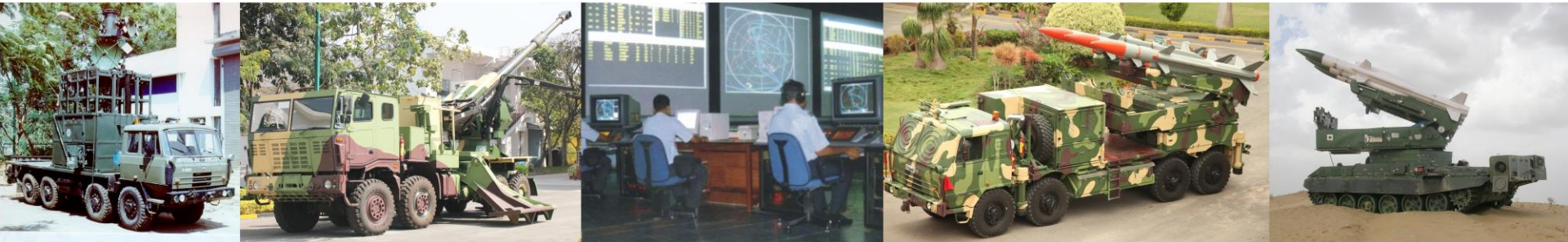


Learning & Development

Excellence

Dignity

Agility



स्वावलंबन के पथ पर अग्रसर

Technology, AI & ML

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Vice Chair, Wireless innovation Forum

Past Chair – IEEE India Council & Bombay Section

11th Aug. 2018

The Universe

- 100 Billion Galaxies in the Universe
- Each Galaxy has 200 to 300 Billion stars
- Each Star has, on an average, 1.6 Planets
- 400 Billion Earth like planets in our Universe
- 1789 confirmed to be Earth like and 10 of them have been discovered
- The latest discovery of an Earth like Planet is Kepler 438b on 6 Jan 2015
 - 470 light years away and 1.12 times the size of Earth.

Solar System

- Solar system is 4.6 Billion Years old
- Predictions say that in 5 Billion years the Earth will merge with the Sun
- Question
 - Which will be the only man made object surviving after 5 Billion years?
 - **Voyager 2**

What's happening on Earth now?

- Technology Trends
- Which is the most Disruptive Innovation?
- Printing Machine
- Which is the next Most Disruptive Innovation?
- Microprocessor

Eras

- Pre-Historic Ages
 - Stone Age
 - Metal Age
 - Golden Age
 - Copper Age
 - Bronze Age
 - Iron Age
- Analog Age
- Digital Age
- IoT Age
- AI age

Most Widely used item in the world

- What is the most widely used item in the world?
 - Toothpaste
 - Pen
 - Watch
 - **Cellular Mobile Phone**

Technical Questions

- Light, Heat, X Rays, Gama Rays, Alpha Rays, Radio waves... all these are EM waves which travel at a constant speed C
- What differentiates these?
- Wavelength

Technical Questions

- Govt. of India is planning to modify the school text books to incorporate ancient Indian discoveries and inventions.
- State Pythagoras Theorem
- The famous Pythagoras theorem was known in ancient India. The Sulva sutras (800 to 500 BC) contain the statement “The diagonal of a rectangle gives an area equal to the sum of the areas given by its length and breadth.” (read area as square for better understanding)
- Pythagoras lived in 572 – 501 BC and most probably the Sulva sutras were composed before Pythagoras.
- The reference for the above is – Srinivasiengar, C.N., The history of Ancient Indian Mathematics, The World Press, Calcutta, 1967.

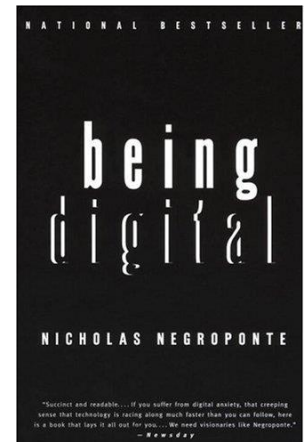
Technical Questions

- James Clerk Maxwell, the Scottish physicist discovered EM Waves in 1864, and came up with the Maxwell's equations.
- Who first demonstrated Radio Communication?
- G. Marconi
- Alexander Popov
- J.C.Bose

Being Digital

- Book “Being Digital” by Nicholas Negraponte, MIT
- Published in 1995
- Digital Technologies and their possible future
- Predicted 25 years ago
 - All forms of information that are now made of atoms (books, CDs, etc.) will eventually be made into bits
 - **Transporting Bits is easier than Atoms**

“Everything connected
Software Defined Everything”



Then and Now



FIAT Padmini

- Not a single line of code or Electronics



Mercedes S Class/AMG

- 20 Million Lines of Code & lots of Electronics
- Toaster, W/M, Coffee Machine all have embedded software

Future - Waymo self driving car



- Alan Turing, in a 1951 paper, proposed a test called "The Imitation Game" that might finally settle the issue of machine intelligence
- a proposed test of a computer's ability to think, requiring that the covert substitution of the computer for one of the participants in keyboard and screen dialogue should be undetectable by the remaining human participant

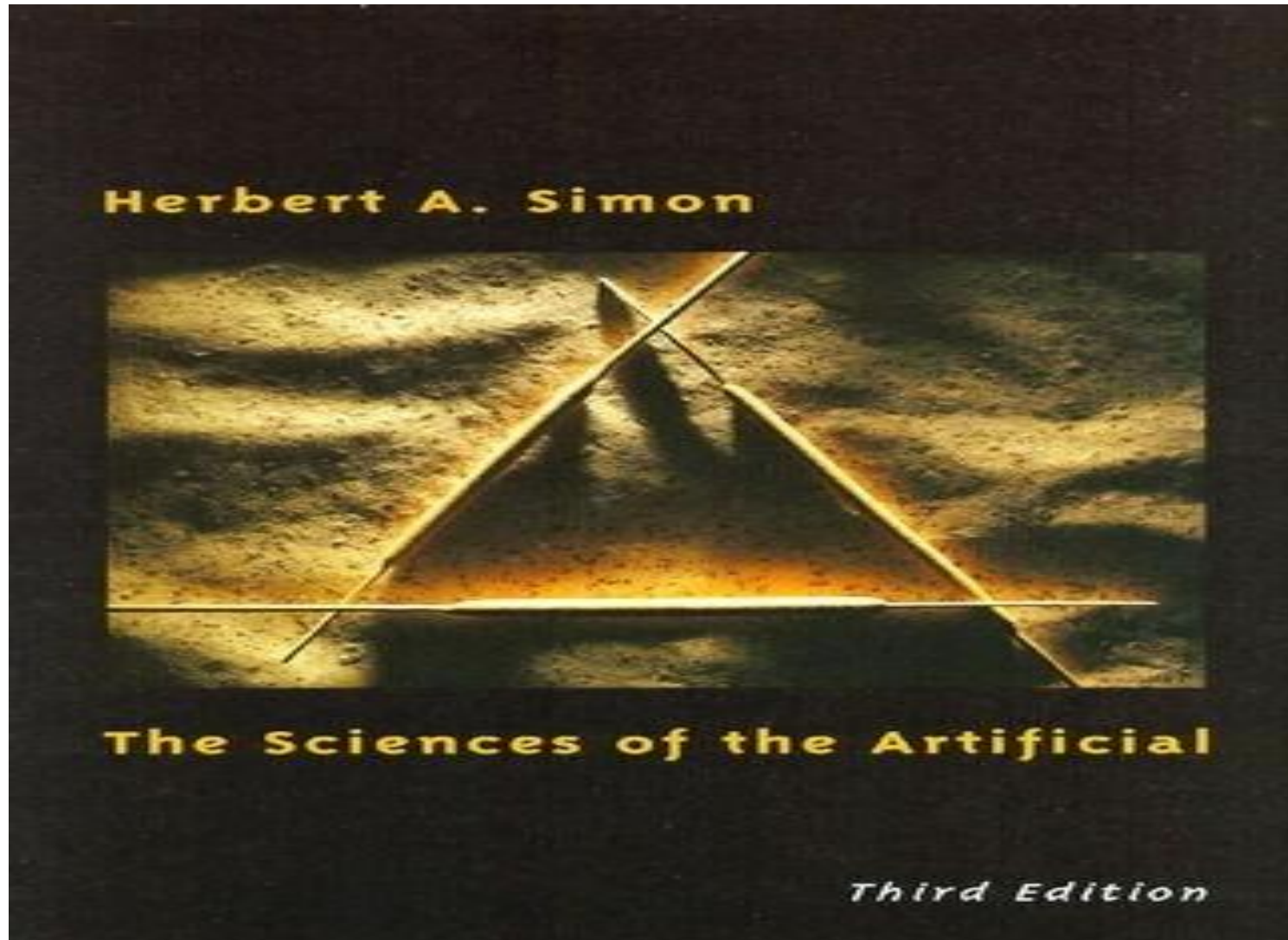
Prof. Raj Reddy – 1994 Turing award

- **Raj Reddy pioneered the construction of systems for recognizing continuous speech.** He developed the first system, *Hearsay I*, capable of continuous speech recognition. In this system and subsequent systems like *Hearsay II*, *Harpy*, and *Dragon*, he and his students developed most of the ideas underlying modern commercial speech recognition technology.

Prof. Raj Reddy (contd...)

- Some of these ideas—most notably the “blackboard model” for coordinating multiple knowledge sources—have been adopted across the spectrum of applied artificial intelligence. Together, the joint Turing Award recipients in 1994, Edward Feigenbaum and Raj Reddy, have been seminal leaders in defining the emerging field of applied artificial intelligence and demonstrating its technological significance.

H A Simon's classic work on AI in 1968



Human Brain & ANN

An average brain has something on the order of

- 100 billion neurons.
- Each neuron is connected to up to 10,000 other neurons,
- number of synapses is between 100 trillion and 1,000 trillion.
- For a simple artificial neural network of the sort proposed in the 1940s, the attempt to even try to replicate this was unimaginable.
- We're still far from the construction of a network of that size, but
- Google Brain's investment allowed for the creation of artificial neural networks comparable to the brains of mice.

What is driving AI advances?

- Advances in
 - computing
 - Communications
 - Sensing
 - Memory
- Availability of training data
- And not necessarily AI theory
- Current machine – brain performance gaps are very large ($> 100,000$)

AI maturity

- Not yet “engineering”
- Fragile – breaks easily
- Performance limits not understood
- Needs massive amount of quality data
- Development model not well understood
- Power & space hungry

Defence applications of AI

- C2 cognitive amplification and confrontation
- Autonomous & swarmed combat platforms
- “brain-machine” fusion
- Military intelligence – recognizing/understanding text, handwriting, audio, photos & video
- US DoD project MAVEN – turn expansive data into actionable intelligence and decision-quality insights at speed

- The U.S. Defense Advanced Research Projects Agency (DARPA) is looking to change the way AI works through a program it calls L2M, or Lifelong Learning Machines.
- Systems that learn continuously, adapt to new tasks, and know what to learn and when. “We want the rigor of automation with the flexibility of the human,” says the program’s director Hava T. Siegelmann.
- The US \$65-million program has already chosen 16 groups for 4-year projects

Is AI a strategic weapon?

- Precision vs mass weapon
- Deal with asymmetric warfare
- Eliminates self vulnerability
- Deniability

Indian defence AI strategy

- No one will sell advanced AI Technology since it is strategic
- India needs to develop its own AI
- Task force submitted its report on AI for Defence to Indian MoD

Defence Spending World over

- Global Spending in 2016: \$ 1.57 Trillion
- Indian Spending : Appx \$ 35 Billion
- Indian Military has a \$ 400 Billion equipment deficit

What is important?

- What is important is NOT what I said but ***what you remember of it.***

Thank You

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