communicate with customers through the Messenger app.

Slack: This team collaboration platform allows businesses to build chatbots that can communicate with team members and perform various tasks, such as booking meetings and answering questions.

Skype: This communication platform allows businesses to build chatbots to communicate with customers through the Skype app or website.

Financial institutions are experimenting with methods to use chatbots to conduct day-to-day banking operations to entice millennials and the unbanked. Chatbot technologies are being explored by banks and financial institutions to provide new interfaces to their existing service channels and to enable the appearance of 24/7 customer care capabilities. Messaging apps have gained in popularity in the last few years as a data-centric alternative to expensive SMS texting choices, with enhanced multimedia and group chat capabilities.

Visitors can access chatbots in one of two ways: through web-based or standalone applications. Today, chatbots are most frequently utilized in customer support, replacing tasks previously done by humans, such as help desk operators and customer relationship executives.

Organizations are gainfully offering chatbot capabilities to automate the following areas.

1) Automate and scale routine support functions,
2) Provide education and information in a friendly, digestible style
3) Guide shoppers to boost e-commerce sales
4) Generate and qualify leads
5) Engage users in an exciting new way

While Chatbots can process the voice/text of the user and decipher what the user says, there are some challenges in the ability of chatbots to parse human speech having inherent complexities in metaphors and similes etc.

Despite these significant limitations, Chatbots are becoming more and more sophisticated, responsive, and natural.

8.10 WEARABLE TECHNOLOGIES

Wearable technologies are electronic devices worn on the body and can collect and exchange data. These devices are often connected to the Internet and are equipped with sensors, software, and connectivity that allow them to transmit data over a network without requiring human interaction.

Artificial intelligence has helped to make our world smarter and more efficient. It goes beyond simply simulating humans in order to make our lives easier. These smarter devices are here to stay as data scientists continue to develop AI home robots, appliances, work devices, and wearables. Almost every upper-level job today necessitates knowledge of IT and automation.

The wearables business is producing a plethora of innovative and inventive products. Nowadays, every gadget we use on a daily basis is a "smart" device, such as smartwatches, smart glasses, and smart houses. These devices assist in collecting and analyzing real-time personal data, which provides information about everything from our health to our workouts.

Wearable technology involves the usage of wearable gadgets that a person can comfortably wear on his body to record and track information for personal or business usage related to health and fitness.

They have grown in popularity as instruments for keeping us informed and connected to ourselves, to the point where one in every three people in the United States now owns a wearable device. Wearable technology will become the next game-changer in retail banking, allowing customers to access key banking services with a single click on a user-friendly interface on their wearable device.

Some examples of wearable technologies include smartwatches, fitness trackers, virtual reality headsets, and smart glasses. Wearable technologies can be used for a wide range of purposes, including tracking physical activity, monitoring health, providing navigation and location services, and interacting with other devices.

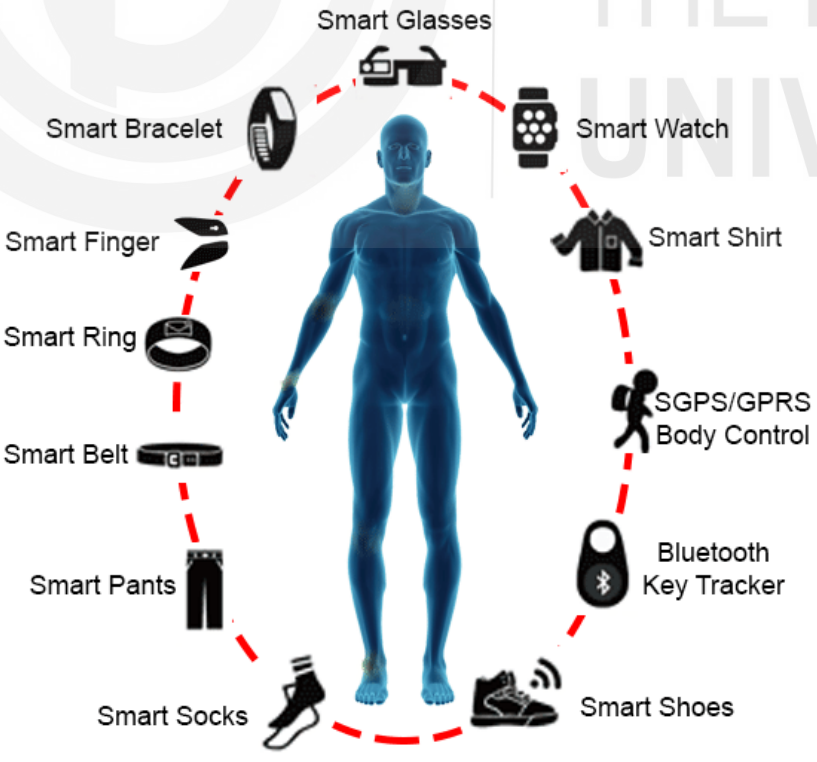
Wearable technologies can potentially transform various industries, including healthcare, fitness, entertainment, and transportation. However, like other forms of technology, wearable devices also raise concerns about data privacy and security. Ensuring the security of wearable devices and the data they collect is an important issue that needs to be addressed.

Wearable Types

Some of the most common types of wearable technology are :

- Smartwatches: Connected wristwatches, such as the Apple Watch or Samsung Galaxy Watch, enable the wearer to answer calls, track fitness, and sleep, among other functions.

Figure 8.4: Weareable Sources



Source: https://www.researchgate.net/

- Smart rings: Wearable technology that integrates the features of a smartwatch into a ring. While smart rings have not yet reached their full potential, some decent options are available.
- Smart clothing: Clothing interwoven with technology can track the user's biometric data or shuffle his audio.
- Advanced medical technology: wearable electrocardiograms (ECGs) transmit a patient's heartbeat to a cardiologist and other potentially life-saving on-body devices.
- Head-mounted displays (HMDs): Virtual reality headsets and other displays enhance the immersive experience of gaming or online browsing.

Wearable services can help banking and financial services to bring enhanced value to customers and bring engaged technology. Banks can provide banking services through Wearables like smartwatches, Google Glass, Wrist Bands, etc.

As more technologies come into play, existing technologies adapt to create more interactive consumer experiences. Wearable devices such as smartwatches are expected to transform the digital payments experience for customers. Gaining popularity among millennials and GenZ for wearable payment devices will revolutionize the payments space.

8.11 APPLICATION PROGRAMMING INTERFACES (API)

An application programming interface (API) is a set of rules for how two software programs can communicate. APIs can allow different software programs to communicate with each other or to allow different components within a single program to communicate with each other. APIs specify the way different components of a computer system or different systems should interact, allowing them to share data and functionality.

Open Banking, enabled by APIs, is widely seen as a turning point for the financial services sector. It has made custom banking services available to businesses and consumers while also ensuring complete safety and increased efficiency. API software enables two applications to communicate with one another.

API Banking is the process of exposing banking functions as a web service so that third-party companies can access them. This makes business processes more efficient, allowing different parts of the organization to work together in a coordinated manner. Additionally, APIs can help third-party companies build products around banking services.

8.11.1 API Banking in India

Banks offer API Banking platforms, extending a wide array of API services to FinTechs, Corporate customers and Technology vendors. Developers can readily access various banking services through APIs in an open and secure

environment. API integration paves the way to innovate new products technologically, to solve various problems.

Unified Payments Interface (UPI) in India has played an integral role in the rise of banking APIs in the country. A few banks then started launching API services which considerably disrupted the traditional retail banking scene in the country.

Some of India's banks now provide a variety of API banking services in categories such as customer onboarding, Payment Gateway services, Loans and Cards, etc. Third-party entities can use these APIs in numerous ways. Banks are using APIs to check a customer's CIBIL score or verify their PAN details.

API banking opened up abundant opportunities for Innovation and collaboration and facilitated APIs to handle services like foreign inward remittances, Fund Transfer, UPI, Smart Collection, Payment Links, Digital Loans, Account openings etc.

8.11.2 Benefits of using APIs in banking

APIs can be used in a variety of ways in the banking industry. Here are a few examples:

Integration with third-party financial services: Banks can use APIs to allow other financial service providers to access certain banking functions, such as account information or payment processing. This can help banks offer a wider range of services to their customers.

Mobile banking apps: Banks can use APIs to enable customers to access their accounts and perform banking tasks using a mobile app. This can include features such as checking account balances, transferring money, and paying bills.

Fraud detection: Banks can use APIs to integrate with fraud detection systems and automatically flag suspicious activity.

Personal finance management: APIs can be used to allow customers to connect their bank accounts with personal finance management tools, such as budgeting apps.

Automated investment services: Banks can use APIs to allow customers to set up and manage automated investment portfolios.

Open banking: Some countries have implemented open banking initiatives that require banks to make certain data and functionality available to third-party developers via APIs. This can help to create a more competitive and innovative financial services ecosystem.

The prime benefit of API is the elimination of redundant procedures, where third parties do not have to verify new customers but solely rely on the KYC procedure already completed by the bank. An example is credit scoring, which can be submitted in seconds because of the data imported from a client’s bank account by the API.

The flip side is that using APIs in banking can be expensive, difficult to use, and require specialized knowledge. There is always the risk of fraud when dealing with sensitive information.

In the future, APIs will be crucial in assisting banks in developing new customer insights and revenue streams, enhancing customer service, and opening up their systems and data to outside parties.

8.12 SUMMARY

The adoption of emerging technologies has gained substantial momentum in India's banking and financial sector recently. Banks are geared up for a transformational phase by implementing advanced technologies such as Blockchain, RPA, Artificial Intelligence (AI), Machine Learning (ML), and AR & VR. Over the years, the speed of adoption of these new technologies has picked up. New banking technologies are redefining the entire retail banking industry in response to consumers' rising need for digital access to financial services.

Computers and other digital devices are becoming increasingly important in the financial sector. Emerging technologies are helping the development of new financial products and services, which, in turn, impact individuals and businesses in important ways. Technology has permeated every facet of the banking sector, from traditional branches to mobile banking apps to neo-bank startups, and this trend will only accelerate as banks move into a more digital future.

More and more banks are investing in cutting-edge technologies to digitize business operations, create more agile work methods, and update their functions. Because of technological changes, traditional banks can now work with fintech companies and neo-banks to offer their customers better, more efficient services.

Banks are using AI to smooth customer identification and authentication while also mimicking live employees through chatbots and voice assistants. Mobile banking became the primary way they accessed their bank account. Consumers can already see AI used by most banks through chatbots in the front office.

Modern banking is frequently the first to experiment with and benefit from newer technologies. Meeting changing consumer needs and competing are two of the main reasons why top banks worldwide, particularly in India, are devouring the latest technologies faster than ever.

Big can transform the way that businesses and organizations operate by providing them with unprecedented levels of insight and understanding. Big data analytics can transform many industries by providing insights and enabling organizations to make more informed decisions.

In the past few years, natural language processing (NLP) has made a lot of progress. NLP technology is becoming more and more important in our daily

lives. Some examples are virtual assistants like Siri, Alexa, and Google Assistant and machine translation tools like Google Translate.

The introduction of API banking also aided the development of neo-banks and challenger banks. One such recent Innovation is open banking. It entails the use of APIs with access to a bank's core system. Third parties can then use these APIs within their organization/platform or offer consumers a more Personalized banking experience.

Customers are open to banking innovations, and the government is keen on encouraging the digitization of products and services. This dual push compels all players in the ecosystem, like regulators, PSU Banks, Private Banks and other financial institutions & intermediaries, to use modern technology to stay competitive and relevant.

In order to establish the digital future of financial services, banks must work with FinTech entrepreneurs, incumbents, and investors. There are unlimited possibilities for financial Innovation, and Banks need to find their way around the digital ecosystem to generate lasting value.

In the coming years, a major portion of the data will be processed at the edge compared to cloud computing. By making data available through APIs, banks can make new products quickly, give customers a better experience, and make technology delivery more efficient. This will be important in a world where technology is always improving and changing quickly.

8.13 KEYWORDS

Emerging Technology refers to innovative technologies in the initial stages of development that are not yet widely available or widely known.

Artificial Intelligence is a computer science branch that focuses on developing and managing technology that can learn to make decisions and carry out actions autonomously on behalf of humans and create intelligent machines and software that work and react like humans.

Blockchain is based on distributed ledger technology (DLT) that stores transactions in “blocks” and then links and sequences the transactions using cryptography.

Consensus Mechanism is a process to achieve agreement among the nodes in a blockchain network

Cryptocurrency is a digital or virtual currency using cryptography for carrying out secure financial transactions. Cryptocurrencies are decentralized systems that use distributed ledger technology, also known as a blockchain, to maintain a secure and transparent record of transactions.

Augmented Reality (AR) is an enhanced representation of the physical world created by delivering digital visual components, sound, or other sensory inputs through technology.

Voice Assistants are software programs that use artificial intelligence (AI) to understand and respond to voice commands.

Chatbots are designed to simulate conversation with human users, especially over the Internet.

Wearable Technologies are electronic devices worn on the body and can collect and exchange data.

8.14 SELF-ASSESSMENT QUESTIONS

1. What is an Emerging technology? Briefly explain the emerging technologies in the field of computing having potential use in the banking industry.
2. Explain Artificial Intelligence. Discuss the types of Artificial intelligence (AI) giving examples.
3. Discuss about Blockchain technology and transaction flow in a blockchain. What is consensus mechanism in a blockchain?
4. What is data analytics? Discuss the different types of analytics and how each helps organisations.
5. Describe the Robotic process automation (RPA) and its characteristics. What are the Uses of RPA in Banking?

8.15 FURTHER READINGS

https://medium.com/
https://www.ibm.com/cloud/learn/supervised-learning
https://www.sisense.com/glossary/data-exploration/
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