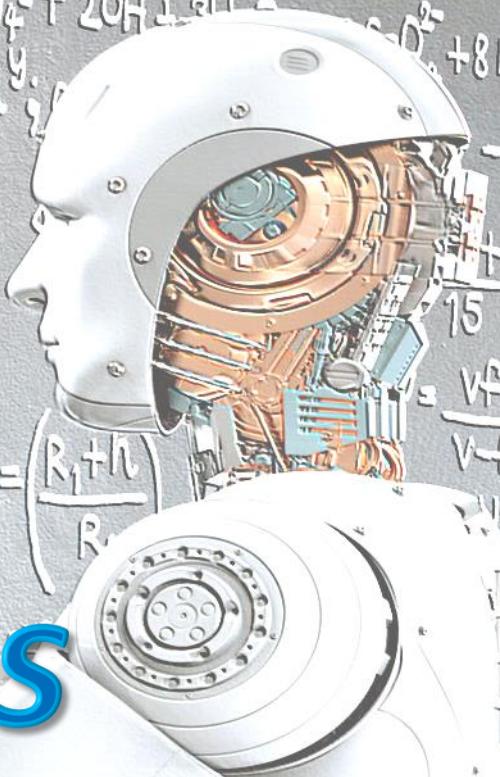


Advanced Topics in *Information Systems*



$$\overline{a} = \sqrt{\frac{a_1}{a_2}} = \sqrt{\frac{a^{\frac{1}{2}}}{a^{\frac{3}{2}}}} = \sqrt{a^{\frac{-1}{2}}}$$

$$CIS8690 = \frac{1}{512} \pi r^2 h$$

$$\cos(B) = \frac{y}{x}$$

$$(100^2)a + 100b -$$

$$10000a + 100b -$$

$$\sin B = \frac{4\sqrt{3}}{x}$$

$$\sin 60^\circ = 4\sqrt{3}$$

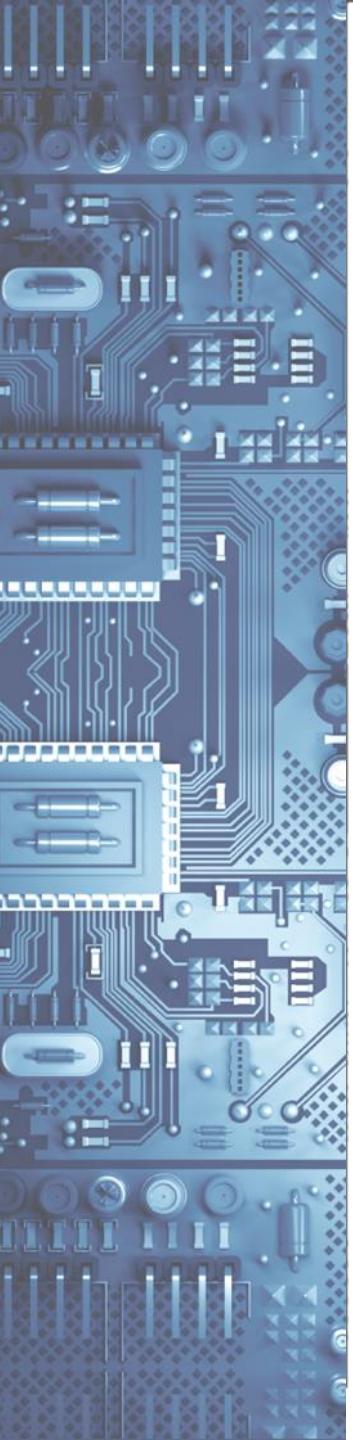
$$\cos(60^\circ) = \frac{y}{x}$$

$$10000a + 100b -$$

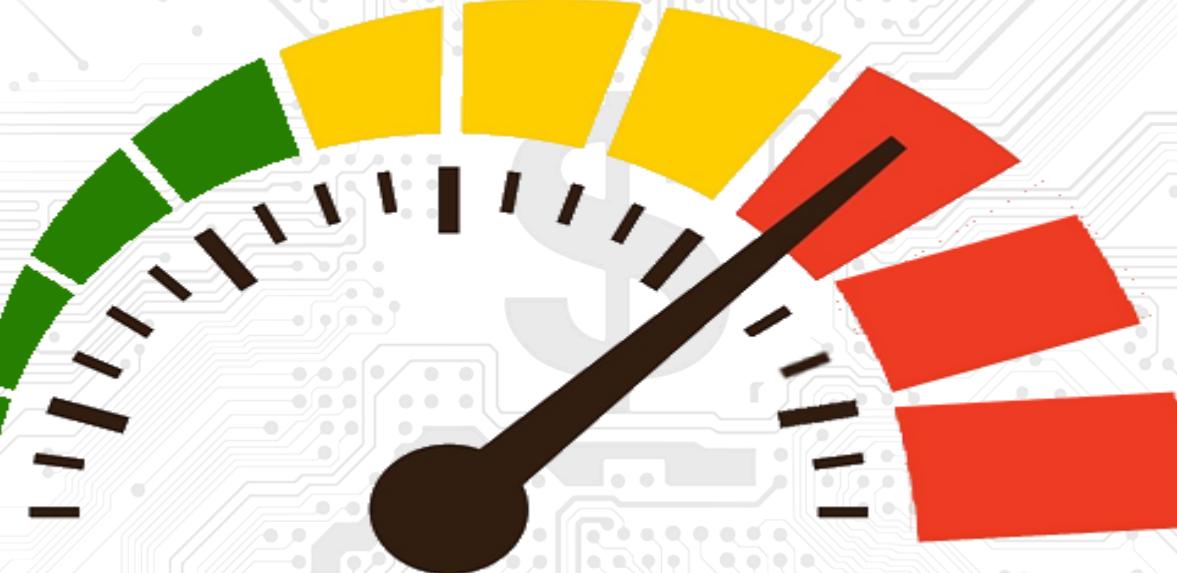
AR and VR in Fintech: Benefits and Pitfalls



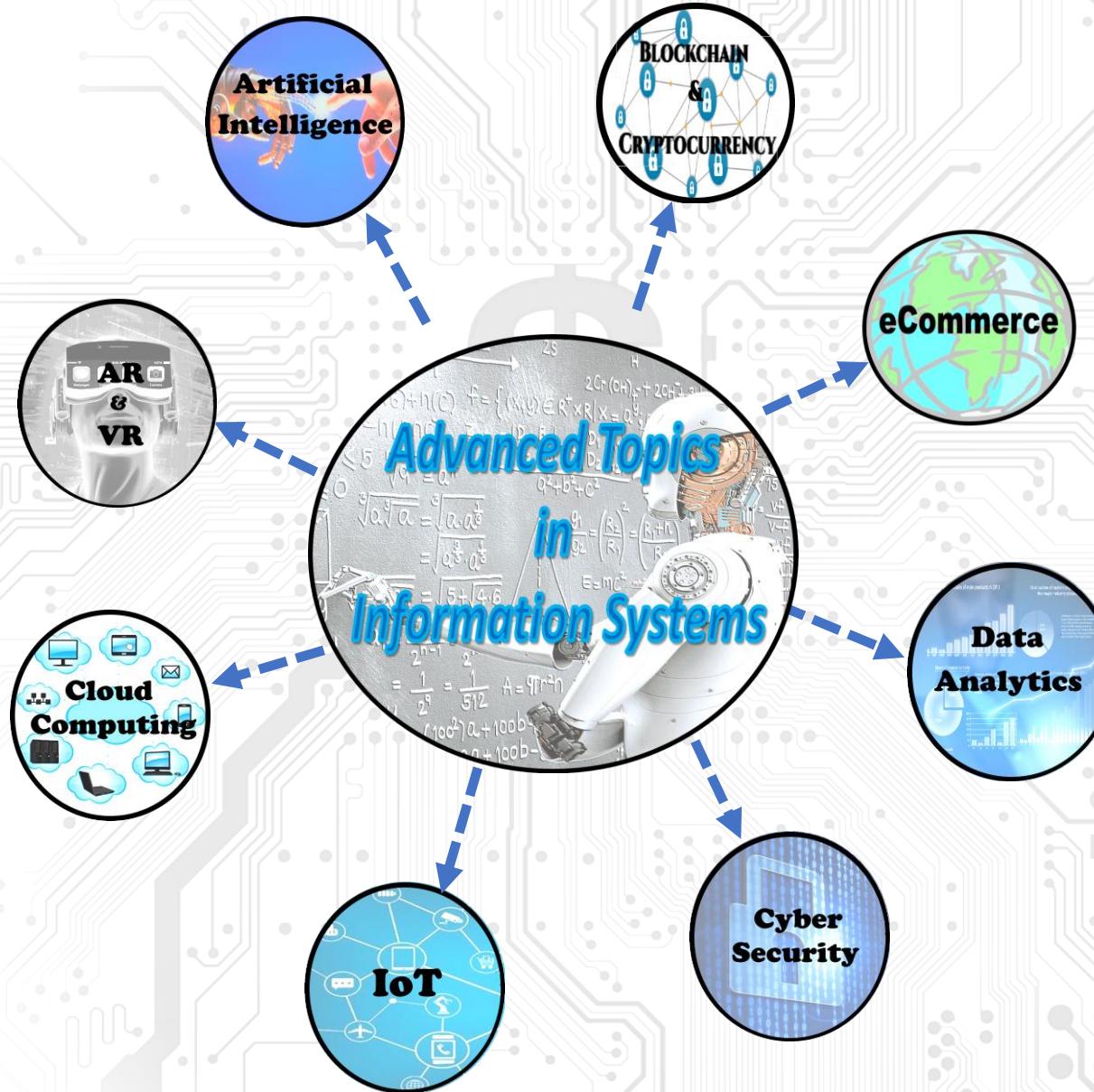
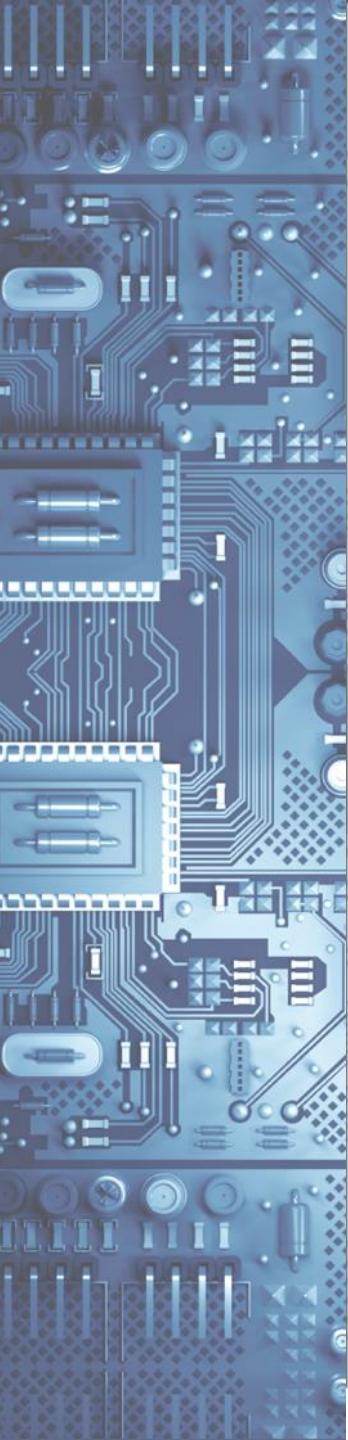
Virtual reality is commonly associated with interactive 3D video games, entertainment and adventures. **However, financial specialists have found a way to use the full potential of VR and AR to construct immersive banking worlds.** Vivid imaginary and 3D environments guide customers through accounts, present figures and handle financial operations.

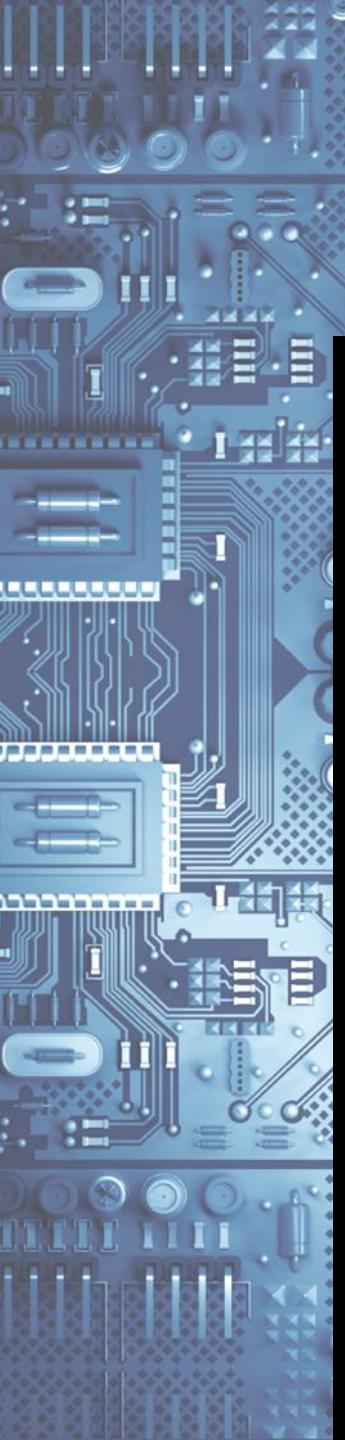


Team Readouts:



- Status (Green / Yellow / Red)
- Issues / Concerns?
- Team Dynamics?





Intro to AR and VR



Augmented vs. Virtual Reality



Augmented Reality



Mixed Reality

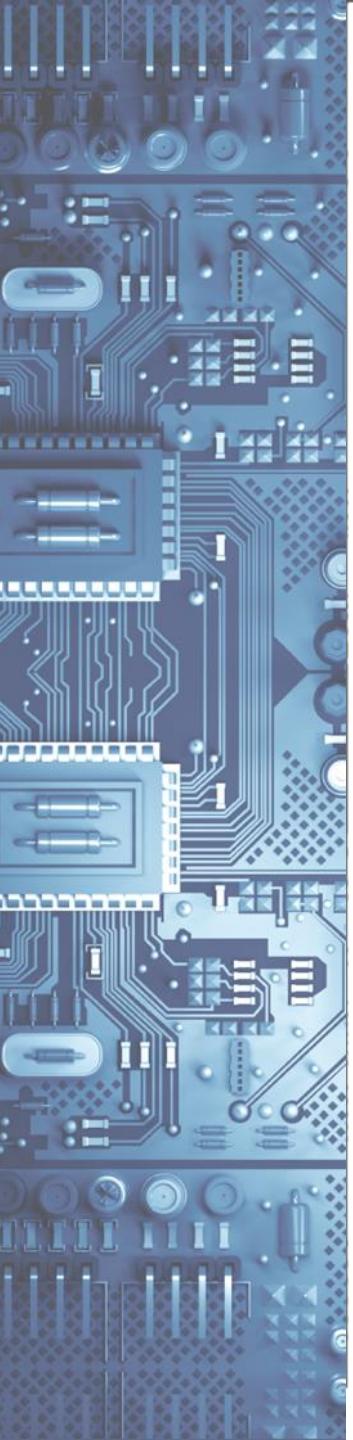


Virtual Reality

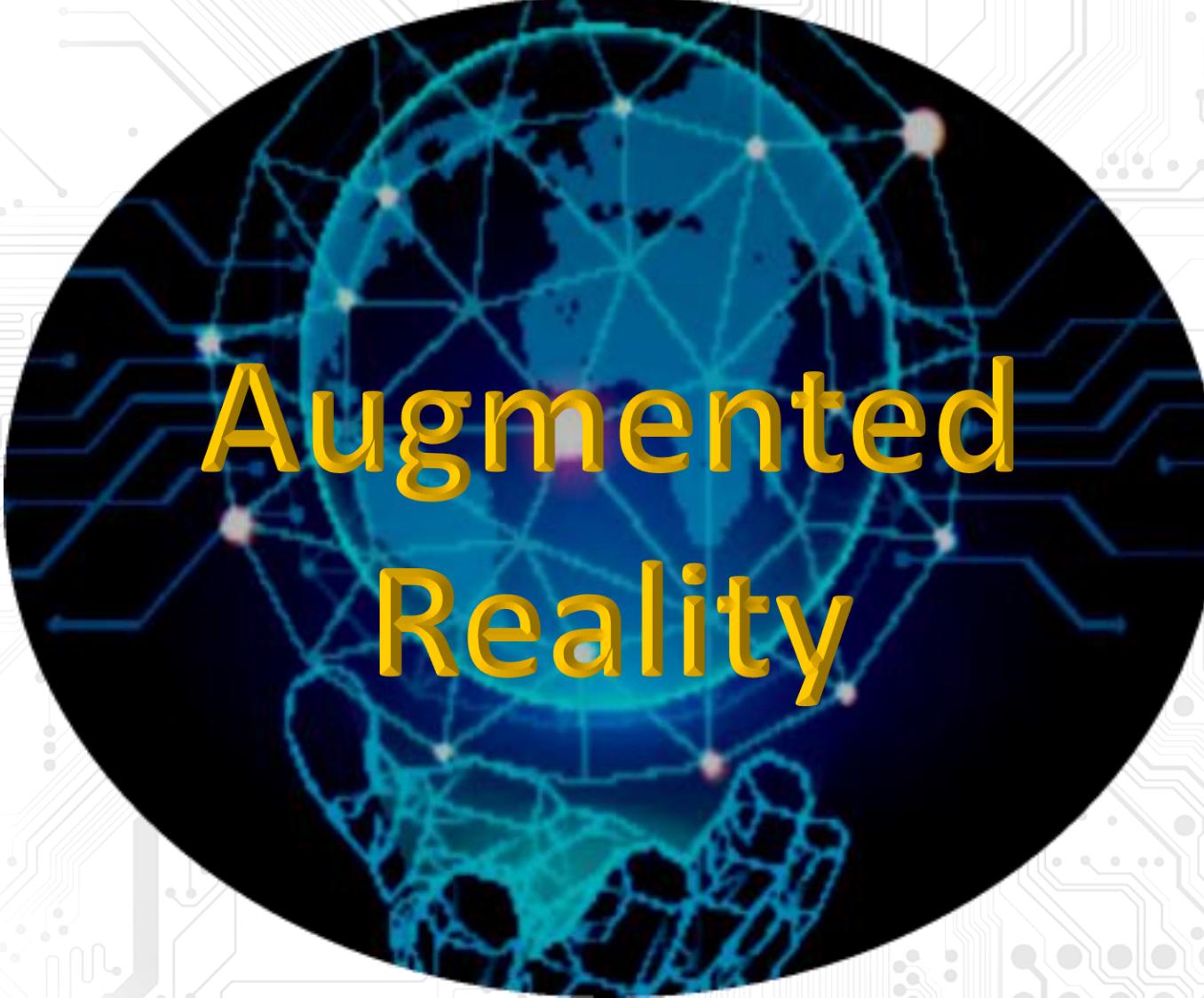


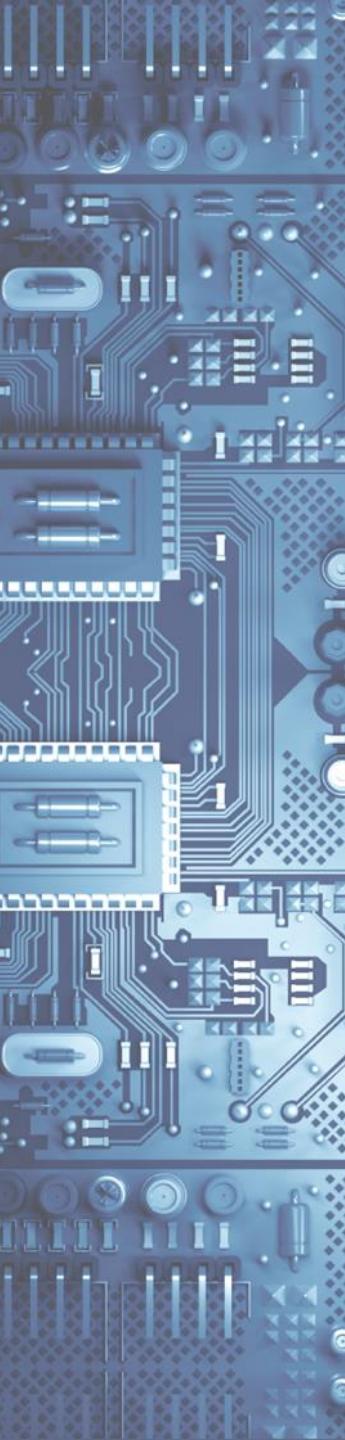
- Really a moving scale when we talk about Augmented and Virtual Reality
- Systems can be at varying degrees along the spectrum
- Pure VR systems use a head mounted display
- In AR the user will still be aware that they are in the “real world.”





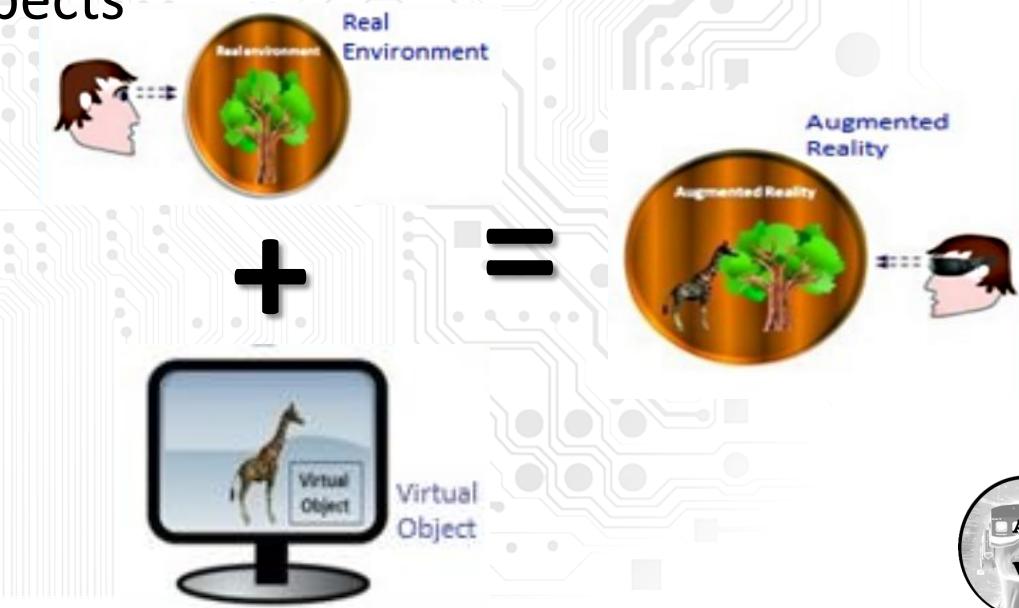
Augmented Reality





What is Augmented Reality?

- Most of the AR research today is concerned with the use of **video imagery which is digitally processed and augmented by adding computer-generated graphics to create a single view.**
- An augmented reality system is often described as one that:
 - Combines real and virtual world aspects
 - Is interactive in real-time
 - Is registered in three dimensions

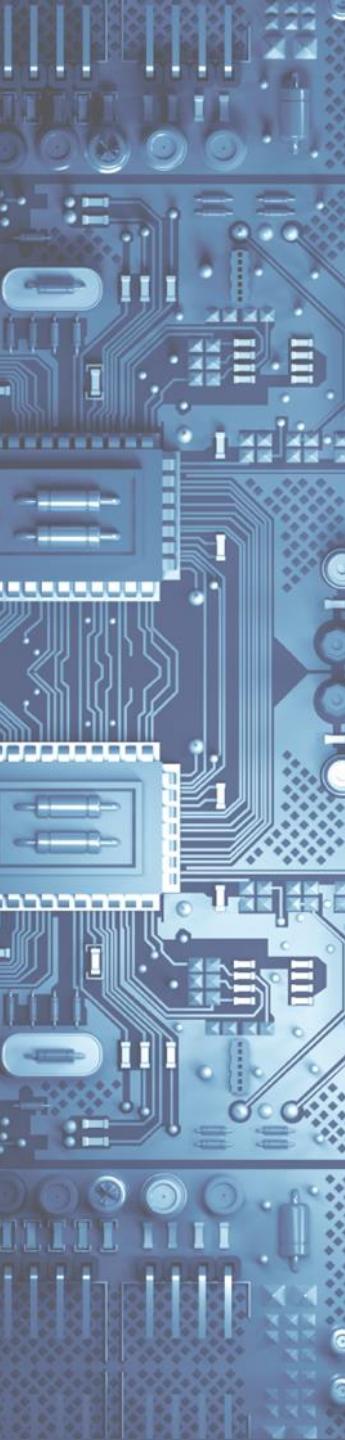


How does AR Work?



- The basic idea of augmented reality is to superimpose graphics, audio and other human sense enhancements over a real-world environment in real-time
- To be successful, the graphics must then adapt and change to accommodate the user's eye or head movements.

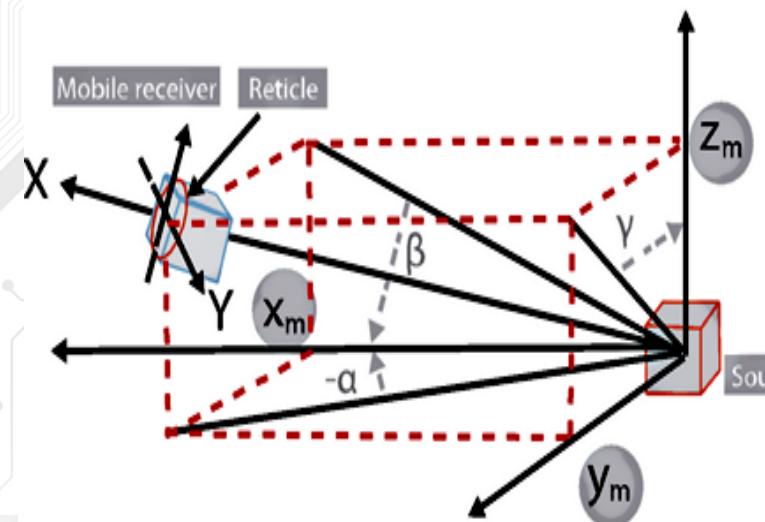




Three Components are needed

1. Sensors/Tracking Including:

- **Accelerators**
- **Optical sensors** (captures visual image of users environment)
- **GPS receiver** (to track geographical location and movements)
- **Compass** (determines geographical orientation of the user)
- **Gyroscope** (which determines rotational movement)



Three Components are needed



2. Mobile computing power:

The are many different types of processors available to be used in AR system from mobile phones to mobile computers



Three Components are needed

3. Display/output devices:

This includes various wearable devices which provides outputs to the user in the form of their visual and audible senses.



Major Types of AR Systems

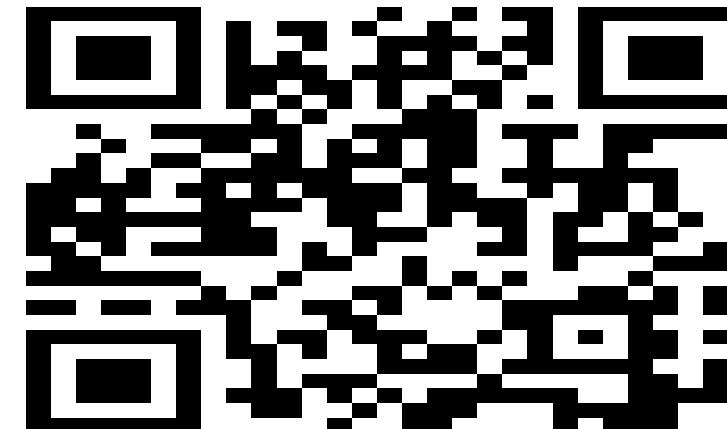


- Marker based AR
- Location based AR
- Super-imposition based AR
- Projection based AR

Types of AR Systems

Marker based Augmented Reality:

- Utilizes QR code scanning using mobile camera.
- The QR code pattern is recognized by software.
- It superimposes digital image on mobile screen and provides 3D image.



Types of AR Systems

Location based Augmented Reality:

- Utilizes smartphone and GPS apps
- GPS software recognizes location of the device in the app
- The digital information data is matched with real scene which is captured through camera of smartphone.



Types of AR Systems

Super-imposition based Augmented Reality:

In this type, augmented view is being superimposed over the real view of the object.



Types of AR Systems

Projection based Augmented Reality:

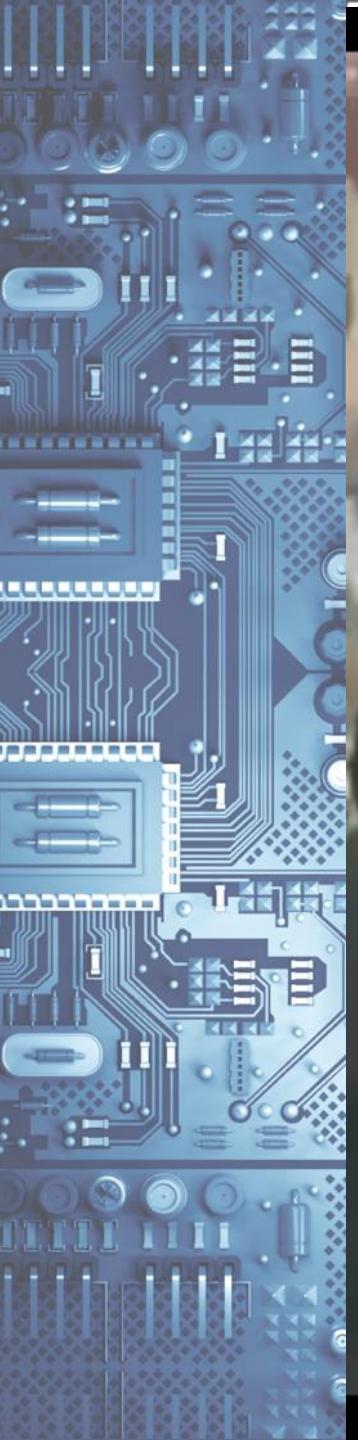
In this type, virtual images are projected onto physical objects and you can touch and feel the virtual image with the hands.



Current Uses of AR

- Lets look at an everyday use of this technology: the **“Yellow Line”** in football games (American), which identifies where a team needs to get to in order to be awarded a first down.
- These **“Yellow first down lines”** use the 2 elements common in AR:
 1. Real world elements: football field and players
 2. Virtual element: the yellow line drawn over the image by computers in real-time. So lets take a look at how that works





Current Uses of AR

Another example is the use of Heads Up Display, also known as a **HUD**

- Today it can be found in aircraft, both military and commercial, automobiles, and other applications like gaming.
- This example is from a commercial aircraft using the HUD to help land an airplane at night.

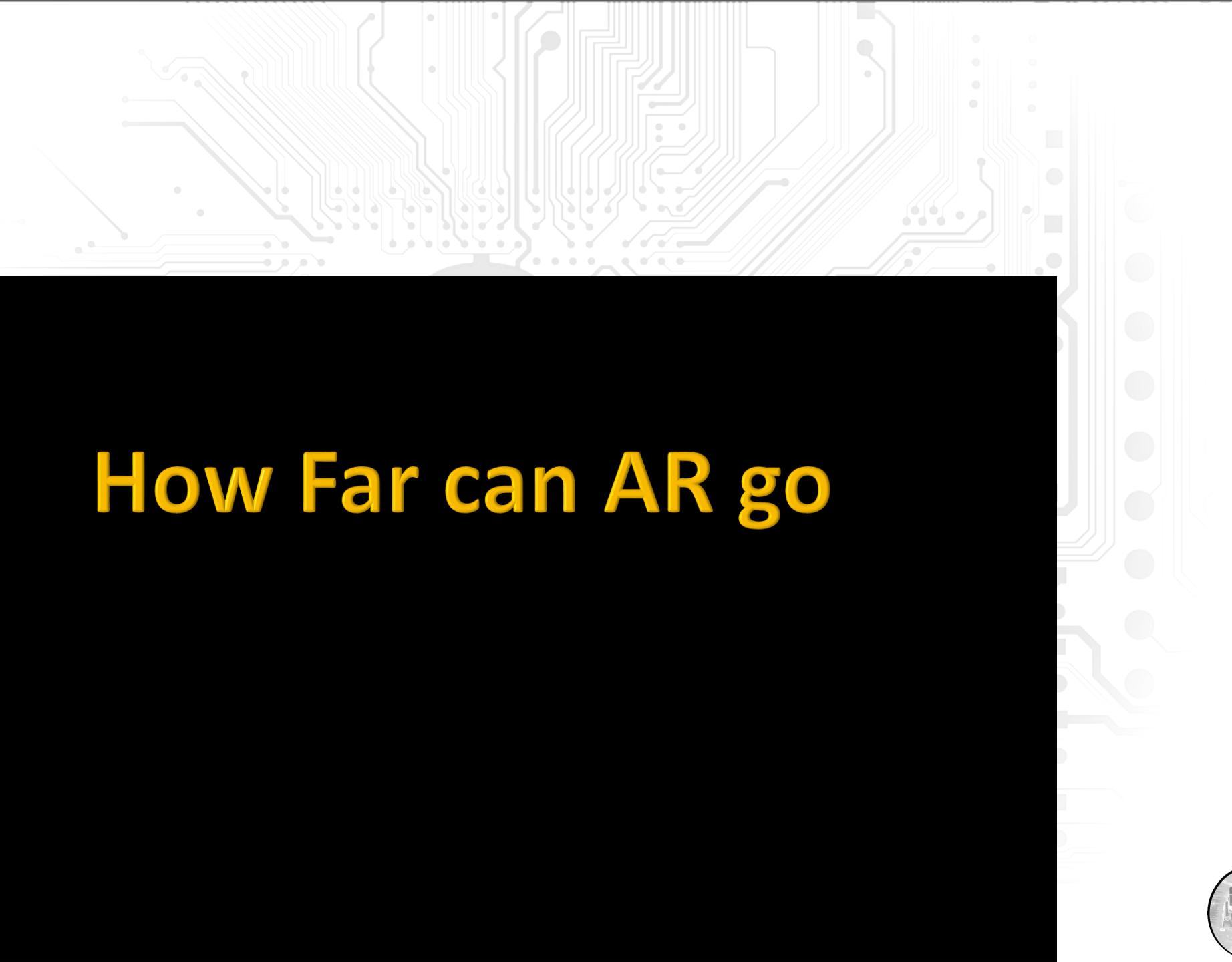
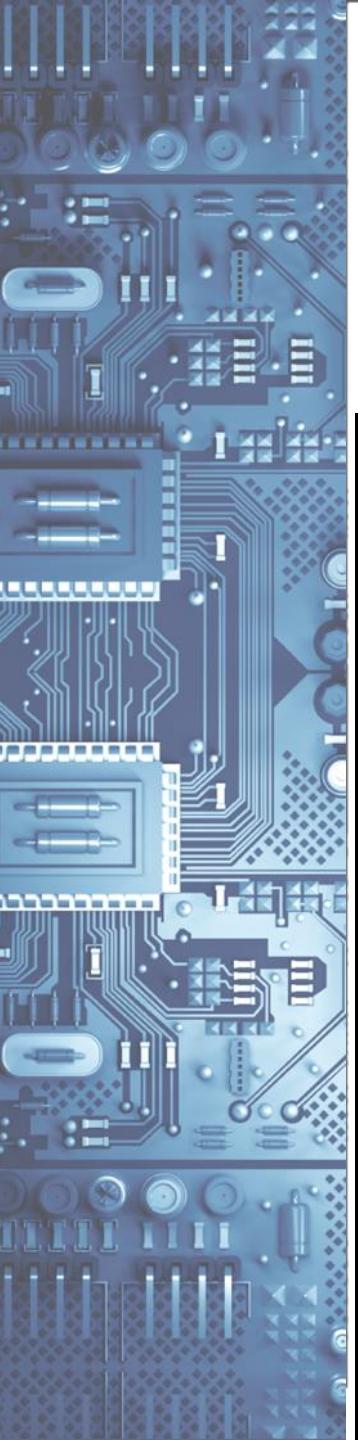


Real Life Immersion like LifeClipper



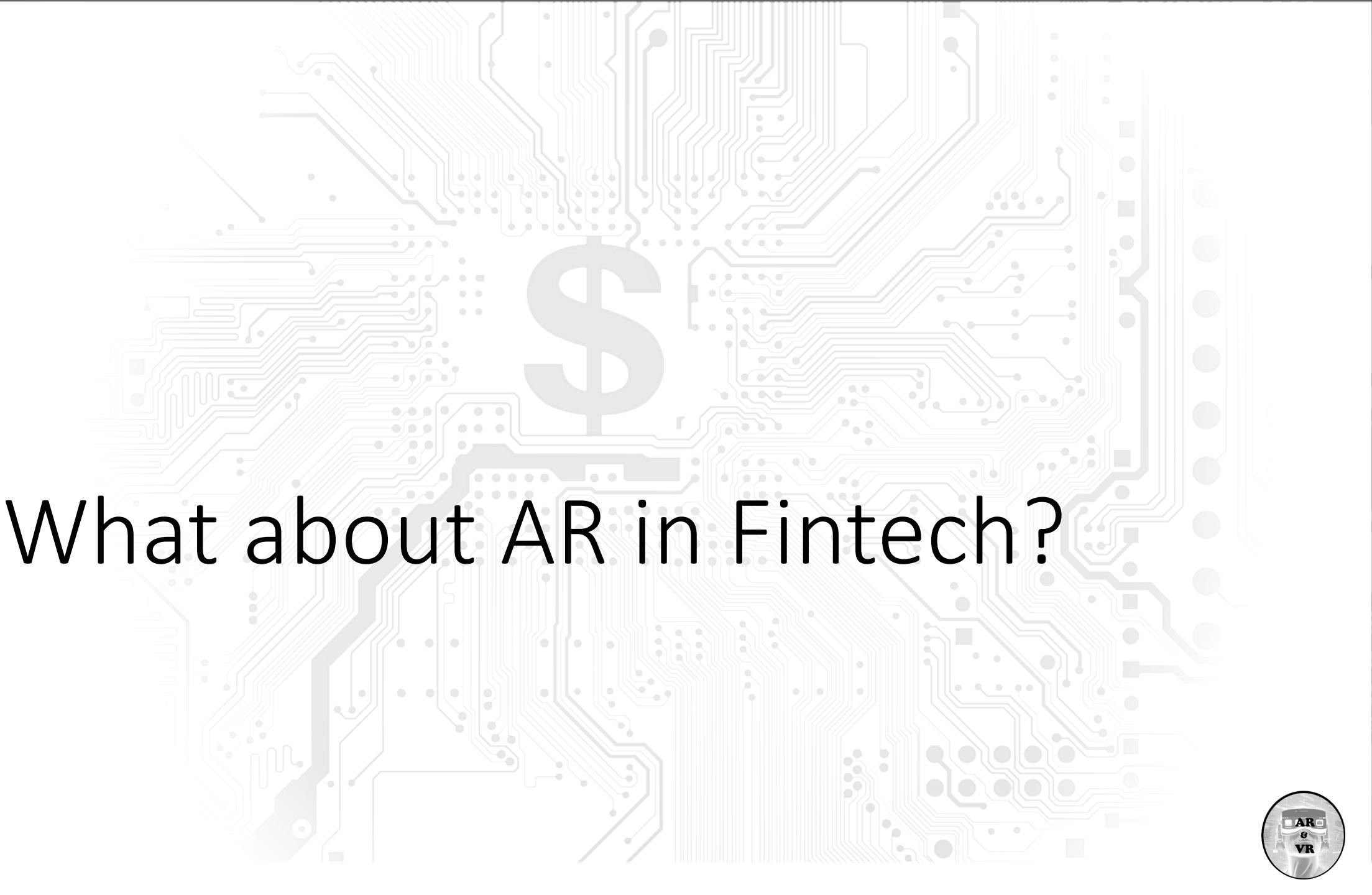
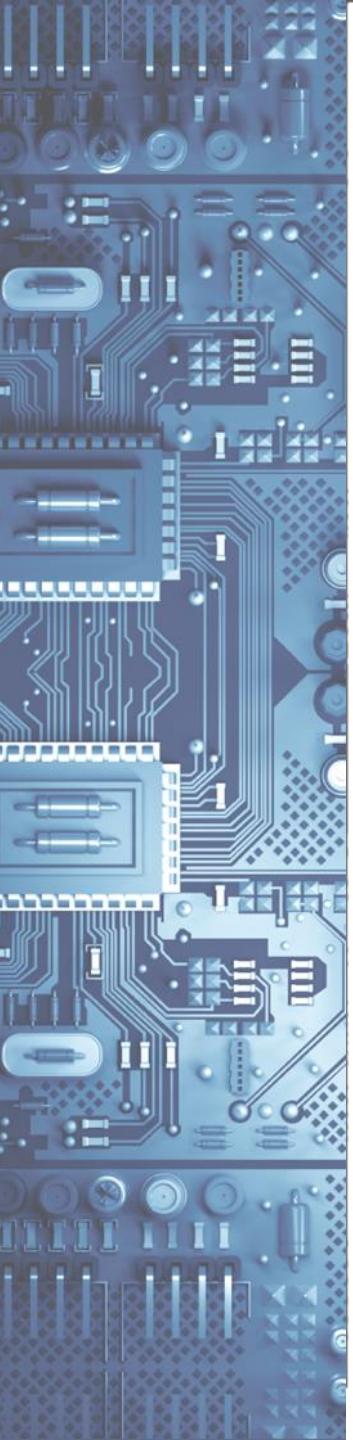
- One real life example of AR, is an application called **LifeClipper, pictured here**
- It is an outdoor art project that was created in Switzerland.
- It creates a completely immersive environment, using a wearable head-mounted display system, built from common off-the-shelf components.





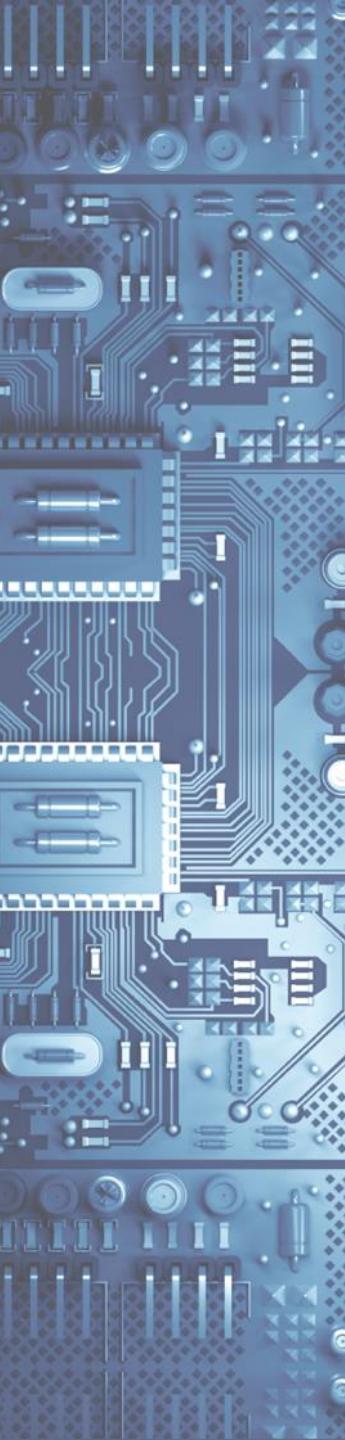
How Far can AR go





What about AR in Fintech?





Why is AR needed in Fintech Today?

- Majority of people 20–35 find customer communication style of most banks slow, frustrating and hard to comprehend!
- Millennial Disruption Index Report states **71% of today's most active workforce would rather go to a dentist than listen to what banks are saying.**
- **AR can help Fintech solve this issue by alleviating the financial industry's most evident “pain”, Improving Customer Experience**



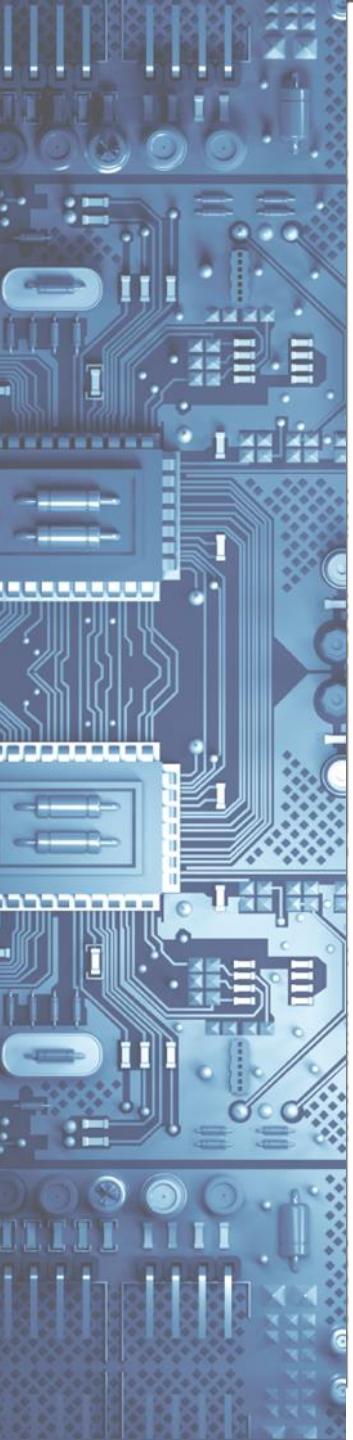
Fintech AR “Now” and in the Future

As a matter of fact, today some banks are already offering AR mobile apps to help users locate the nearest ATM's in their area

The service also lets users book an appointment straight from the app, without having to use the phone

The use of VR in fintech in the future will provide the ability to hold financial meetings without having to visit a brick-and-mortar location





Virtual Reality

What is Virtual Reality(VR)?

- Virtual Reality refers to a high-end user interface that involves real-time simulation and interactions through multiple sensorial channels.
- ***VR is about experiencing a world that doesn't actually exist.***

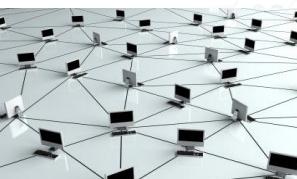


Brief History

- In 1950s, flight simulators were built by US Air Force to train student pilots.
- In 1965, a computer graphic called “The Ultimate Display” was laid out.
- In 1988, commercial development of VR began.
- In 1991, first commercial entertainment VR system "Virtuality" was released.



Types of VR System



- **Windows on World(WoW)**

Conventional computer monitor used to display 3D virtual world.

- **Immersive VR**

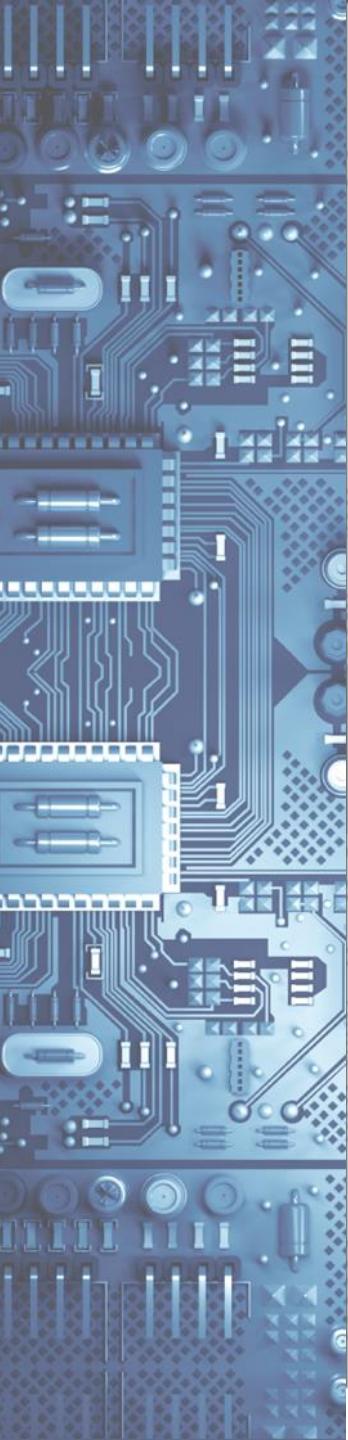
Where the user has no visual contact with the physical world.

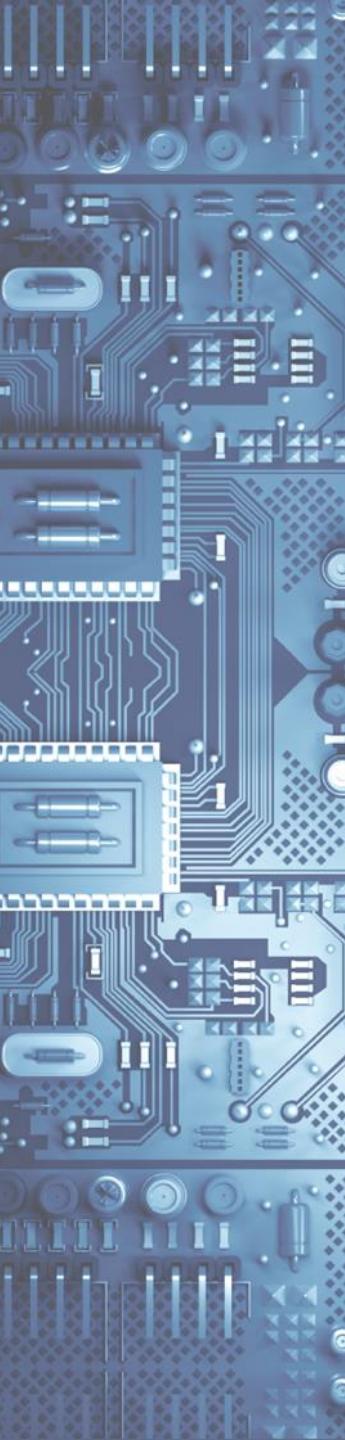
- **Telepresence**

Links real world remote sensors world with the senses of a human

- **Distributed VR**

- Simulated world runs on several computers which are connected over network
- People are able to interact in real time, sharing the same virtual world.
- This is very common in the gaming world.





Technologies of VR--Hardware

Head-Mounted Display (HMD) :

- A Helmet or a face mask providing the visual and auditory displays.
- Use LCD* or CRT* to display stereo images.
- May include built-in head-tracker and stereo headphones



*LCD – Liquid Crystal Display
*CRT- Cathode Ray Tube



Technologies of VR--Hardware

Binocular Omni-Orientation Monitor (BOOM):

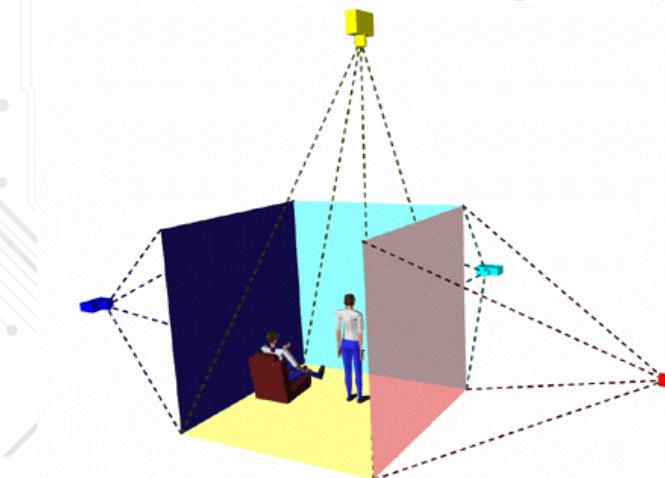
- A head-coupled stereoscopic display device
- Uses CRT to provide high-resolution display
- It is Fast and accurate because it uses built-in tracking

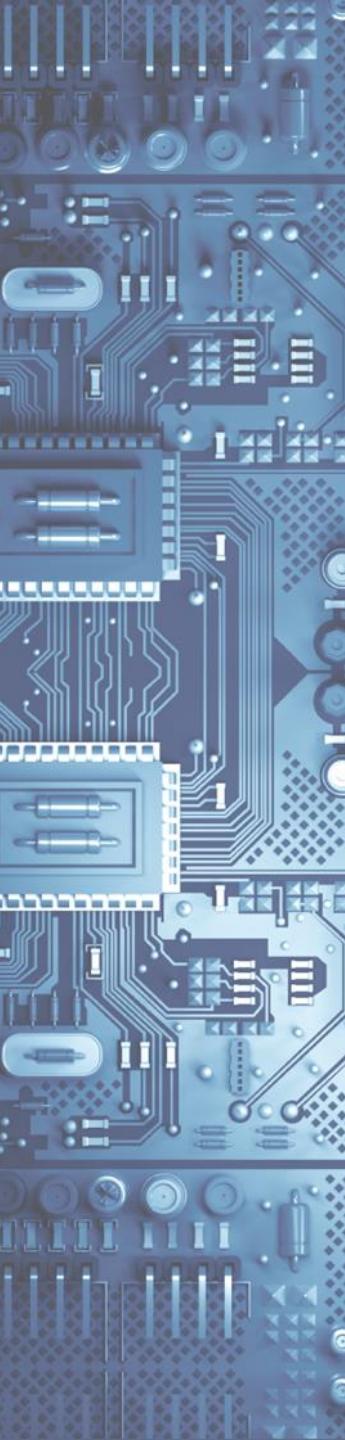


Technologies of VR--Hardware

Cave Automatic Virtual Environment (CAVE):

- This device provides the illusion of immersion by projecting stereo images on the walls and floor of a room-sized cube.
- A head tracking system continuously adjust the stereo projection to the current position of the viewer.





Technologies of VR--Hardware

Data Glove:

- A glove outfitted with sensors on the fingers as well as an overall position/orientation tracking equipment.
- Enables natural interaction with virtual objects by hand gesture recognition.



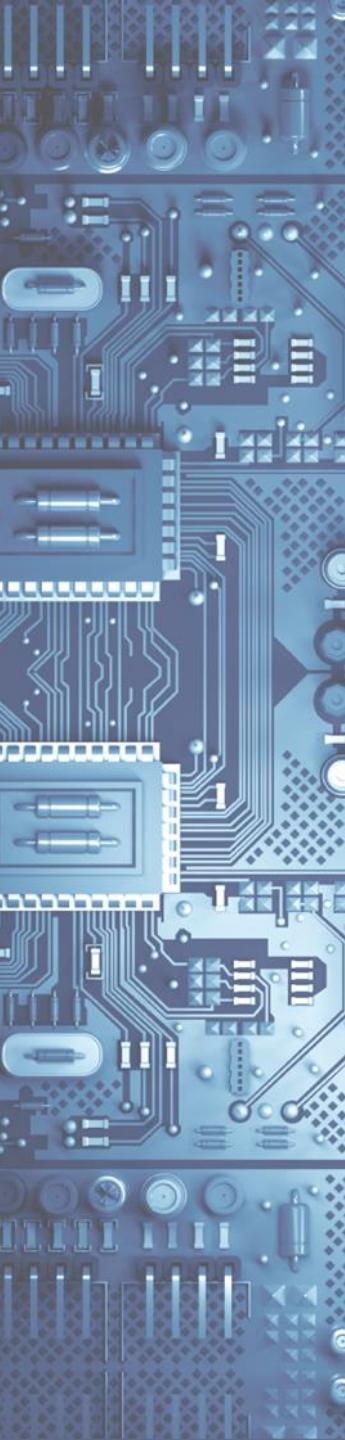
Technologies of VR--Software

Toolkits & Authoring systems:

There are also some Toolkits, that can be used in VR

- **Programming Libraries**
 - Provide functionality using languages like C & C++
- **Authoring systems**
 - Complete, working, ***prebuilt programs with graphical interfaces*** used for creating worlds without resorting to individualized detailed programming.





Technologies of VR--Software

Software packages available in market:

- Multiverse (Freeware)
- Virtual Reality Studio (\$100)
- Sense8 World Tool Kit (WTK) (over \$1000)
- Autodesk Cyberspace Development kit (over \$1000)





Technologies of VR--Software

VRML(Virtual Reality Modeling Language):

A standard language to **allow interoperability simulation** on the Web

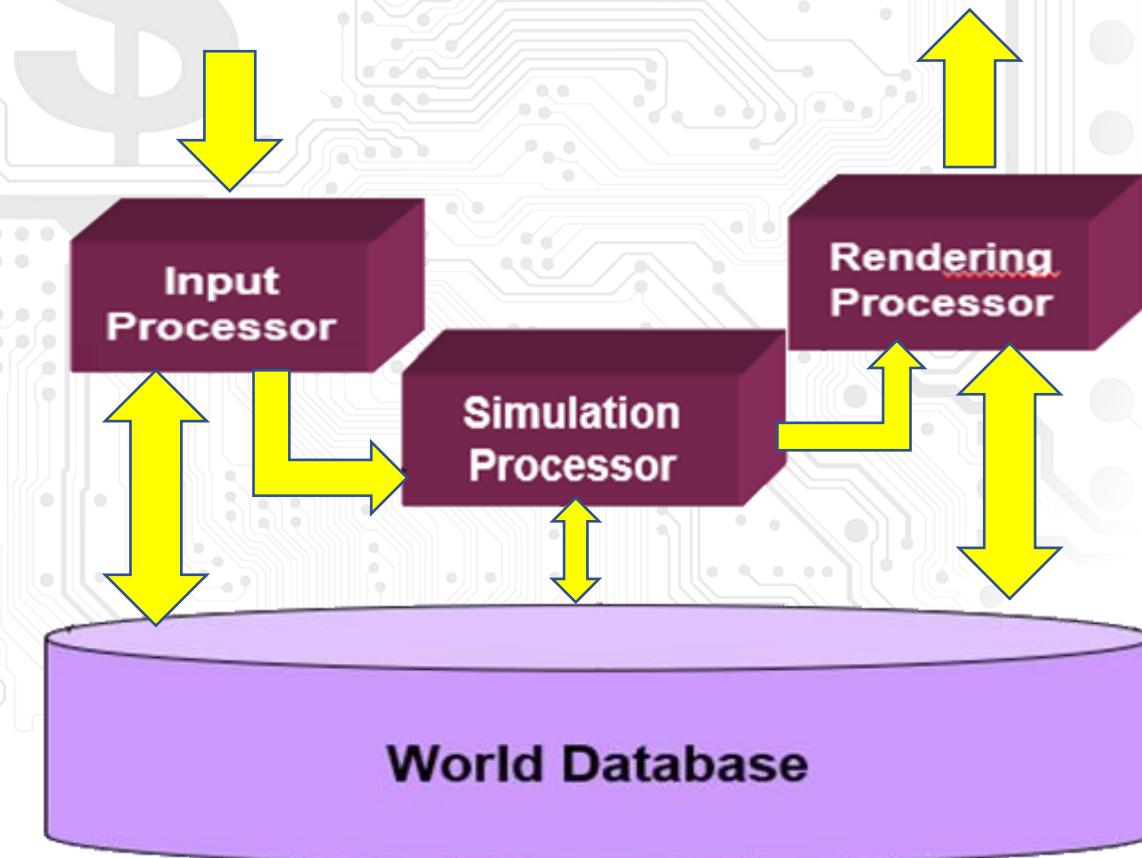
- Allows someone to **create "virtual worlds" that can be networked via the Internet and hyperlinked in the World Wide Web.**
- Provides common aspects for virtual world display, interaction and internetworking... **without being dependent on special gear like HMD**
- ***Models built under this standard can be viewed using Netscape or IE (Internet Explorer) with a browser plug-in.***



Simplified Components of a VR System

Input Processor

- Control the devices used to input information to the computer
- Simulation Processor
 - Takes the user inputs along with any task
- Rendering Processor
 - Create the sensations that are output to the user
- World Database
 - Stores the objects that inhabit the world



VR advantages in Fintech



- Today in some fintech companies, a **consumer can purchase financial products without stepping out into the physical world**
- **VR can completely mimic the “real life” shopping experience** and lets the consumer pay for goods that they can choose and evaluate in the virtual environment
- In the future, we will see Fintech companies using the potential of **VR and AR to help customers make payments as it can be integrated into the payment systems**



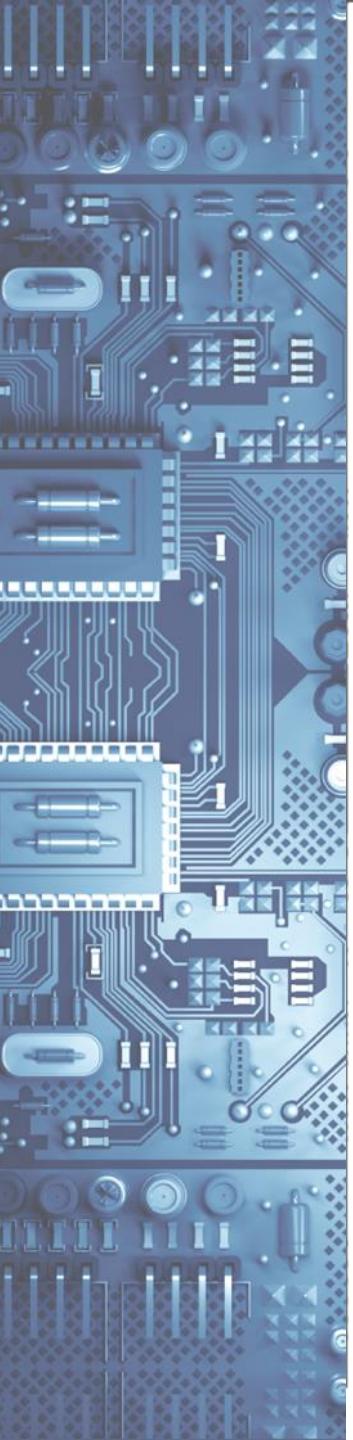
Where can AR / VR be used in Fintech ?

Current State of VR in Fintech

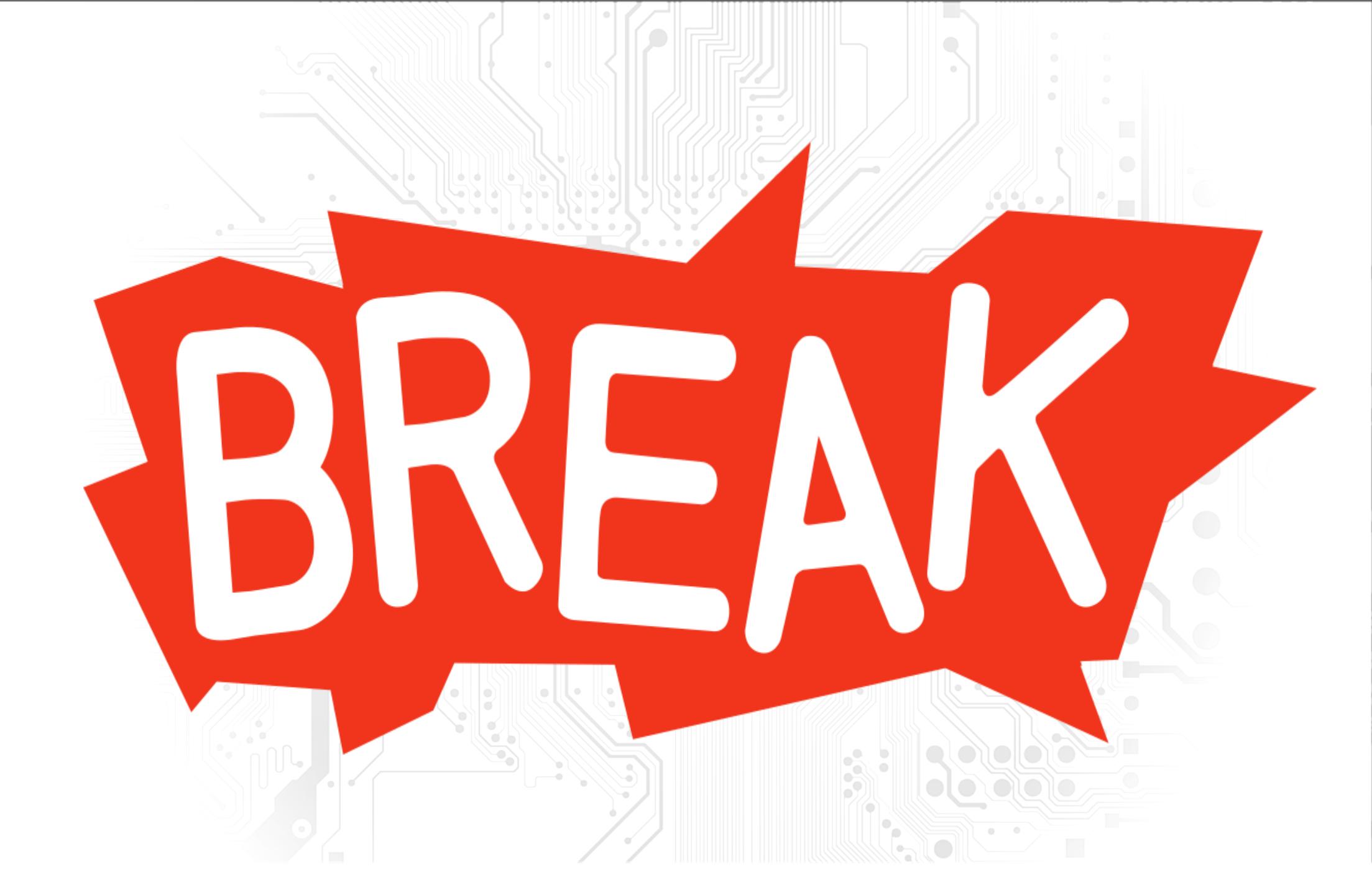
- ✗ Cybersickness / simulator sickness is still common
- ✗ Low-fidelity in current equipment
- ✗ Expensive to implement
- ✗ Lack of integration between application packages

- ✓ High-fidelity system are available
- ✓ Cost-saving available if properly implemented
- ✓ Provides a high opportunity for Collaborative
- ✓ High-level contact between participants in distributed VR





BREAK



What is Artificial Intelligence ?

Artificial intelligence (AI) is the ability of a computer program or a machine to think and learn. It is also a field of study which tries to make computers "smart". ... As machines become increasingly capable, mental facilities once thought to require intelligence are being removed from the definition



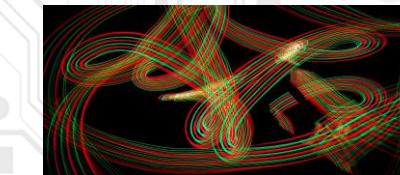
Computers versus humans

A computer can do some things better than a human can

- Adding a thousand four-digit numbers

$$\begin{aligned}\frac{\partial}{\partial \theta} \mathcal{L}_{T_K}(\theta; t_1, \dots, t_n) = & \left[\prod_{k=1}^n \left(\frac{1}{\pi_{t_k}} + \frac{\beta_k}{\pi_{t_k}^2} (\mu_{\theta, k}^{\beta_k-1} - \gamma_{\theta, k}^{\beta_k-1}) \right) \right] \left(\frac{1}{\pi_{t_n}} \right)^{n-j} e^{-\frac{(t_n-\bar{t}_K)^2}{\pi_{t_n}^2}} \times \{-n(1-p)^{n-1} \right. \\ & \left[\prod_{j=n+1}^n \lambda(\bar{T}_j) \right] \lambda^{1/(n-\bar{T}_K)}(t_n) e^{-\lambda(t_n)} + \sum_{k=N_{\bar{T}_K}+1}^n (1-p)^{n-k-1} \left(\prod_{j=k+1}^n \lambda(\bar{T}_j - T_k) \right) \right. \\ & \left. \lambda^{1/(n-\bar{T}_K)}(t_n - T_k) e^{-\lambda(t_n - T_k)} \left[(1 - (n - k + 1)p) \mathcal{L}_{T_K}(\theta) + p(1-p) \frac{\partial}{\partial \theta} \mathcal{L}_{T_K}(\theta) \right] \right]\end{aligned}$$

- Drawing complex, 3D images



- Store and retrieve massive amounts of data



Computers versus humans

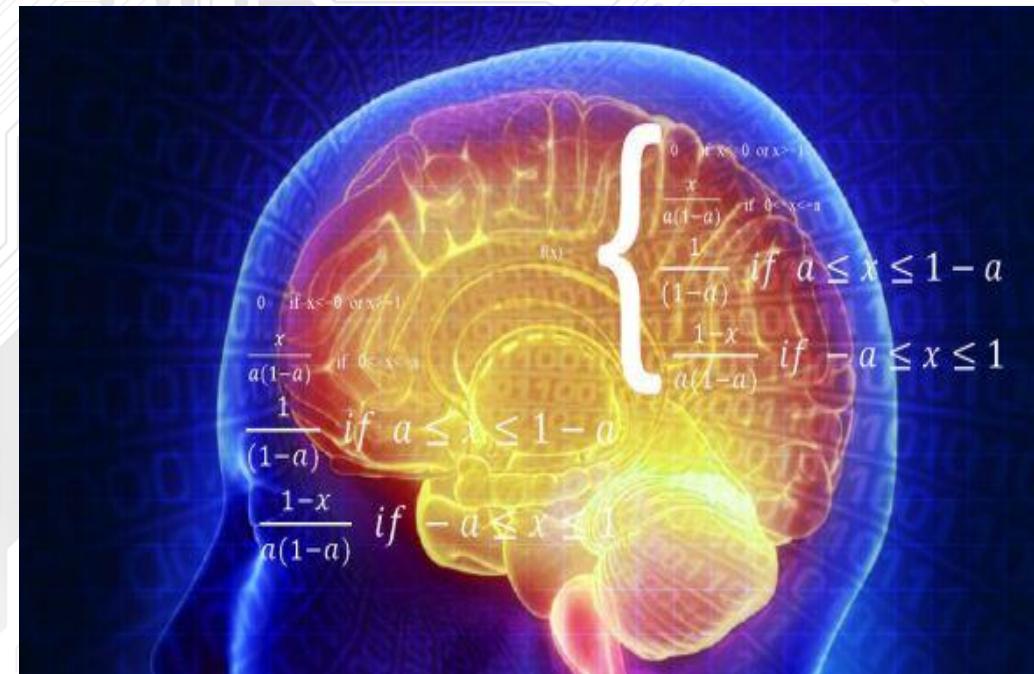
However, there are things humans can do much better

- A computer would have difficulty identifying this cat or matching it to another picture of a cat.



First things first...

- Of course, first we have to understand why we use the term “intelligence” in regard to humans.
 - What defines “intelligence”?
 - Why do we even assume humans are intelligent?



The Beginnings of A.I.

In 1950 English mathematician Alan Turing wrote a landmark paper:

- “Computing Machinery and Intelligence” that asked the question: “***Can machines think?***”
- He felt that such machines would eventually be constructed
- But he also realized a bigger problem.....
How would we know if we've succeeded?
- He noted that "intelligence" is difficult to define and devised his now famous Turing Test.



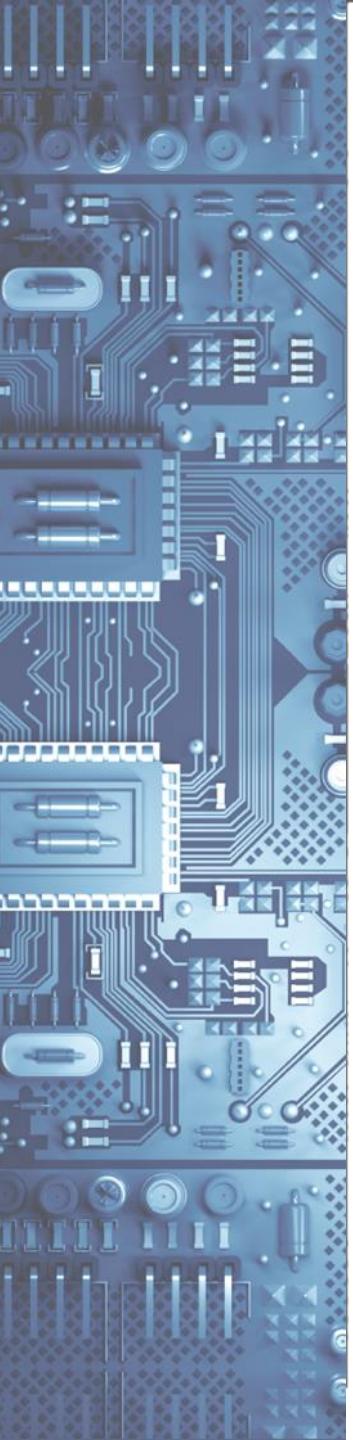
Alan Turing 1950

The Beginnings of A.I.

- In 1955, Allen Newell & Herbert Simon developed something called “***The Logic Theorist***”, considered by many to be the first AI program.
- Represented each problem as a **tree model** (like the Binary tree that we will discuss later)
- Would attempt to solve it by **selecting the branch that would most likely result in the correct conclusion**.
- **A crucial steppingstone in developing the AI field.**

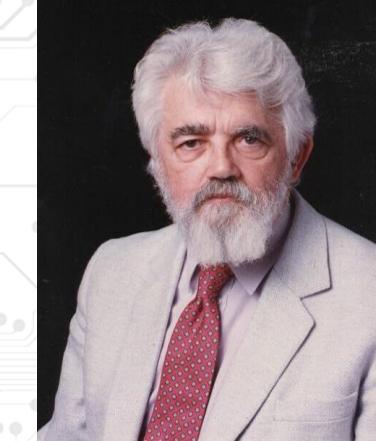


Allen Newell &
Herbert Simon 1955



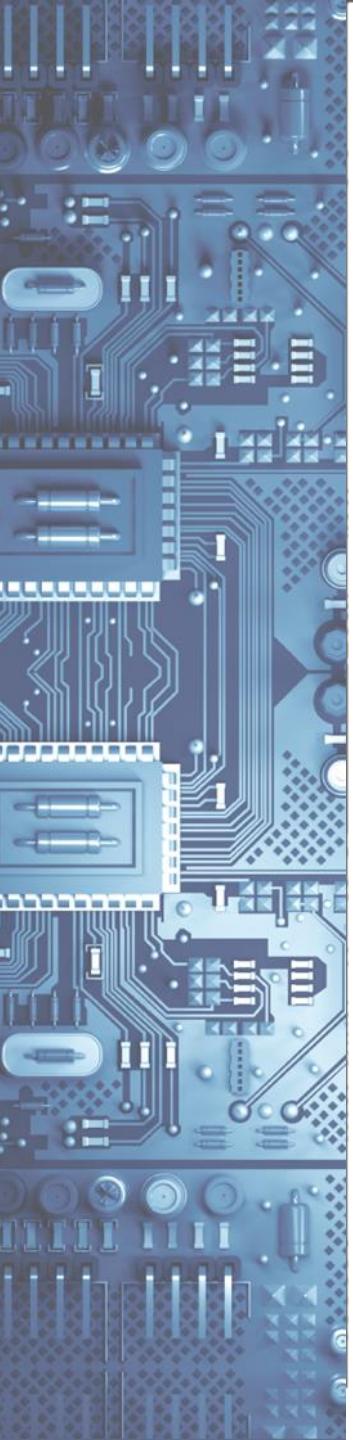
The Beginnings of A.I.

- In 1956 John McCarthy regarded as the ***FATHER of AI***, organized a conference to draw the talent and expertise of others interested in machine intelligence for a month of brainstorming.
- From that point on, because of McCarthy, the field would be known as “Artificial Intelligence”.
- Although not a huge success, the Dartmouth Conference did bring together the founders in AI and served to lay the groundwork for the future of AI research.



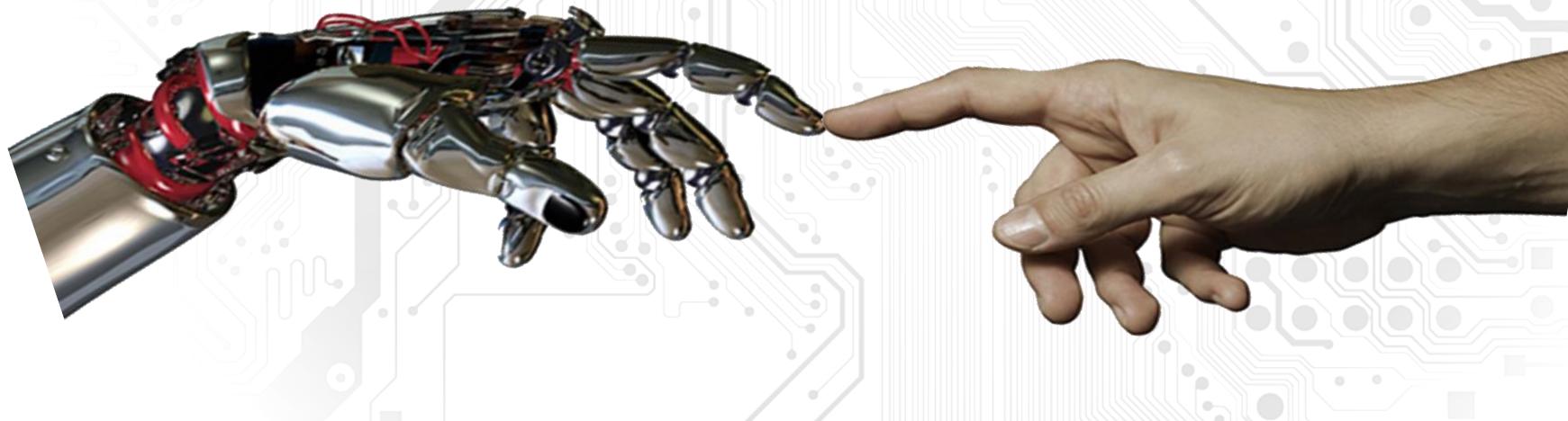
John McCarthy 1956

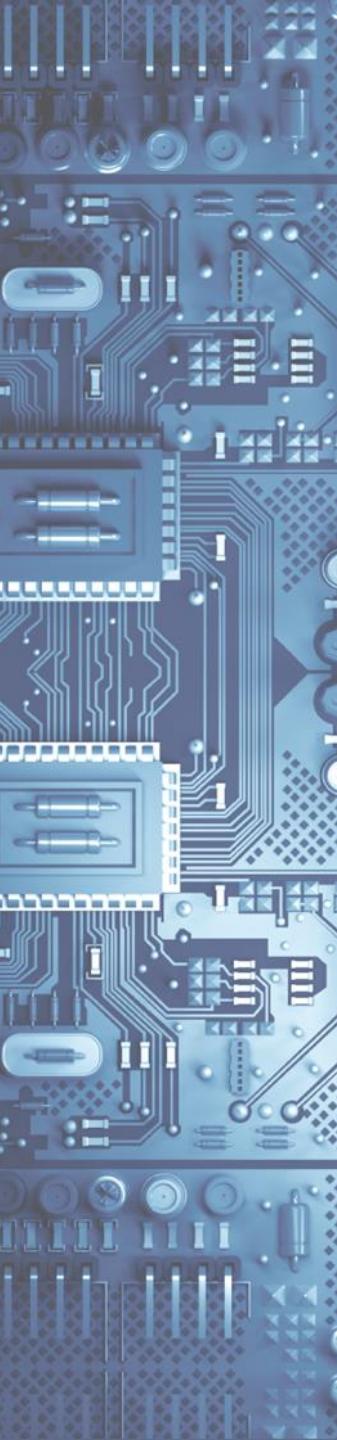




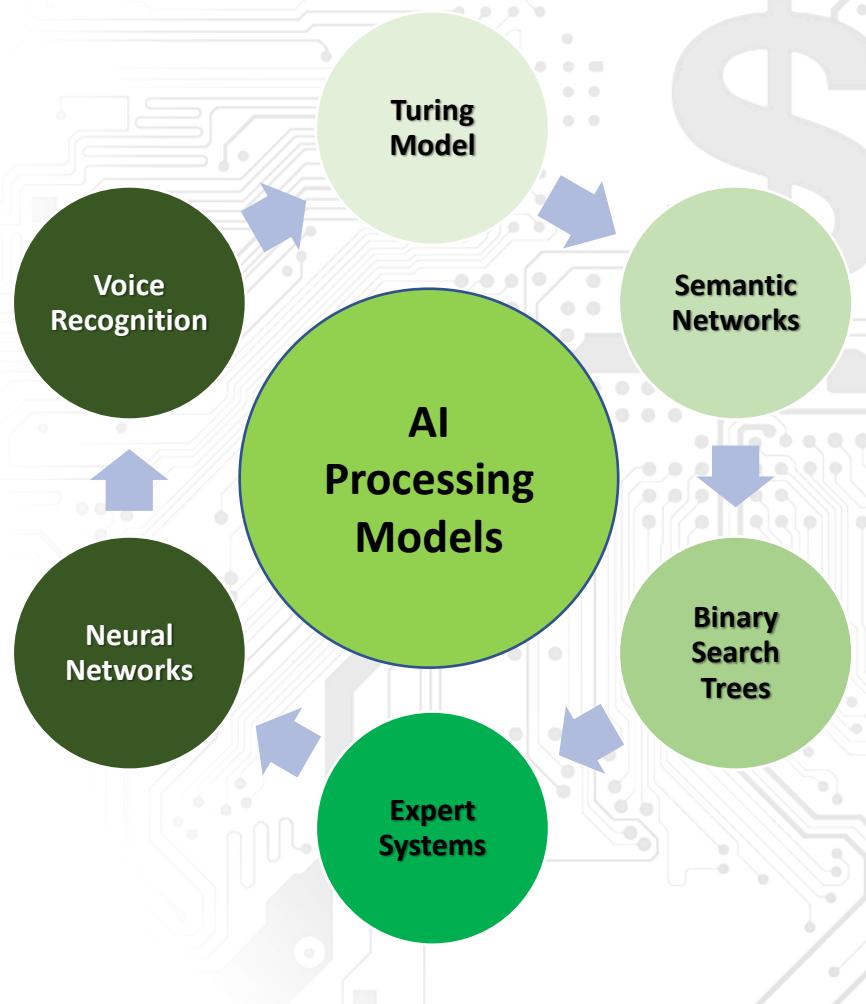
Knowledge Representation

- What we trying to do is to **compare the way that computers and humans work to see if we can better understand why each have their own computational-Reasoning strengths and weaknesses.**
- **We can do that using something called AI Processing Models**





Artificial Intelligence Processing Models

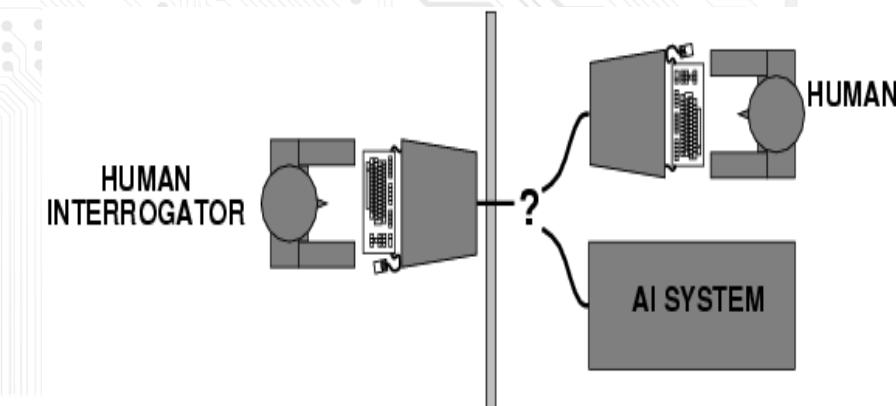


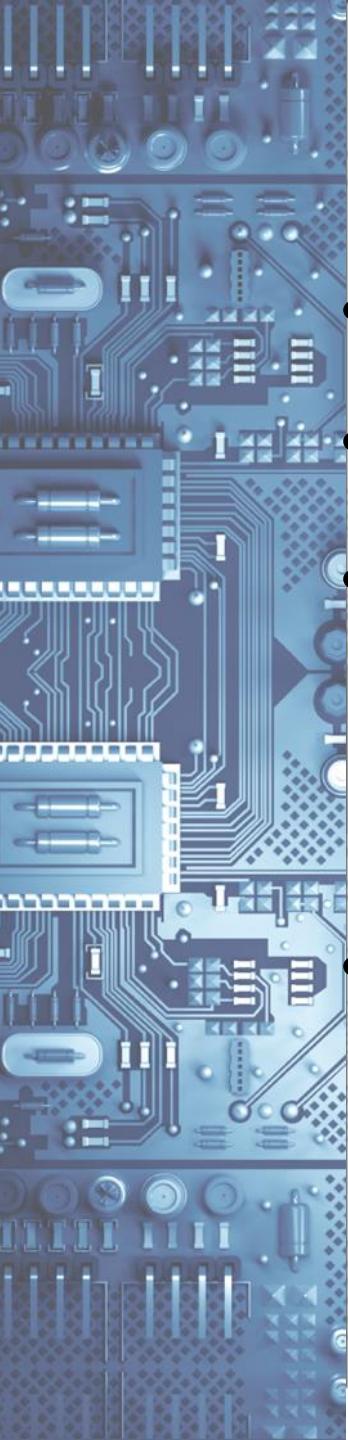
Although there are some additional processing models that have been developed in recent years, lets focus on 6 of the major ones at play today



The Turing Test

- A Turing Test is a method in artificial intelligence for determining whether or not a computer can think like a human being.
- During the test, one of the human's functions as the questioner, while the second human and the computer function as respondents.
- After a preset length of time or number of questions, the questioner is then asked to decide which respondent was human and which was a computer.



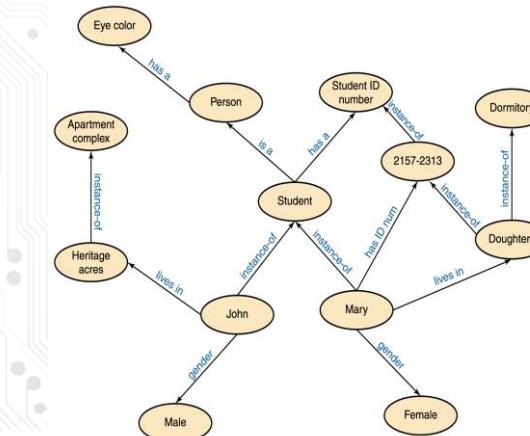


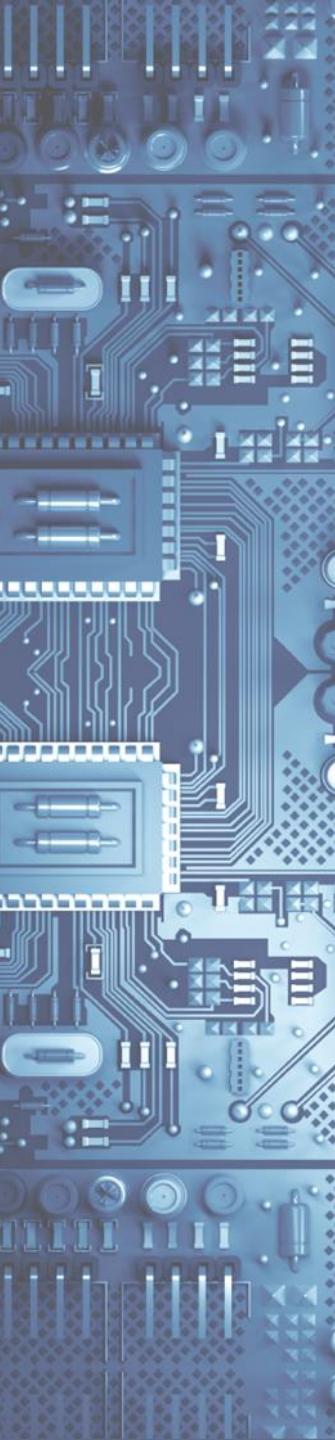
The Turing Test

- **Passing does not show that the machine was thinking**
- It only shows that the behavior looks like human thinking
- **Weak equivalence:**
 - The human and computer are equivalent in results (output)
 - **But they do not necessarily arrive at those results in the same way**
- **Strong equivalence:**
 - The two systems use the same internal processes to produce results

Semantic Networks (Processing Model)

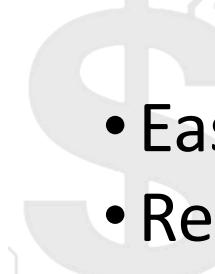
- A knowledge technique that focuses on relationships between objects
- Objects represent the objects in the real world
- Relationships are based on the real world questions
- Types of relationships determine which questions are easily answered, which are more difficult to answer, and which cannot be answered
 - Would be difficult to ask “how many students are female?” or “who lives in GSU housing?”
 - The answers are present - just difficult to find by searching in a BINARY fashion. You must find ALL Relationships!

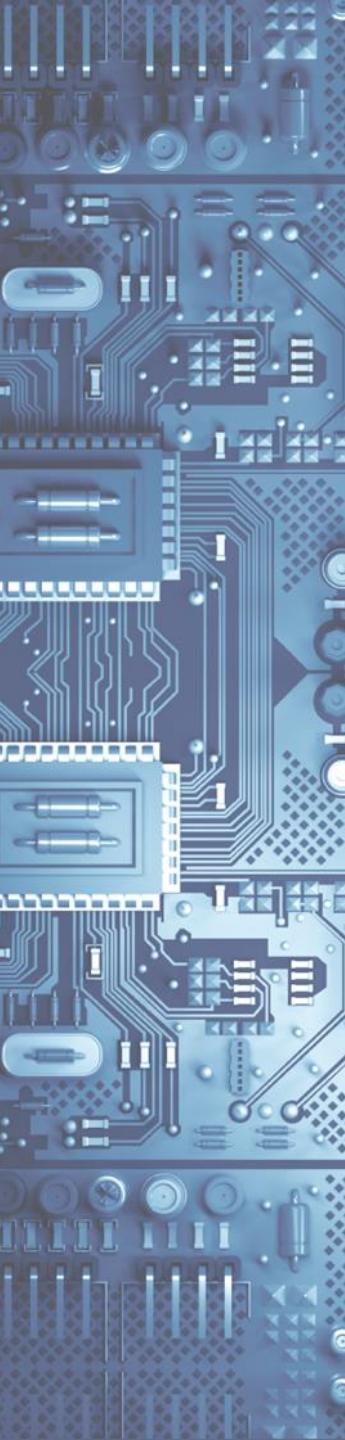




Semantic Network Advantages



- 
- Easy to understand and visualize.
 - Related knowledge is easily clustered.
 - Easy to follow hierarchy.
 - Efficient in space requirement.
 - It is flexible.



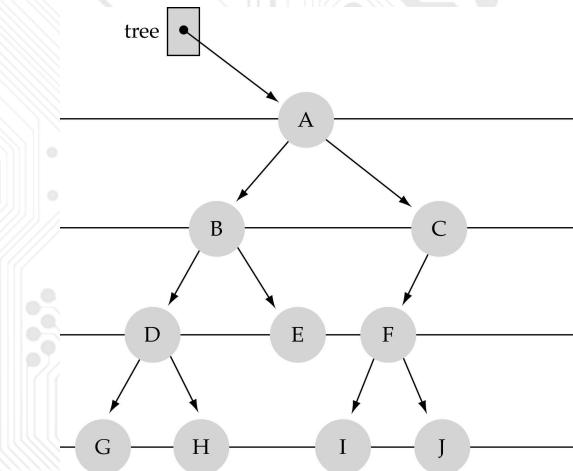
Semantic Network Disadvantages



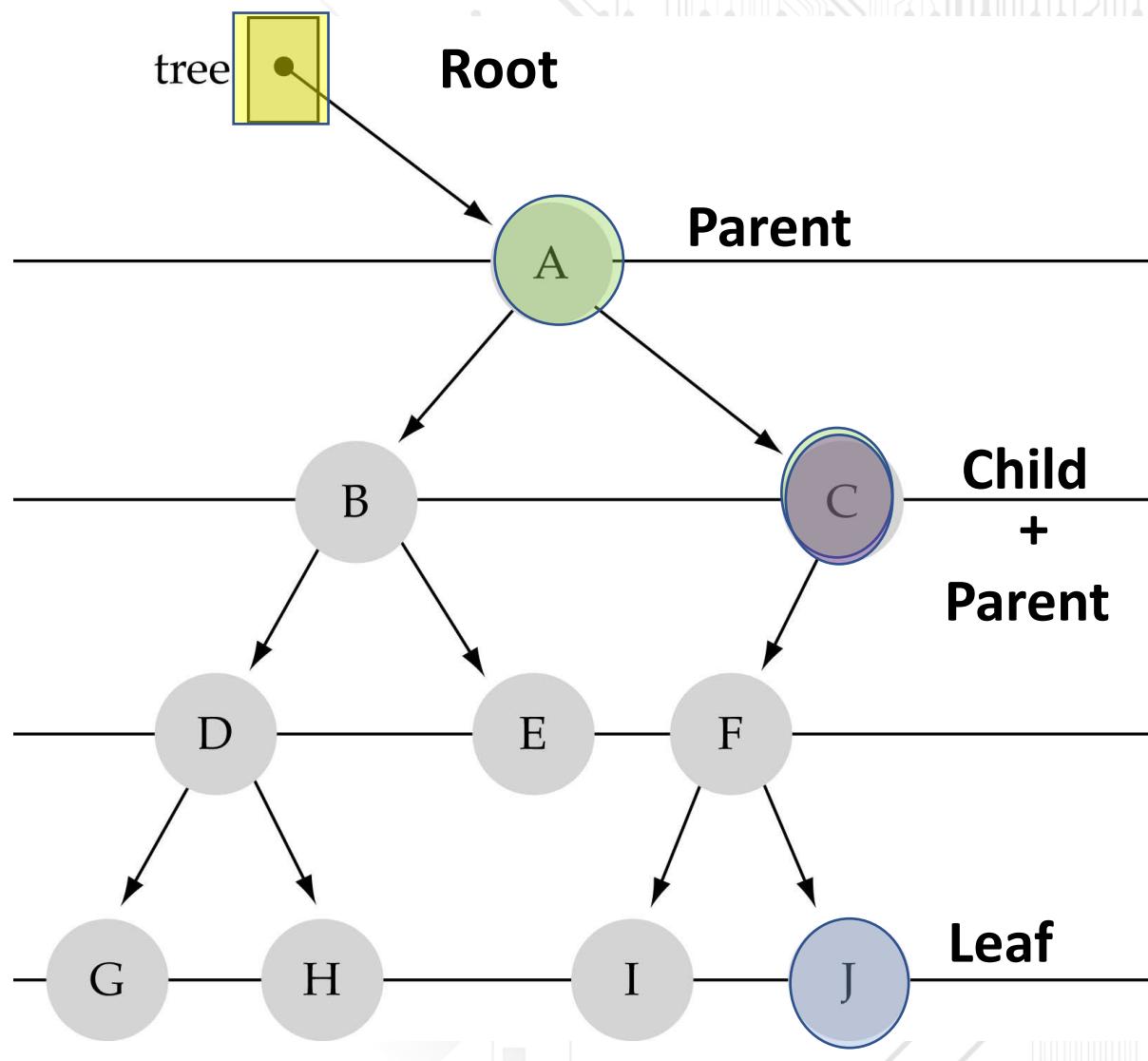
- Links on object represent only binary relations, yes or no, on or off. Etc.
- No standard definitions about links .
- Unclear Inheritance may cause problems meaning which concepts are uniquely part of another concept.
- Full implementation can often be very hard.

What is a Binary Search Tree (BST)

- Sometimes called **ordered** or **sorted binary trees**, are data structures that stores "items" (such as numbers, names etc.) in memory.
- **Binary search trees keep their keys in sorted order**, so that lookup can use the principle of binary search (Yes or No)
- They traverse the tree from root to leaf, making comparisons to keys stored in the nodes of the tree and deciding

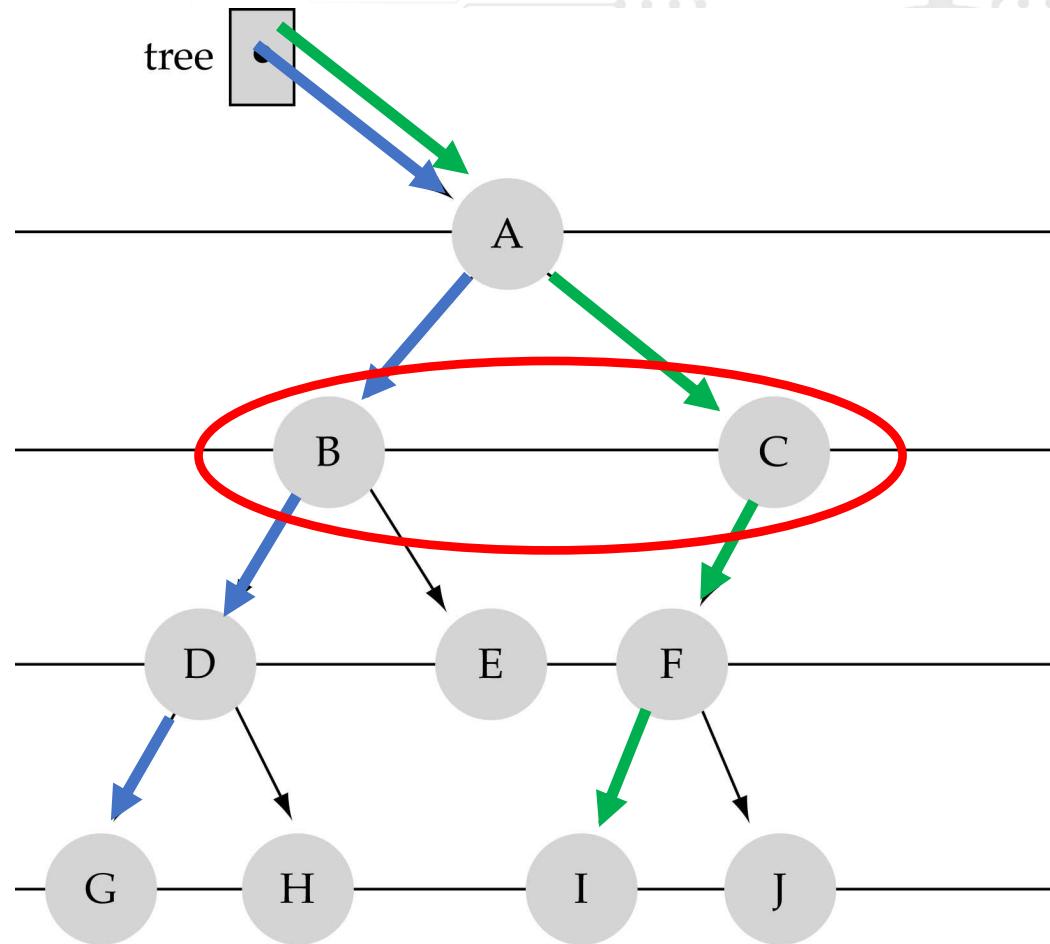


Some terminology



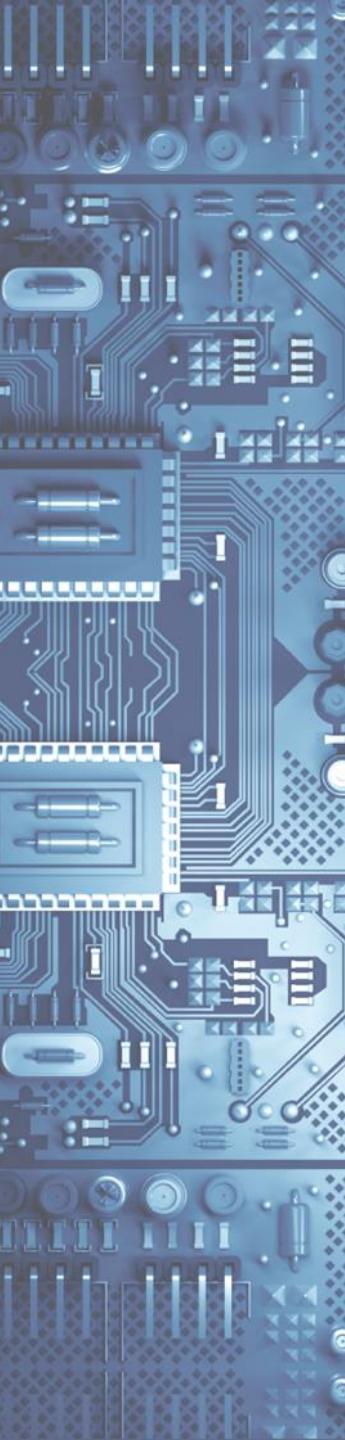
- The successor nodes of a node are called its *children*
- The predecessor node of a node is called its *parent*
- The "beginning" node is called the *root* (has no parent)
- A node without *children* is called a *leaf*

Binary tree Properties



Property 1: each node can have UP TO two successor nodes. Meaning it can also just have 1 successor

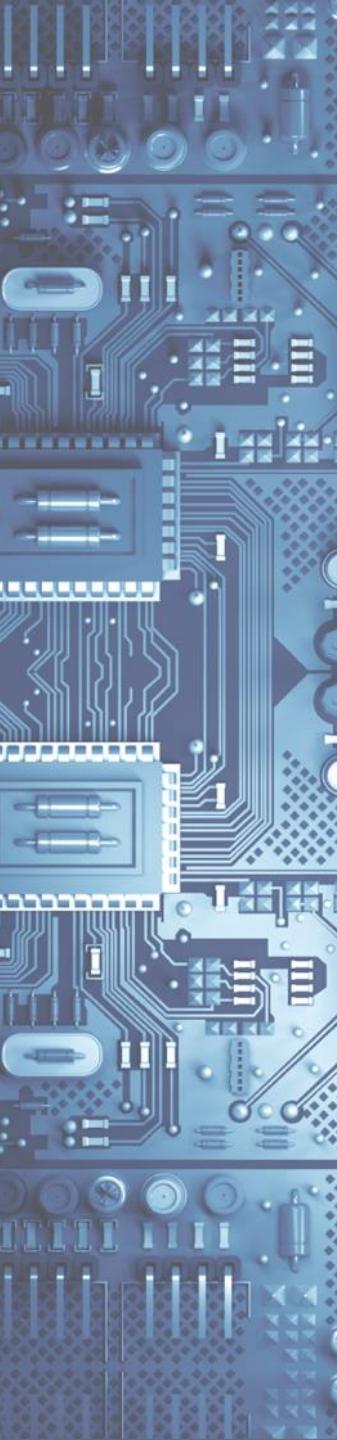
Property 2: a unique path exists from the root to every other node



Binary Search Trees Advantages



- Lookups can be done in extremely fast time which matters when the search field is large
- You can implement from the smallest to the largest element, because it is can be looked at as a sorted array
- We can also do range queries - find keys between 1 and 10,000



Binary Search Trees Disadvantages



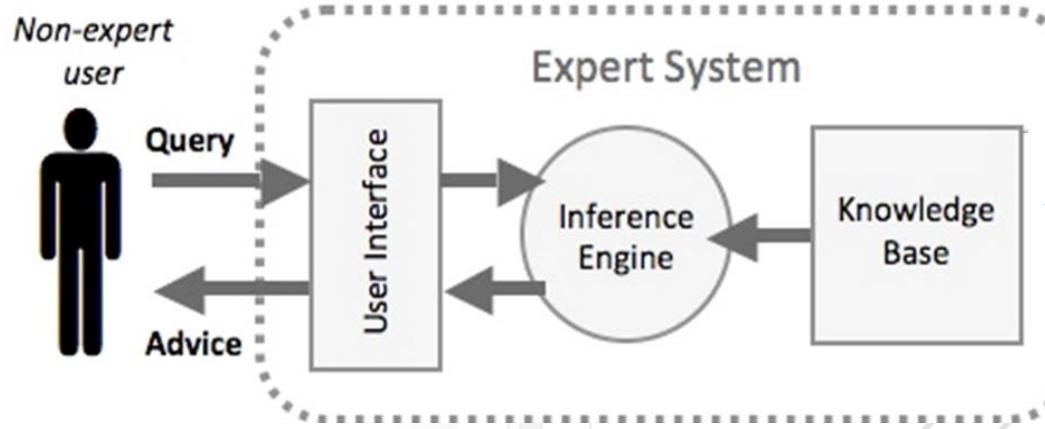
- The main disadvantage of binary search trees, is that we should always implement a balanced binary search tree, meaning true binary, either.... or.
- Otherwise, the cost of the search may increase and degenerate into a linear search on an array.

Expert Systems

A computer program that simulates human intelligence and behavior by providing knowledge from an expert.

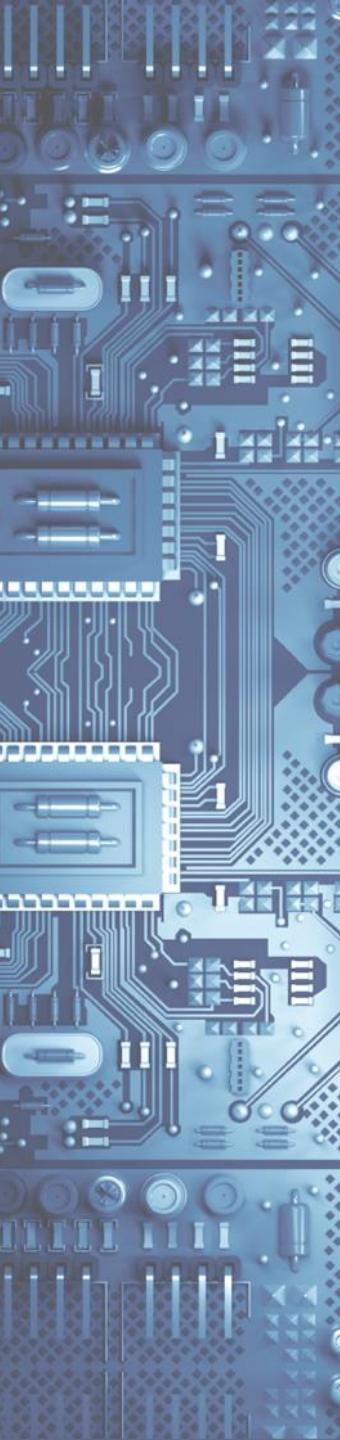
It is composed of three major modules:

- A Knowledge Base
- An Inference Engine
- A User Interface
- The software that processes rules to draw conclusions



EXPERT

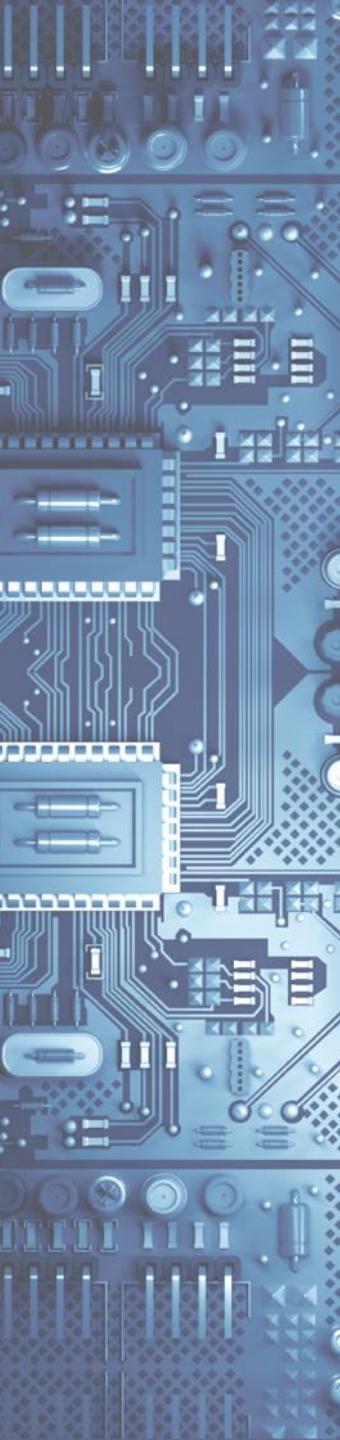




Expert Systems Advantages



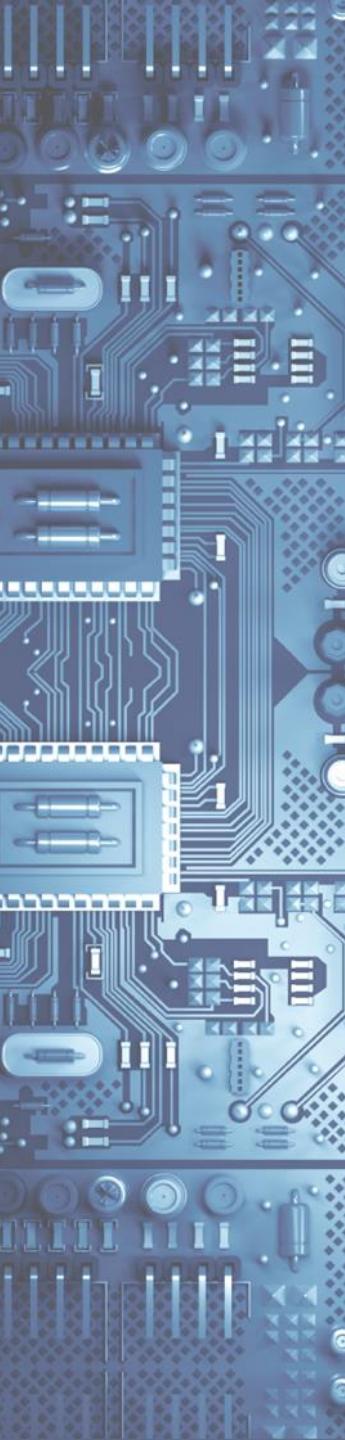
- Many knowledge domains where expert knowledge is available
- Enable the ability to provide expert opinions into remotely located areas that are difficult to reach
- Provide the ability to enhance the performance of tasks by applying industry leading expert knowledge



Expert Systems Advantages & Disadvantages

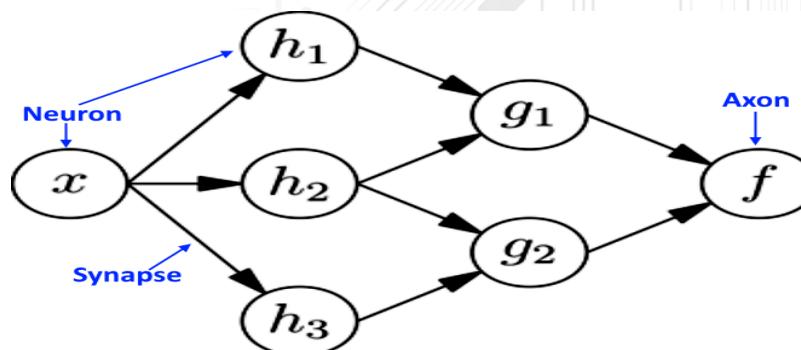


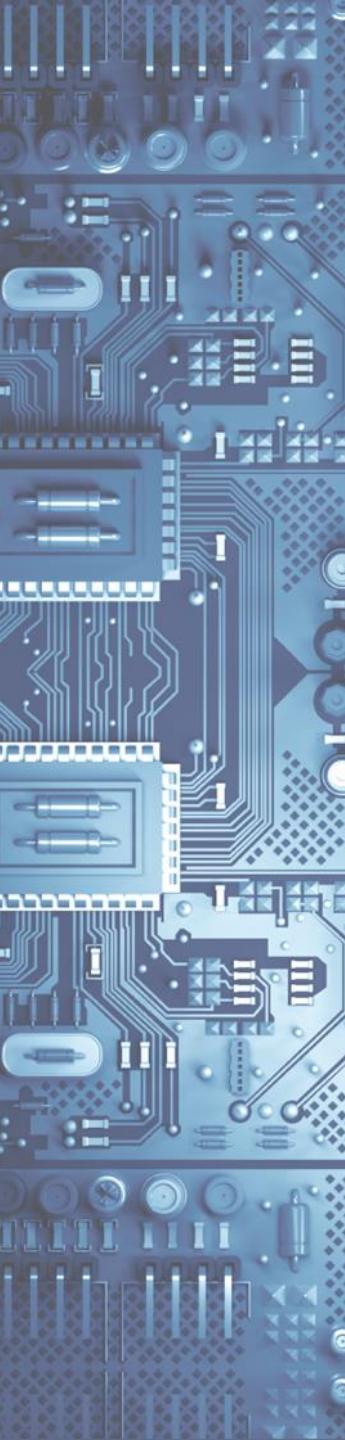
- Lack of available Resources like
 - Trained Personnel
 - Expert System tools
- Need for acquiring needed knowledge, refining Knowledge Bases
- FinallyExpert Systems take a long time to build and are costly to implement & maintain



Artificial Neural Networks (Reasoning)

- Based on a collection of nodes called **artificial neurons**, which models the neurons in a human brain.
- Each connection (synapses) can transmit a signal from one neuron to another.
- The neuron receives a signal, processes it, then signals other neurons
- Learns to perform tasks by reviewing examples, without being programmed
- *I.E - Could learn to identify cat images by analyzing example images that have been manually labeled as "cat" or "no cat"*
- They do this without any prior knowledge about cats.
- Can automatically generate characteristics from data that they are provided.

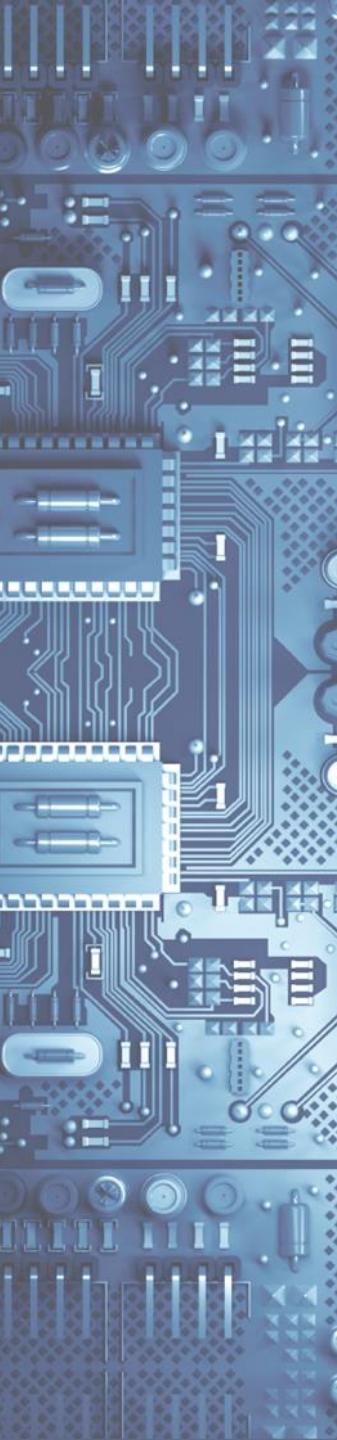




Neural Networks Advantages



- Information is stored on the entire network, not on a database so it is fault tolerant.
- Can learn events and make decisions by commenting on similar events.
- Have numerical strength that can perform more than one job at the same time providing parallel processing.



Neural Networks Disadvantages

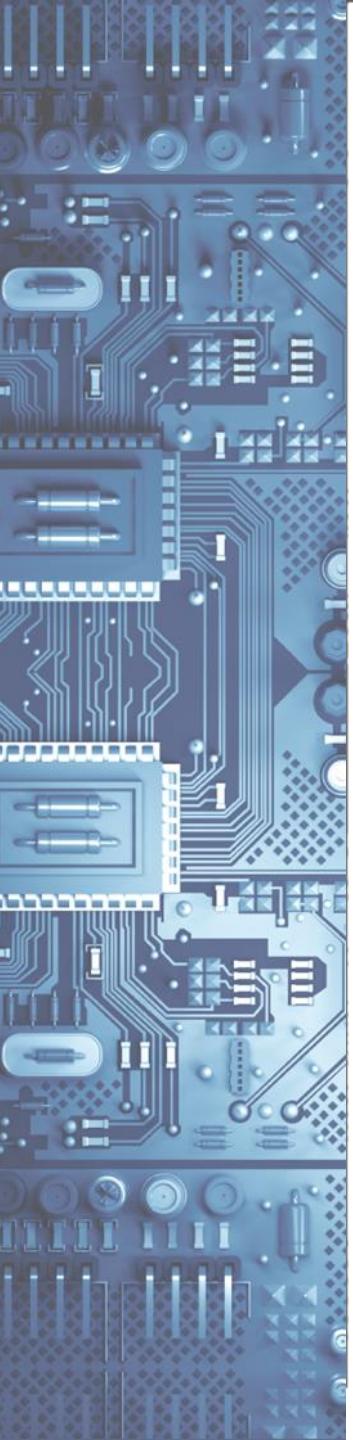


- Requires processors with parallel processing power, so it is heavily hardware dependent
- No specific rule for determining the structure of artificial neural networks. It is achieved through trial and error.
- Difficult to display the problem to the network because questions have to be translated into numerical values before being introduced to the network.

Voice Recognition

- I am sure most of you are familiar with at least using this technology with Siri or Lexus. This is also known as **speech recognition**.
- A computer software program or hardware device with the ability to basically decode the human **voice**.
- Commonly used to operate a device, perform commands, or write without having to use a keyboard, mouse, or press any buttons

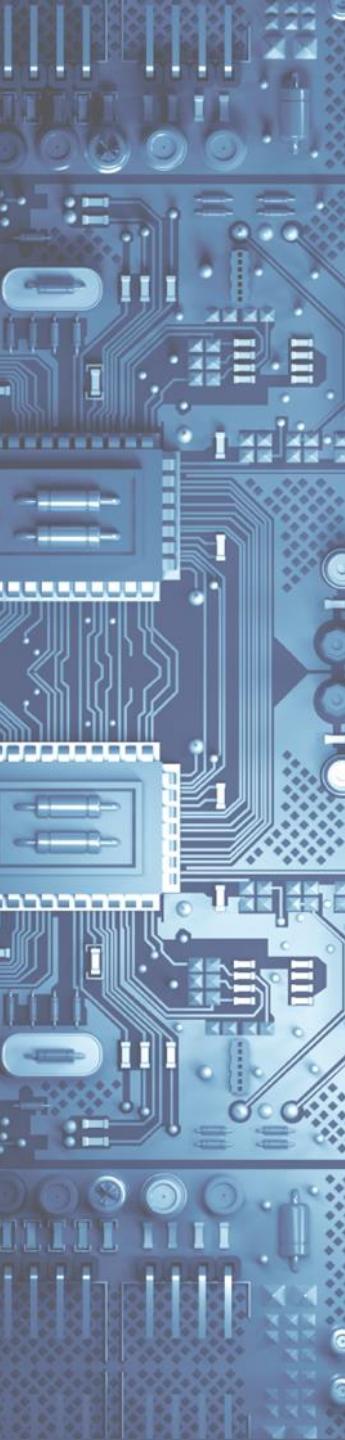




Voice Recognition Advantages



- **Access** – Allows writers with physical disabilities that prevent them from using a keyboard and mouse to use voice commands to dictate words into a text document
- **Spelling** – Access to the same editing tools as a standard word processing solution. Of course, nothing is 100 percent accurate (but the software will catch the majority of spelling and grammatical errors).
- **Speed** with which the software can capture your speech at a faster rate than you might normally type.



Voice Recognition Disadvantages



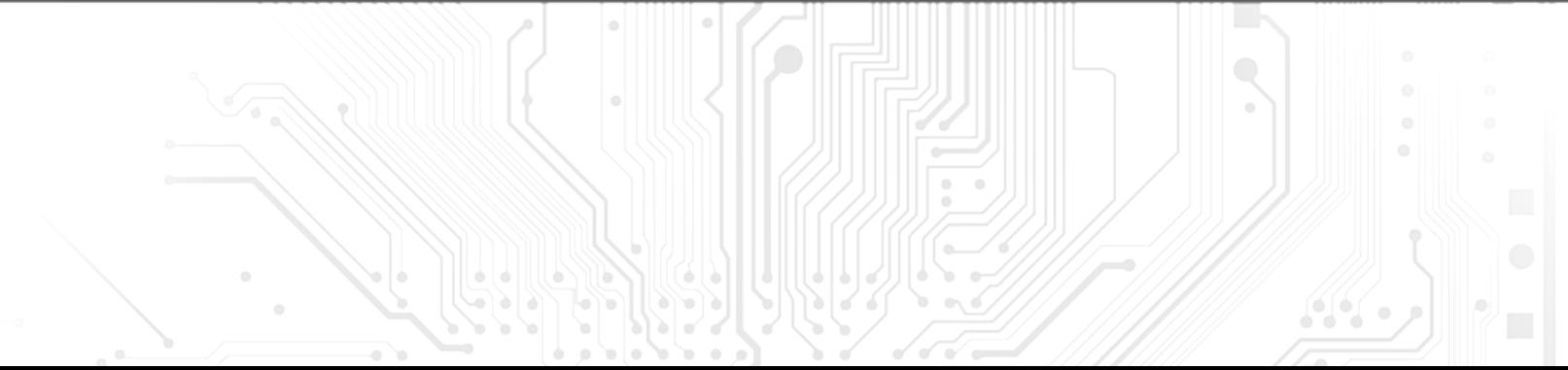
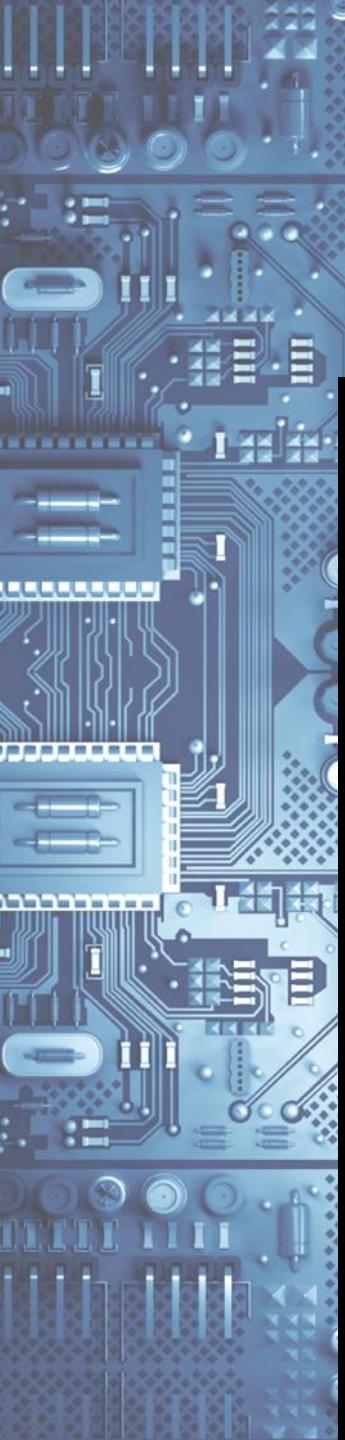
- **Problems with understanding speech**
 - Each person's sounds are unique
 - Speech impediments, mumbling, volume, and regional accents can add further complications
- **Systems still do not do well with continuous, conversational speech**
 - Humans speak in a *continuous, flowing* manner, stringing words together
 - Sound-alike phrases like “ice cream” and “I scream”

Human vs. Computer

	Human Brain	Computer
Speed	Neurotransmitters travel at about 1000 ft/second	Electrons at speed of light 
Memory	10 terabytes	Exabyte
Learning	Pattern recognition	Machine learning

HUMANS WIN..... For Now!

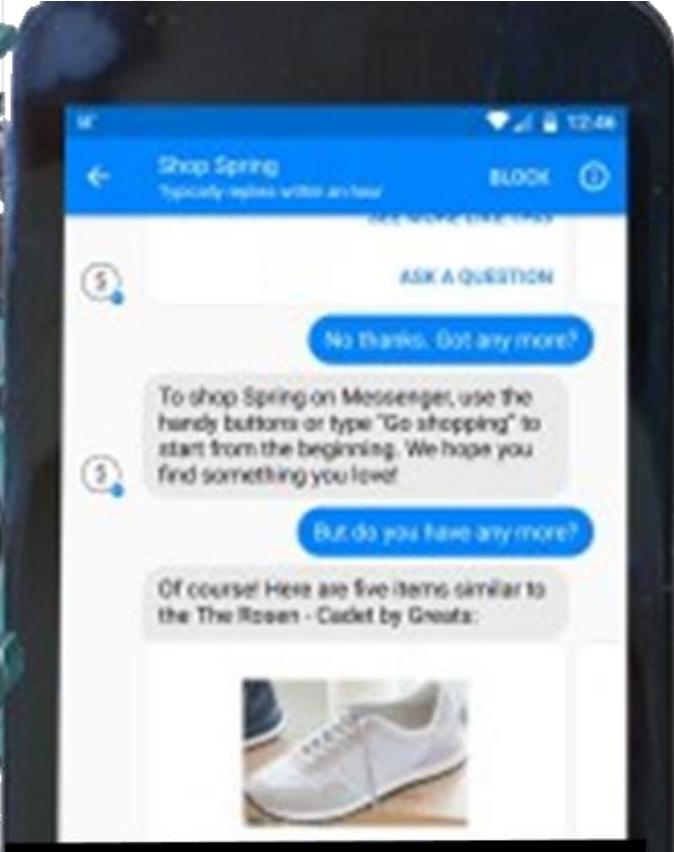




Big Data and AI

From the Textbook Author

Chatbots



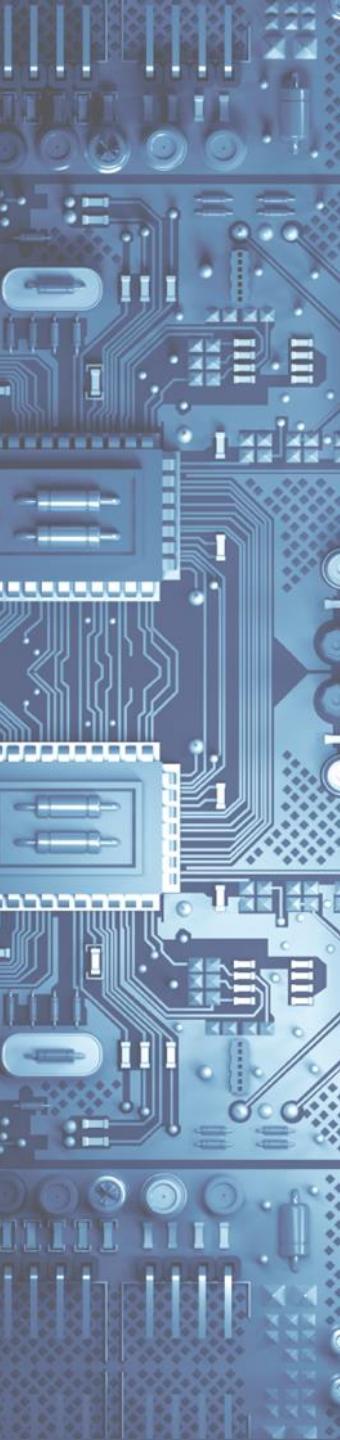
**Can AI-Powered
Chatbots Transform
Banking
Experiences?**



Introduction to Chatbots

- **By the end of 2021, customers will manage 85% of their enterprise relationship without human interaction says Gartner**
- **Chatbot growth is rapidly expanding as organizations deploy them across all sectors including Financial service**

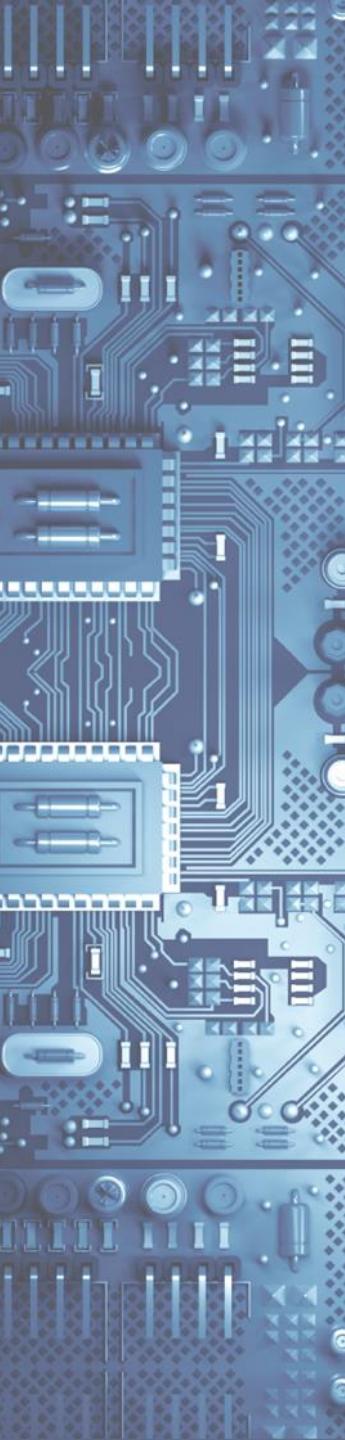




What exactly are chatbots?

- Unlike sales/service “live chat” that’s seen mainstream adoption within online banking, **chatbot banking is 100% automated.**
- A **Back and Forth “chat”** is designed to streamline and optimize services by **homing in on the specific request**
- These **bots access data from existing databases and use AI to enable speedy responses to specific needs**





AI and chatbots?

- Conversational platforms are exploding in the banking industry!
- The rise of Apple's Siri and Amazon's Alexa shows consumers are ready to adapt to this technology in Financial sectors
- 2020 survey of 33,000 consumers in 18 countries by Accenture revealed that a whopping 71% of respondents are open to the idea of robo-advisors helping them determine which bank account to open.
- In Asia, Alibaba's Alipay already has 450 million customers



Banking Chatbot Use Cases

- Banking Chatbots can be programmed to ask specific questions, allowing it to **“collect” valuable information like:**
 - “Lead” data
 - Unqualified prospects to EXCLUDE
 - Qualified prospects to deliver to sales departments
 - Opportunities for cross selling
- “Machine Learning” chatbots can now predict when a **customer may be in a “buying cycle”** (i.e house, marriage, and childbirth)





Banking Chatbot Use Cases

- **An Intelligent Assistant for Managing Money**

Banks need to quickly **integrate financial decisions** into their customers' everyday life

- A **24/7/365 “practice personal” banker** providing a simplified financial experience
- **Simple question & answer, conversational “bots”** that will help customers
 - Keep track of balances and limit notifications
 - Bill reminders
 - Suggestions on saving for a “rainy day” and much more
- **AI powered predictive systems will need to plug directly into accounts** to analyze patterns, deliver targeted results, and real time advice





Adoption Today in Banking & Finance

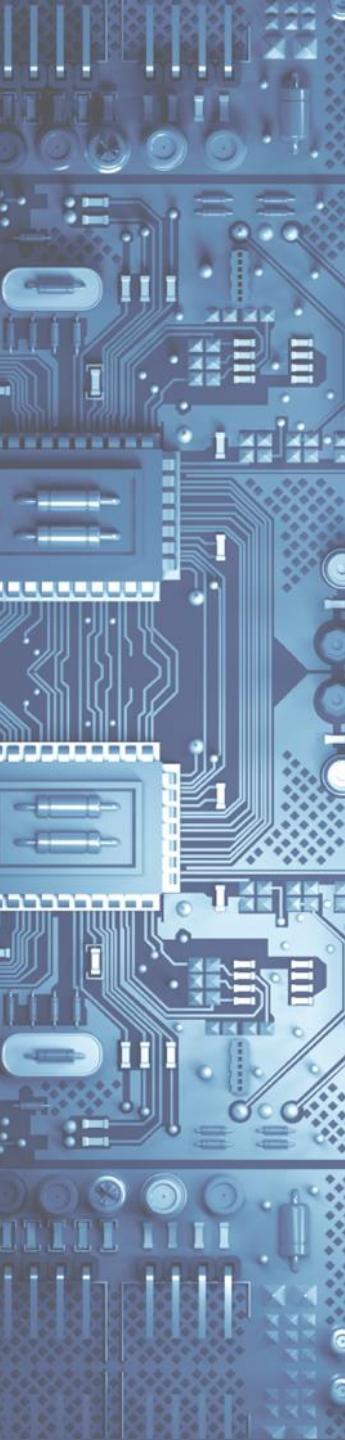
- Some FinTech's are experimenting with Chatbots in their Mobile apps
- Lower cost of development by supporting new functionality like Facebook Messenger is significantly less than supporting their own Web Site or mobile interface
- **Deutsche Bank is working on embedding chat happy banking app into messaging platforms like WhatsApp and WeChat**



Aspire Systems Special Report: “State of Chatbots in Banking”

- The vast majority of banks (**93%**) do not currently have an offering in conversational systems for their Millennial market
- **In most cases, their platforms have not yet progressed past the experimental phase**
- **71% of respondents believe that the level of AI and ML in current banking systems is very basic**
- **79% admit that their chatbots in the current state only support basic transactional functions (i.e. checking)**
- **Chatbot AI has not evolved to the point where it can become the “face” of a bank’s brand for a customer service or sales role**

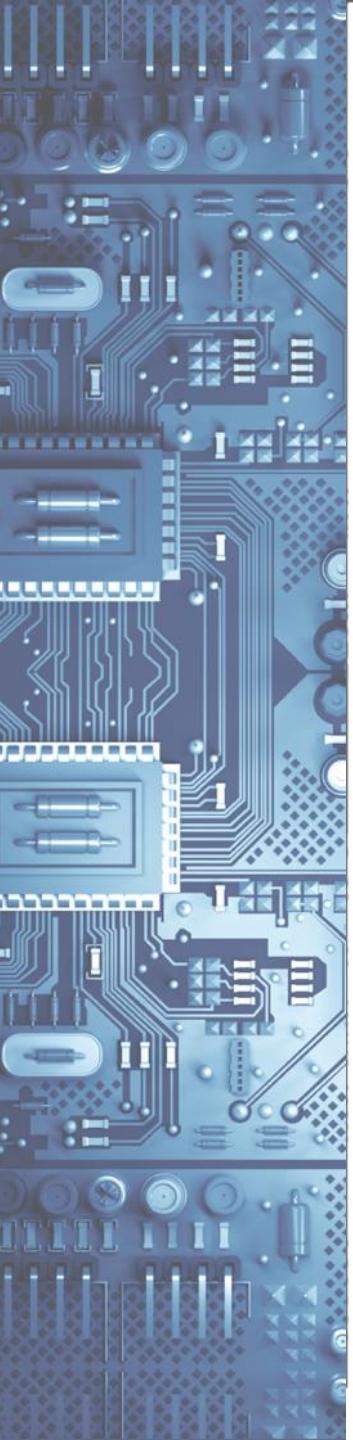




What should Fintech Companies Do?

- Effective FinTech's in the future will be the ones that **integrate AI, data analytics, & chatbots** into a single platform
- These systems require the capability to deliver '**digital design**' thinking, and domain expertise to understand the technical issues in place in existing systems.
- Banks need to "**find**" **trusted technology partners** who have the experience in **Advanced AI and Machine Learning** to more quickly get to market
- Banks cannot underestimate the **level of innovation and technical expertise** needed to develop such needed "advanced" chatbots



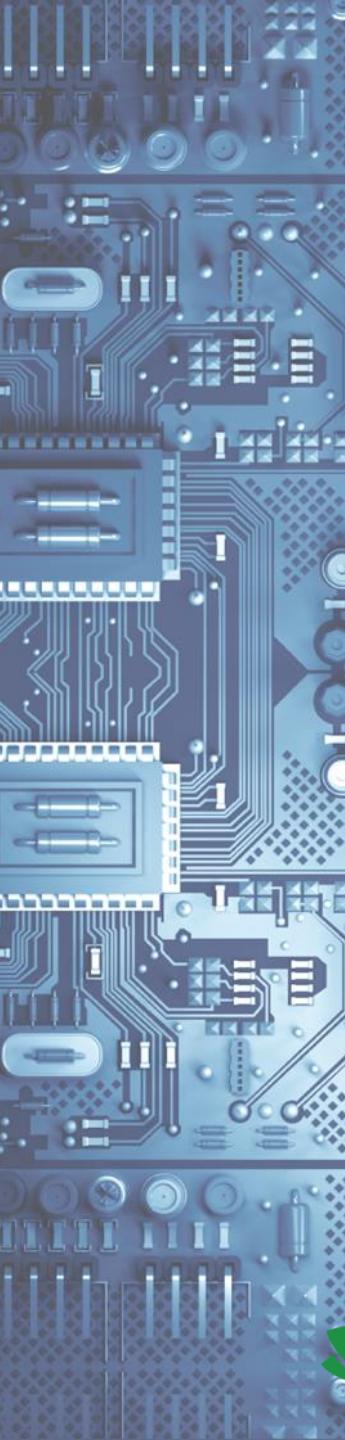


Artificial Intelligence in the Finance Industry



AI in Fintech





38% of Fintech companies already use AI

- Fintech Venture capitalists across the country are parroting the phrase ***“AI is the new mobile.”*** and will **someday soon** be a **requirement** for going forward in the Fintech Industry.
- A small, lucky handful of early movers like those pictured here will ride it to untold revenue. **By the time the rest of the market adapts, it may be too late.**

JPMORGAN CHASE & Co.



RBC
Royal Bank

Deutsche Bank



Bank of America



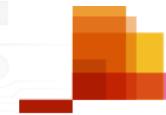
citi

wealthfront



BNP PARIBAS

CREDIT SUISSE



Swedbank



Current AI Impact on Fintech Companies



Fintech Industry Changes

The Fintech AI Industry changing

- Leading financial institutions have started hiring *Chief AI Officers* and *investing in AI labs*
- *AI-powered banking bots* are commonplace
- Estimated that *companies will spend \$12.5B on AI technology/software* in 2021



Fintech Success Stories

AI success stories

- JP Morgan Chase deployed AI for *document processing* (300k+ hours reduced to seconds)
- Top three credit agencies implemented AI for *risk assessments*



THE END