CREATE.INNOVATE.DEVELOP

TECHNO-VUCA

DEPARTMENT OF COMPUTER SCIENCE
AND ENGINEERING

OCTOBER 2018

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VISION

Department is committed to provide Intellectual, Inovative & Inspirational environment and contribute to academic, scientific, research and technical knowledge through excellence through excellence and to produce technocrats, researchers and bureaucrats.

MISSION

M1: To improve the problem-solving capability of students through continual learning so as to produce quality engineers in the field of Computer Science.

M2: To bridge the gap between industry and academia by bringing state-of-the-art technology.

M3: To encourage innovation through multidisciplinary research and development activities.

M4: To inculcate human values and ethics into students to serve the society in all possible ways.

PROGRAM SPECIFIC OUTCOMES (PSO'S)

PSO 1: The ability to design and develop the hardware and software systems.

PSO 2: An understanding of interdisciplinary computing techniques and an ability to apply them in the design of advanced computing.

PSO 3: An understanding of Programming methodology, Software development Paradigms, Design and Analysis of Algorithms, Operating Systems, digital Logic Design, Theory of Computation, discrete Mathematics, Compiler design, etc.

PSO 4: The ability to integrate and manage the various phases/components of software development projects.

Dr. Sarojini Agarwal
(Chairperson)

The future lies before you like a hidden mass of snow, be careful how you tread on it, for every mark will show.

-Dr. Sarojini Agarwal

Dr. Om Prakash Agarwal
(Managing Director)

Success is not a one-shot process. It is an valuable opportunity to rectify errors and move forward. Failure in working for a good cause is better than success in working for a wrong cause. Over the years now, NIET has built quite a special position in the private higher education sector. With its distinctive culture, it provides a clear student-centered environment in which to explore existing technical knowledge, and gain new learning at the leading edges of technology development. Our unique educational system ensures that you gain not just depth and breadth in your chosen area of specialization, but also a holistic set of skills that will equip you to face the real world.

-Dr. Om Prakash Agarwal

Dr. Neema Agarwal
(AMD)

In the course of last 20 years many technical & management institutes have sprung up all over the country. Graduates passing out every year are highly optimistic, that technical courses ensure a rewarding career. Beyond the academics, the curriculum at NIET is strongly linked with several recent themes like latest technologies needed by organizations, soft skills, communication, among others. Our approach has resulted in programs of study relevant to the leadership trends and challenges of tomorrow. Students regularly undergo personality development and grooming sessions that leads to both extrinsic and intrinsic confidence boosting and prepares them for the corporate world.We appreciate your interest and want you to know that we are here to bring you a leading edge technical education.

-Dr. Neema Agarwal

Mr. Raman Batra
(EVP)

This new generation is an interesting one. Most of them were born into a world where technology has always been at the forefront. These students rely on Google, texting, social media and Wi-Fi, and they view email - not letter writing- as a formal form of communication.NIET has been helping students write their own stories since its inception. Committed to providing the best jobs by creating life-changing educational opportunities and collaborative learning environments, we have stayed at the forefront of innovation in higher education, providing the tools our students need to make them industry ready from day one and make an impact in the world.

-Mr. Raman Batra

Dr. R.K Ranjan
(Director)

We motivate our students to dream big and guarantee that we include the right spirit and the necessary talent to realize their objective. We also continuously strive to build ethical values in our words so that they become responsible citizen
of tomorrow.

-Dr. R.K Ranjan

Prof. Dr. Chandra Shekhar Yadav
(HOD OF CSE DEPARTMENT)

Students must keep pace with the changing world by acquiring knowledge about latest technologies. This will help them to achieve success and reach new heights in their life.

-Prof. Dr. C.S Yadav

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About the Department

In Computer Science, NIET is definitely the place to bet on. You can become a part of the tradition of excellence. With rapidly evolving technical and the continuous need for innovation, the department has always produced quality professionals and holds an important position in software industry in India and abroad.

The Department of Computer Science and Engineering at NIET is renowned for its cutting edge research and imparting state-of-the-art education. The department attracts the bright students and faculty members. The faculty members are leaders in advanced computer technologies such as Genetic Algorithm, parallel processing, data mining, computer graphics, and software engineering, cloud computing, mobile applications & network programming.

Some Articles By Students

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GET FUTURE READY

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SQL
(STRUCTURED QUERY LANGUAGE)

BY-

ISHA VERMA

CSE First Year

SQL full form is **Structure Query Language**. SQL is a domain-specific language. It is used in applications development language. According to ANSI (American National Standards Institute), it is the standard language for relational database management systems. It is used in application development language to enable a programmer to work with the data. Although most database systems use SQL, most of them also have their own additional proprietary extensions that are usually only used on their system. The data is stored in a relational databases . To manage the data, we have relational databases management systems like SQL Server, MySQL, etc. that use SQL as a standard databases language.

SQL became the de facto standard programming language for relational databases after they emerged in the late 1970s and early 1980s. Also known as SQL databases, relational systems comprise a set of tables containing data in rows and columns. An official SQL standard was adopted by the American National Standards Institute (ANSI) in 1986 and then by the International Organization for Standardization, known as ISO, in 1987. More than a half-dozen joint updates to the standard have been released by the two standards development bodies since then; as of this writing, the most recent version is SQL:2011, approved that year.

DATA

Data is distant pieces of information, which can be facts, figures, or details that are used by a computer. **Data** on its own has no meaning, or context. It is only after processing by a computer that data takes on a context and becomes information.

DATABASE MANAGEMENT SYSTEM

It is a software for storing and retrieving users data while considering appropriate security measures. It consist of a group of programs which manipulate the database. The DBMS accept the request for data from an application and instruct the operating system to provide the specific data in large systems, a DBMS helps users and other third party software to store and retrieve data. These commands can be to load, retrieve or modify existing data from the system. A DBMS always

provides data independence. Any change in storage mechanism and formats are performed without modifying the entire application.

Relational Database: Data is organized as logically independent tables. Relationships among tables are shown through shared data. The data in one table may reference similar data in other tables, which maintains the integrity of the links among them. This feature is referred to as referential integrity – an important concept in a relational database system. Operations such as "select" and "join" can be performed on these tables. This is the most widely used system of database organization.

STRUCTURE QUERY LANGUAGE

Structured Query Language is a standard Database language which is used to create, maintain and retrieve the relational database. Following are some interesting facts about SQL.

- SQL is case insensitive. But it is a recommended practice to use keywords (like SELECT, UPDATE, CREATE, etc) in capital letters and use user defined things (liked table name, column name, etc) in small letters.

- We can write comments in SQL using “–” (double hyphen) at the beginning of any line.

- SQL is the programming language for relational databases (explained below) like MySQL, Oracle, Sybase, SQL Server etc. Other non-relational databases (also called No SQL) databases like MongoDB, , etc do not use SQL

- Although there is an ISO standard for SQL, most of the implementations slightly vary in syntax. So we may encounter queries that work in SQL Server but do not work in MySQL.

TYPES OF SQL

SQL Categorizes its commands on the basis of functionalities performed by them. SQL command is the coding format used in writing statements. There are five types of SQL Commands which can be classified as:

- DDL (Data Definition Language).
- DML (Data Manipulation Language).
- DQL (Data Query Language).
- DCL (Data Control Language).
- TCL (Transaction Control Language).

Data Definition Language (DDL)

Data definition statement are use to define the database structure or table.

Statement	Description
CREATE	Create new database/table.
ALTER	Modifies the structure of database/table.
DROP	Deletes a database/table.
TRUNCATE	Remove all table records including allocated table spaces.
RENAME	Rename the database/table.

Data Manipulation Language (DML)

Data manipulation statement are use for managing data within table object.

Statement	Description
SELECT	Retrieve data from the table.
INSERT	Insert data into a table.
UPDATE	Updates existing data with new data within a table.
DELETE	Deletes the records rows from the table.
MERGE	MERGE (also called UPSERT) statements to INSERT new records or UPDATE existing records depending on condition matches or not.
LOCK TABLE	LOCK TABLE statement to lock one or more tables in a specified mode. Table access denied to a other users for the duration of your table operation.
CALL EXPLAIN PLAN	Statements are supported in PL/SQL only for executed dynamically. CALL a PL/SQL program or EXPLAIN PATH access the data path.

Data Control Language (DCL)

Data control statement are use to give privileges to access limited data.

Statement	Description
GRANT	Gives privileges to user for accessing database data.
REVOKE	Take back for given privileges.
ANALYZE	ANALYZE statement to collect statistics information about index, cluster, table.
AUDIT	To track the occurrence of a specific SQL statement or all SQL statements during the user sessions.
COMMENT	Write comment to the data table.

Transaction Control Statement (TCS)

Transaction control statement are use to apply the changes permanently save into database.

Statement	Description
COMMIT	Permanent work save into database.
ROLLBACK	Restore database to original form since the last COMMIT.
SAVEPOINT	Create SAVEPOINT for later use ROLLBACK the new changes.
SET TRANSACTION	SET TRANSACTION command set the transaction properties such as read-write/read only access.

Session Control Statement (SCS)

Session control statements are managing properties dynamically of a user session.

Statement	Description
ALTER SESSION	ALTER SESSION statement to modify conditions or parameters that are affect to your database connection.
SET ROLE	SET ROLE statement to enable or disable the roles that are currently enabled for the session.

SYNTAX

The SQL language is subdivided into several language elements, including:

Clauses, which are constituent components of statements and queries.

Expressions, which can produce either scalar values, or tables consisting of columns and rows of data

Predicates, which specify conditions that can be evaluated to SQL three-valued logic (3VL) (true/false/unknown) or Boolean truth values and are used to limit the effects of statements and queries, or to change program flow.

Queries, which retrieve the data based on specific criteria. This is an important element of SQL.

Statements, which may have a persistent effect on schemata and data, or may control transactions, program flow, connections, sessions, or diagnostics.

Table Basics

A relational database system contains one or more objects called tables. The data or information for the database are stored in these tables. Tables are uniquely identified by their names and are comprised of columns and rows. Columns contain the column name, data type, and any other attributes for the column. Rows contain the records or data for the columns.

SQL-on-Hadoop tools

SQL-on-Hadoop query engines are a newer offshoot of SQL that enable organizations with big data architectures built around Hadoop systems to take advantage of it instead of having to use more complex and less familiar languages-- in particular, the Map Reduce programming environment for developing batch processing applications. More than a dozen SQL-on-Hadoop tools have become available through Hadoop distribution providers and other vendors; many of them are open source software or commercial versions of such technologies.

In general, SQL-on-Hadoop is still an emerging technology, and most of the available tools don't support all of the functionality offered in relational implementations of SQL. But they're becoming a regular component of Hadoop deployments as companies look to get developers and data analysts with SQL skills involved in programming big data applications.

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MACHINE LEARNING

BY-
HIMANSHU MIDHA

CSE First Year

MACHINE LEARNING:

What is Machine learning?

Machine Learning (ML) is a subset of artificial intelligence which focuses mainly on machine learning from their experience and making predictions based on its experience.

ML is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead.

It enables the computers or the machines to make data-driven decisions rather than being explicitly programmed for carrying out a certain task. These programs or algorithms are designed in a way that they learn and improve over time when are exposed to new data

Machine learning is closely related to computational statistics, which focuses on making predictions using computers. The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning. Data mining is a field of study within machine learning, and focuses on exploratory data analysis through unsupervised learning. In its application across business problems, machine learning is also referred to as predictive analytics.

History

Arthur Samuel, an American pioneer in the field of computer gaming and artificial intelligence, coined the term "Machine Learning" in 1959 while at IBM. A representative book of the machine learning research during the 1960s was the Nilsson's book on Learning Machines, dealing mostly with machine learning for pattern classification. The interest of machine learning related to pattern recognition continued during the 1970s, as described in the book of Duda and Hart in 1973. In 1981 a report was given on using teaching strategies so that a neural network learns to recognize 40 characters (26 letters, 10 digits, and 4 special

symbols) from a computer terminal. As a scientific endeavour, machine learning grew out of the quest for artificial intelligence. Already in the early days of AI as an academic discipline, some researchers were interested in having machines learn from data. They attempted to approach the problem with various symbolic methods, as well as what were then termed "neural networks"; these were mostly perceptions and other models that were later found to be reinventions of the generalized linear models of statistics. Probabilistic reasoning was also employed, especially in automated medical diagnosis.

However, an increasing emphasis on the logical, knowledge-based approach caused a rift between AI and machine learning. Probabilistic systems were plagued by theoretical and practical problems of data acquisition and representation. By 1980, expert systems had come to dominate AI, and statistics was out of favour. Work on symbolic/knowledge-based learning did continue within AI, leading to inductive logic programming, but the more statistical line of research was now outside the field of AI proper, in pattern recognition and information retrieval. Neural networks research had been abandoned by AI and computer science around the same time. This line, too, was continued outside the AI/CS field, as "connectionism", by researchers from other disciplines including Hopfield, Rumelhart and Hinton. Their main success came in the mid-1980s with the reinvention of backpropagation.

Machine learning, reorganized as a separate field, started to flourish in the 1990s. The field changed its goal from achieving artificial intelligence to tackling solvable problems of a practical nature. It shifted focus away from the symbolic approaches it had inherited from AI, and toward methods and models borrowed from statistics and probability theory. It also benefited from the increasing availability of digitized information, and the ability to distribute it via the Internet.

Applications

The value of machine learning technology has been recognized by companies across several industries that deal with huge volumes of data. By leveraging insights obtained from this data, companies are able work in an efficient manner to control costs as well as get an edge over their competitors.

According to Forbes, the International Data Corporation (IDC) forecasts that spending on AI and ML will grow from $12 Billion in 2017 to $57.6 Billion by 2021. This is how some sectors / domains are implementing machine learning –

Financial Services:

Companies in the financial sector are able to identify key insights in financial data as well as prevent any occurrences of financial fraud, with the help of machine learning technology. The technology is also used to identify opportunities for investments and trade. Usage of cyber surveillance helps in identifying those individuals or institutions which are prone to financial risk, and take necessary actions in time to prevent fraud.

Marketing and Sales:

Companies are using machine learning technology to analyse the purchase history of their customers and make personalized product recommendations for their next purchase. This ability to capture, analyse and use customer data to provide a personalized shopping experience is the future of sales and marketing.

Government:

Government agencies like utilities and public safety have a specific need for ML as they have multiple data sources, which can be mined for identifying useful patterns and insights. For example sensor data can be analysed to identify ways to minimize costs and increase efficiency. Furthermore, ML can also be used to minimize identity thefts and detect fraud.

Healthcare:

With the advent of wearable sensors and devices that use data to access health of a patient in real time, ML is becoming a fast-growing trend in healthcare. Sensors in wearable provide real-time patient information, such as overall health condition, heartbeat, blood pressure and other vital parameters. Doctors and medical experts

can use this information to analyse the health condition of an individual, draw a pattern from the patient history, and predict the occurrence of any ailments in the future. The technology also empowers medical experts to analyse data to identify trends that facilitate better diagnoses and treatment.

Transportation:

Based on the travel history and pattern of traveling across various routes, machine learning can help transportation companies predict potential problems that could arise on certain routes, and accordingly advise their customers to opt for a different route. Transportation firms and delivery organizations are increasingly using machine learning technology to carry out data analysis and data modelling to make informed decisions and help their customers make smart decisions when they travel.

Oil and Gas:

This is perhaps the industry that needs the application of machine learning the most. Right from analyzing underground minerals and finding new energy sources to streaming oil distribution, ML applications for this industry are vast and are still expanding.

Skills required:

Technical skills:

Applied Mathematics
Neural Network Architectures
Physics
Data Modelling and Evaluation
Advances Signal Processing Techniques
Natural Language Processing
Audio and video Processing
Reinforcement Learning

Programming skills:

Computer Science Fundamentals and Programming
Software Engineering and System Design
Machine Learning Algorithms and Libraries

- Distributed computing
- Unix

Soft skills:

- Domain knowledge
- Communication Skills
- Problem-solving skills
- Rapid prototyping
- Time management
- Love towards constant learning

Programming languages used in Machine learning:

C, C++ and Java
Spark and Hadoop
R Programming
Apache Kafka
Python
Weka Platform
MATLAB/Octave

Types of Machine Learning:

Machine learning is mainly divided into three main categories:

Supervised Learning:

Supervised Learning is the first type of machine learning, in which labelled data used to train the algorithms. In supervised learning, algorithms are trained using marked data, where the input and the output are known. We input the data in the learning algorithm as a set of inputs, which is called as Features, denoted by X along with the corresponding outputs, which is indicated by Y, and the algorithm learns by comparing its actual production with correct outputs to find errors. It then modifies the model accordingly. The raw data divided into two parts. The first part is for training the algorithm, and the other region used for test the trained algorithm.

Supervised learning uses the data patterns to predict the values of additional data for the labels. This method will commonly use in applications where historical data predict likely upcoming events. For example: It can anticipate when transactions are likely to be fraudulent or which insurance customer is expected to file a claim.

Unsupervised Learning:

Unsupervised Learning is the second type of machine learning, in which unlabelled data are used to train the algorithm, which means it used against data that has no historical labels. What is being showing must figure out by the algorithm. The purpose is to explore the data and find some structure within. In unsupervised learning the data is unlabelled, and the input of raw information directly to the algorithm without pre-processing of the data and without knowing the output of the data and the data cannot divide into a train or test data. The algorithm figures out the data and according to the data segments, it makes clusters of data with new labels.

This learning technique works well on transactional data. For example, it can identify segments of customers with similar attributes who can then be treated similarly in marketing campaigns. Or it can find the primary qualities that separate customer segments from each other. These algorithms are also used to segment text topics, recommend items and identify data outliers.

Reinforcement Learning:

Reinforcement Learning is the third type of machine learning in which no raw data is given as input instead reinforcement learning algorithm have to figures out the situation on their own. The reinforcement learning frequently used for robotics, gaming, and navigation. With reinforcement learning, the algorithm discovers through trial and error which actions yield the most significant rewards. This type of training has three main components which are the agent which can describe as the learner or decision maker, the environment which described as everything the agent interacts with and actions which represented as what the agent can do.

The objective is for the agent to take actions that maximise the expected reward over a given measure of time. The agent will reach the goal much quicker by following a good policy. So, the purpose of reinforcement learning is to learn the best plan.

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"AUGMENTED REALITY & VIRTUAL REALITY"

BY-

RISHABH MALIK

CSE Third Year

Introduction

In the current highly competitive business and manufacturing environment, manufacturing industry is facing the constant challenge of producing innovative products at reduced time-to-market. The increasing trend of globalized manufacturing environments requires real-time information exchanges between the various nodes in a product development life cycle, e.g., design, setup planning, production scheduling, machining, assembly, etc., as well as seamless task collaboration among these nodes. In addition, with increased environmental awareness and legislation, more constraints have been placed on product disposal, hence promoting product recycling, servicing and repairing activities. Product development processes are becoming increasingly more complex as products become more versatile and intricate, and inherently complicated, and as product variations multiply with the trend of mass customization. Thus, manufacturing processes have to be more systematic in order to be efficient and economically competitive. An innovative and effective solution to overcome these problems is the application of virtual reality (VR) and augmented reality (AR) technologies to simul Virtual reality is often used as an umbrella term for all manner of immersive experiences, including many related terms such as augmented reality, mixed reality, and extended reality. In this book, however, when I refer to virtual reality, I generally mean an immersive computer-simulated reality that creates a physical environment that does not exist. VR environments are typically closed off from the physical world in the sense that the environments they creates are wholly new. Although the digital environments could be based on real places (such as the top of Mount Everest) or imagine drones (such as the underwater city of Atlantis), they exist apart from the current physical reality.

Figure shows an example of a VR environment. It’s a screen shot of Wevr’s VR experience, The Blu, which allows users to explore undersea coral reefs and ocean depths, including an encounter with an 80-foot whale.

Augmented reality is a way of viewing the real world (either directly or via a device such as a camera creating a visual of the real world) and “augmenting” that real-world visual with computer-generated input such as still graphics, audio, or videos. AR is different from VR in that AR augments (adds to) a real-world or

existing scene instead of creating something new from scratch.

By strict definition, in AR, the computer-generated content is an overlay on top of the real-world content. The two environments have no way of communicating with corresponding to one another. However, AR's definition has been somewhat co-opted in recent years to also include a more blended hybrid called mixed reality, in which interaction can occur between the real world and digitally augmented content.

remember In this article, when I refer to augmented reality, I use it as a blanket term that includes mixed reality as well. The two terms are often used synonymously within the industry as well, with mixed reality rapidly gaining favor as the more descriptive term for the combination of analog and digital realities.

Figure shows an example of one of the most popular recent examples of AR, Pokémon Go, whichplaces a digital Pokémon character within your real-world environment.

AR Vs VR – What's the difference

It is human nature to assume that these both types of reality as equally similar, and do provide comparable applications for users to enjoy, but it is important to know where they differ. While they hold the ability to allow users to co-exist with a virtual world, they differ based on the immersive experience offered and our sense of perception.

To summarize, the main uses of virtual reality is to completely transpose the user into a different world and focus our presence into a fully immersive computer-generated reality.

Augmented reality, however, applies virtual elements to the world already existing and augments our state of presence, digitally manipulating a given environment.

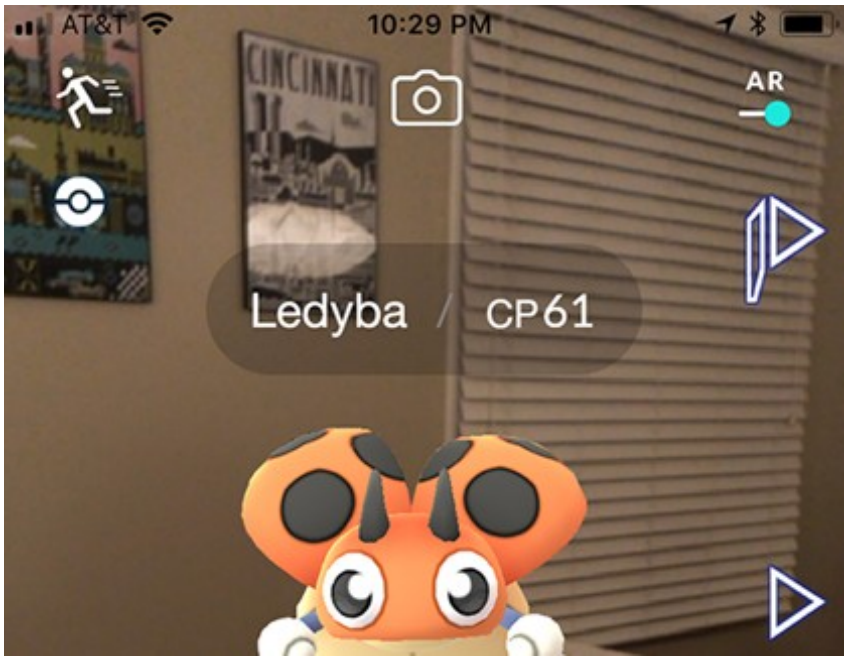
AR does provide more freedom to users without using a head-mounted display as virtual reality users do. Regardless of what separates these 2 groundbreaking technologies, the applications shown in both of these realities allows our world to be continually enhanced by these systems.

Virtual Reality-A New World

Many of us assume that virtual reality has been a marketing buzzword to describe immersive experiences with video games or TV shows selectively, as they can make you adapt to a whole new world of a computer-generated reality.

You can often think of virtual reality as being a gateway to a whole new world, where you can respond to what you see and what you see can respond back to you. The computer-generated technology is harnessed to make this virtual reality look 100% believable to the human eye since VR changes to match how your senses are stimulated.

There are many different variations of virtual reality, each of them being equally explorable, believable and interactive.



Fully Immersive

Fully immersive VR experiences have specific criteria to make them revolutionary interface and a new computing platform.

A richly detailed world is needed that is powered by a computer model/stimulation

A powerful computer is also required that can detect quick movements in real-time and adjust the VR experience accordingly

Hardware such as a head-mounted display (HMD) with sensory gloves, screens, and stereo sound that can be linked to the computer which can fully immerse us into the VR world

Non-Immersive

For those who don’t wish to be fully immersed into the VR world, examples such as a realistic flight simulator on a PC and a joystick classify as non- immersive experiences that do not take you into an alternative reality.

Many computer archaeologists and those involved in industrial design use 3D models to their advantage, and can create reconstructions or models which can mimic different features with rich experience.

Web-based VR

During the early 1990s, virtual reality technologies were rising rapidly, until the fast-growing World Wide Web offered a new experience, an outlook into real reality.

This new web database gave users access to publish information and establish a new form of communication with people all across the world. With companies such as Facebook being on the edge of virtual reality, the future of VR is both collaborative and web-based.

It is true that computer stimulations or interactive games meet part of the definition of the term “virtual reality,” but there are so many more approaches to what this virtual world can be used for past the gaming realm disrupting fields such as medicine, education or industrial architecture.

Virtual Reality Equipment

While ordinary computers use equipment such as a keyboard, mouse or different input systems (speech recognition), VR uses sensors to adjust the experience based on the movement of your body.

Head-Mounted Displays (HMDs)

To achieve the fully immersive VR experience, a head-mounted display is needed to construct a 3D image of the virtual world as you are moving your head in real-time (head tracking).

The 2 screens seen on an HMD have built-in position sensors (accelerometers) to adjust the image accordingly based on the angle of your body and orientation. There are many companies such as Oculus, Google, Samsung and Microsoft providing more features to these headsets, to ensure immersive experiences and a detailed 3D world for users.

A system called 6DoF, implemented into the HMD locates your x, y and z axis, while measuring your head movements to adjust the VR experience.

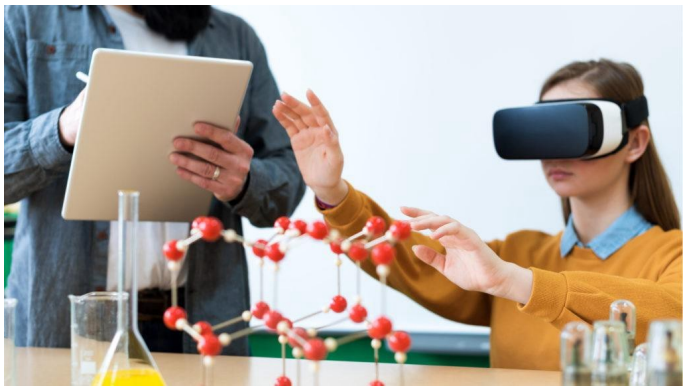
Another feature of these VR headsets is eye tracking. An infrared sensor monitor is located inside the headset, which provides information about the movement of your eyes so the image can adjust accordingly. This system allows characters in the stimulation to react more closely based on where they are looking and provide realism to the detailed images.

Wands:

Wands used in VR experiences, give the user opportunities to point, touch and interact with the virtual environment around them. To navigate the VR world, these wands have built-in accelerometers and are wireless.

Applications Of Virtual Reality

Education:



We all know that our world is based on the use of vocational skills on a daily basis, but how do we use VR to enable students to practice this type of content?

Well, one of the greatest benefits of VR being integrated into classroom-based learning, is how it allows for students to be trained from realistic scenarios, which VR can stimulate.

An experiment conducted by Google's Daydream Labs revealed that students who received VR training learned in a more efficient way than those who used classroom/video-based tutorials.

Medicine/Surgery:

Virtual reality has allowed the medical field to open its doors to “telemedicine”, which describes the process of monitoring, examining or preforming surgery on patients remotely.

While it is evident that surgery requires much practice and proper technique, there were not that many efficient ways to gain experience doing so, until the rise of VR came into the picture. Methods of patient scans such as MRIs and CAT scans can only reveal so much about what the patient is experiencing.

VR technology allows for these images to be projected into a 3D model, so physicians are able to observe the detailed parts of the anatomy, therefore stimulating surgery even before stepping into an OR.

An example of this technology was presented to the world in 2009, called the “daVinci” surgical robot which has now been integrated into many hospital practices globally. Surgeons can use this system to perform complex operations with robotic based surgery.

Computer-GeneratedArchitecture:

In the past, architectures had to settle for constructing models of buildings or designs out of resources they already had (real-world materials), but thanks to VR technology, they can now build computer-generated models that can be explored interactively.

The Oculus Rift hardware allows for eager students to construct different buildings and implement them into 3D models to bring their plans to life, even to explore them virtually.

Augmented Reality-Merging Digital Content With Our World

Along with virtual reality, augmented reality also proves to be providing usefulness to our daily lives, as this technology has the power to digitally transform the world around us and add elements from the virtual world, into the one we see every day.

AR is based on augmenting virtual information and merging aspects of the computer-generated world, into the existing environment of a user. Users immersive themselves into an AR experience, to achieve an improved reality where virtual objects and real-life elements can co-exist with each other.

Types Of AR:

Projection-Based Augmented Reality:

Projection-based AR allows for users of this technology to project artificial light onto real-world objects and surfaces. Through this, humans can physically interact with the light through touch, since many AR apps are now accustomed to detecting user interaction by differentiating between an untouched projection and an altered one based on the user's interaction with it.

This type of AR also enables the use of "laser-plasma technology" which can launch a 3D hologram for users to interact with into mid-air.

Superimposition Based Augmented Reality:

Nowadays, AR app companies enable superimposition based AR to construct new dimensions of an object which can replace the original object, by recognizing the object model.

It is heavily vital for AR apps to detect the original object's dimensions and model, to strategically locate where augmented objects can belong in a room/space.

Marker Based AR:

Marker-based AR helps the device being used to detect through a live camera feed and whether the user is pointing the camera to a specific place for an animation to show up.

The device must recognize what location is being viewed from the camera, by placing an image/shape in the location that the user wishes to animate. The image

will be processed and the picture can be animated immediately, tracking it to the same location as the original image

The picture recognized by the device is referred to as a marker and has many visual aspects to it.

Markerless Based AR:

Think about how AR can be used to place furniture inside your room, much like the virtual Ikea catalog which helps customers to decide combinations of furniture styles, objects, and locations. The user needs to find a location to place the object often referred to as “markerless AR”, where an “anchor” to the real world is not needed.

To increase realism when placing objects, you can use this application to automatically locate a 3D object onto a flat surface, rather than letting it float in mid-air.

Companies Disrupting AR & VR

Let’s take a closer look at the companies making immense progress in the space of virtual and augmented reality.

Microsoft-HoloLens:

Microsoft constructed a new virtual reality headset with transparent AR lenses called HoloLens, which is comparable to a holographic computer. This hardware injects interactive holograms into our natural environments and surrounds us with a full array of apps in an interactive experience.

Exploring the field of mixed reality (MR), the HoloLens applies features from both AR and VR, to give users a fully immersive experience, and features a wide field of view (FOV), and a transparent surface for AR applications.

Samsung Gear VR:

Gear VR, released in March of 2017, is described as a VR headset constructed by Samsung in collaboration with Oculus VR and designed to use a Samsung device as a display piece. The latest version works with 9 different devices, and is quite mobile, requiring only a phone and a headset to work without any external sensors or equipment.

Oculus VR designed and built the app meant to turn a Samsung phone into a VR headset while providing a storefront for many virtual reality games. Samsung is now disrupting the AR space as they are building a new monitorless AR glasses, which replaces device screens by connecting to PCs and WiFi.

Oculus VR-Oculus Rift:

Oculus VR, a startup purchased by Facebook, is another company on the cutting edge of awesome VR applications and hardware, mainly developing goggles for immersive experiences. The Rift is able to fully enable stereoscopic 3D images by using eye screens located for each eye and lenses placed on top of the panels to structure these images according to the movement of your eyes.

A new headset is now coming to the VR market, Oculus Quest. This standalone VR headset will encompass the ideal VR elements along with positional tracking, virtual hand controllers and wireless design.

Google VR:

Google took it's first step into the VR world, by developing Google Expeditions, an immersive app that allows users to actively explore new environments and Google Cardboard making its debut to provide an interactive experience to app users. The company is now disrupting the field of VR with new applications such as Tilt Brush and the Daydream headset.

Google is also stepping into the world of AR, with its spinoff Niantic. Niantic manages shared AR-based communication, security, mapping and functionality. The company is the world's only 'planet-scale' augmented reality platform, catering to a global demographic.

In the summer of 2016, Niantic launched Pokemon Go, a game that quickly brought AR into the mainstream developed a reputation as the most popular AR game so far.

We must learn how to co exist with this technology, as it can provide answers to questions we've been asking for years, simply by transposing us to a different dimension or adding virtual elements to our already existing environment.

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DEEP LEARNING ALGORITHMS

BY-

SHASHANK

CSE Second Year

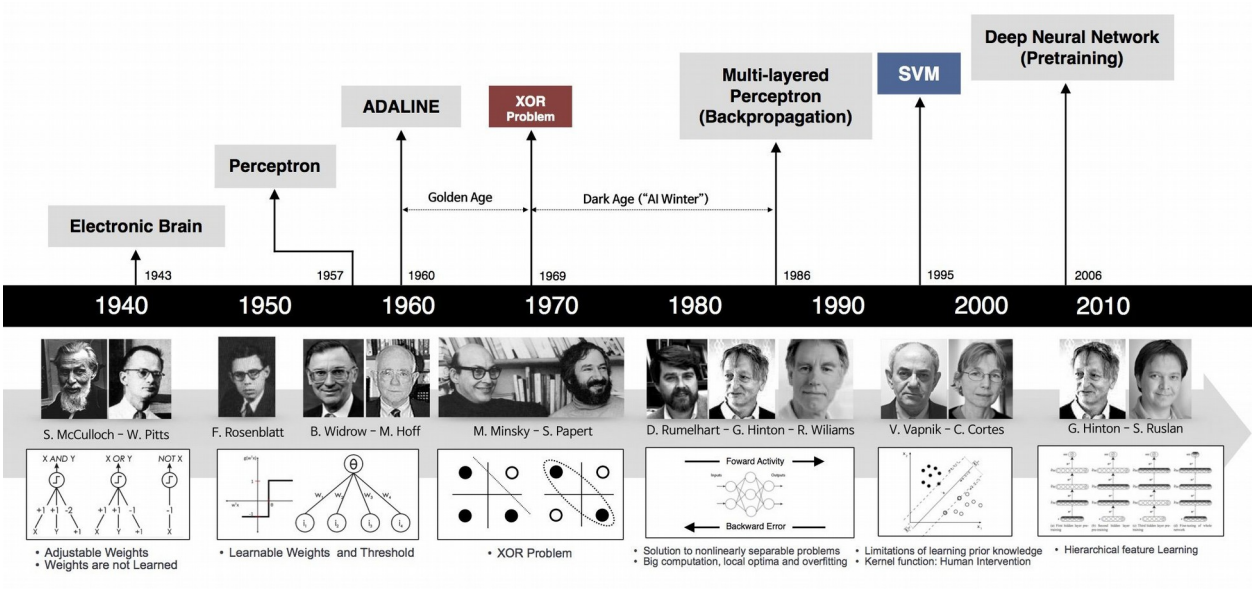
Focus on the applications of Deep Learning in Digital Image Processing and Computer Vision.

Introduction:

Deep Learning is a collection of statistical machine learning techniques used to learn future hierarchies often based on artificial neural networks.
It is a part or subset of Machine Learning. Learning can be supervised , semi-supervised or unsupervised.
Deep learning architecture includes deep neural networks, deep belief networks and recurrent neural networks which are applied to various departments such as Computer Vision, speech recognition, natural language processing, audio recognition, social network filtering, machine translation, bioinformatics, drug design, medical image analysis, material inspection and board game programs.
Deep learning uses neural networks to pretend human like decision making.

History:

The concept of deep learning was introduced to the machine learning community and to artificial neural networks by Rina Dechter in 1986 and by Igor Aizenberg and colleagues in 2000 respectively, in the context of Boolean threshold neurons.
In 1994, André de Carvalho, together with Mike Fairhurst and David Bisset, published experimental results of a multi-layer boolean neural network, also known as a weightless neural network, composed of a 3-layers self-organizing feature extraction neural network module (SOFT) followed by a multi-layer classification neural network module (GSN), which were independently trained. Each layer in the feature extraction module extracted features with growing complexity regarding the previous layer.
In 2012,there is a revolution started in a deep learning when a team led by Dahl won the “Merck Molecular Activity Challenge”. They were using multi-task deep neural networks to predict the biomolecular target of one drug and so on.
Some researchers assess that the October 2012 Image Net victory anchored the start of a "deep learning revolution" that has transformed the AI industry.



Digital Image Processing:

Digital Image Processing provides wider range of algorithms to be applied to the input data and can avoid problems such as the build up of noise and signal distortion during processing.

Digital Image processing is the only practical technology for:-

1. Classification
2. Feature extraction
3. Multi-Scale signal analysis
4. Pattern Recognition
5. Projection

Some techniques which are used in digital image processing include:

1. Anisotropic diffusion
2. Hidden Markov models
3. Image editing
4. Image restoration
5. Independent component analysis
6. Linear filtering
7. Neural networks
8. Partial differential equations
9. Pixelation

10. Principal components analysis
11. Self-organizing maps
12. Wavelets

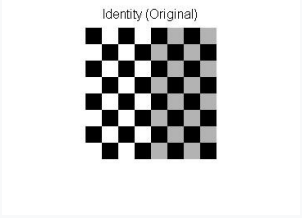
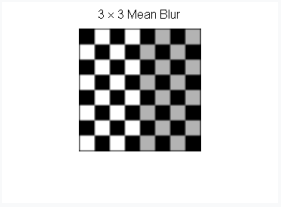
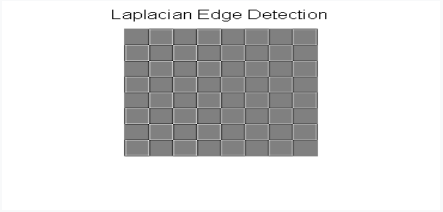
The given techniques is used for digital image transformation:--

1. Filtering

Digital filters are used to blur and sharpen digital images. Filtering can be performed by:

- Convolution with specifically designed kernals (filter array) in the spatial domain
- Masking specific frequency regions in the frequency (Fourier) domain

The following examples show both methods:

Filter type	Kernel or mask	Example
Original Image	$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$	
Spatial Lowpass	$\frac{1}{9} \times \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$	
Spatial Highpass	$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 0 \end{bmatrix}$	

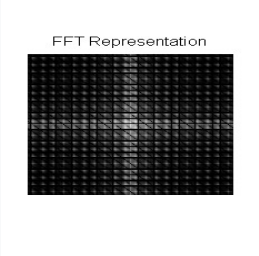
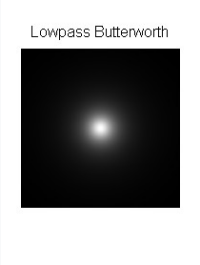
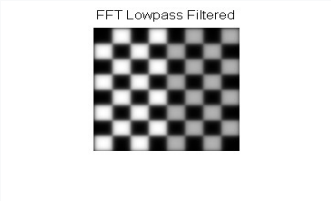
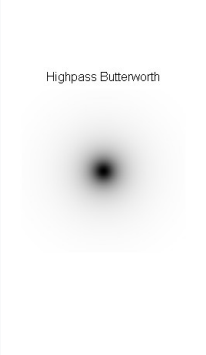
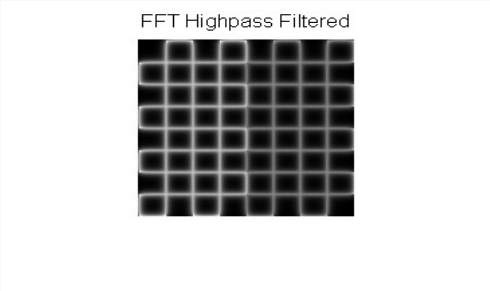
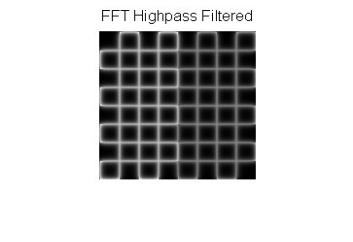
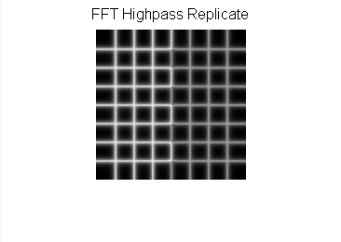
Fourier Representation	Pseudo-code: image = checkerboard F = Fourier Transform of image Show Image: log(1+Absolute Value(F))	
Fourier Lowpass		
Fourier Highpass		

Image padding in Fourier domain filtering:

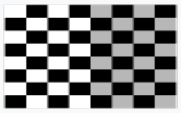
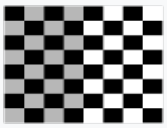
Images are typically padded before being transformed to the Fourier space, the highpass filtered images below illustrate the consequences of different padding techniques:

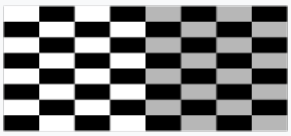
Zero padded	Repeated edge padded
	

Notice that the highpass filter shows extra edges when zero padded compared to the repeated edge padding.

2. Affine Transformation

Affine transformations enable basic image transformations including scale, rotate, translate, mirror and shear as is shown in the following examples:

Transformation Name	Affine Matrix	Example
Identity	$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	
Reflection	$\begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	

Scale	$\begin{bmatrix} c_x = 2 & 0 & 0 \\ 0 & c_y = 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	
Rotate	$\begin{bmatrix} \cos(\theta) & \sin(\theta) & 0 \\ -\sin(\theta) & \cos(\theta) & 0 \\ 0 & 0 & 1 \end{bmatrix}$	 where $\theta = \pi/6 = 30°$
Shear	$\begin{bmatrix} 1 & c_x = 0.5 & 0 \\ c_y = 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	

To apply the affine matrix to an image, the image is converted to matrix in which each entry corresponds to the pixel intensity at that location. Then each pixel's location can be represented as a vector indicating the coordinates of that pixel in the image, [x, y], where x and y are the row and column of a pixel in the image matrix. This allows the coordinate to be multiplied by an affine-transformation matrix, which gives the position that the pixel value will be copied to in the output image.

However, to allow transformations that require translation transformations, 3 dimensional homogeneous coordinates are needed. The third dimension is usually set to a non-zero constant, usually 1, so that the new coordinate is [x, y, 1]. This allows the coordinate vector to be multiplied by a 3 by 3 matrix, enabling translation shifts. So the third dimension, which is the constant 1, allows translation.

Because matrix multiplication is associative, multiple affine transformations can be combined into a single affine transformation by multiplying the matrix of each individual transformation in the order that the transformations are done. This results in a single matrix that, when applied to a point vector, gives the same result

as all the individual transformations performed on the vector [x, y, 1] in sequence. Thus a sequence of affine transformation matrices can be reduced to a single affine transformation matrix.

For example, 2 dimensional coordinates only allow rotation about the origin (0, 0). But 3 dimensional homogeneous coordinates can be used to first translate any point to (0, 0), then perform the rotation, and lastly translate the origin (0, 0) back to the original point (the opposite of the first translation). These 3 affine transformations can be combined into a single matrix, thus allowing rotation around any point in the image.

Applications:-

Digital Image Processing is used in **Digital Camera Image and Film.**

Computer Vision:

Computer vision deals with the theory behind artificial systems that extract information from images and videos. The image is present in forms such as video sequences, views from multiple cameras or multiple dimensional data from a medical scanner.

Computer Vision works on several fields such as Artificial Intelligence, Information Engineering, Solid State Physics, Neurobiology, Signal Processing, other fields and Distinctions.

Artificial Intelligence and Computer Vision share different topics such as pattern recognition and learning techniques. Accordingly, sometimes computer vision is a part of artificial intelligence field or the computer science field in general.

Examples of applications of computer vision include system for:-

- Automatic inspection, *e.g.*, in manufacturing applications;
- Assisting humans in identification tasks, e.g., a species identification system;
- Controlling processes, *e.g.*, an industrial robot;
- Detecting events, *e.g.*, for visual surveillance or people counting;
- Interaction, *e.g.*, as the input to a device for computer-human interaction;
- Modeling objects or environments, *e.g.*, medical image analysis or topographical modeling;

- Navigation, *e.g.*, by an autonomous vehicle or mobile robot; and
- Organizing information, *e.g.*, for indexing databases of images and image sequences.

Some examples of typical computer vision tasks aregiven below:-

1. Recognition
2. Motion analysis
3. Scene reconstruction
4. Imae restoration

There are typical functions which are found in many computer vision systems:-

- Image acquisition
- Pre-processing
- Feature extraction
- Detection/Segmentation
- High level processing
- Decision making

One of the Hardware example of computer vision system is Egocentric Vision System which are made up of a wearable camera that automatically take pictures from a first person perspective.