

**Highlights of 3rd Lecture of the Distinguished Lecture Series organized
by INAE Bhubaneswar Chapter, SOA University & IMMT Bhubaneswar on 7th Feb 2022:**

Title: “Revenge of Silicon- tracing the trends in computing and communication and how the machines mimic man”

Speaker: Prof N Balakrishnan, Professor of the Department of Aerospace Engineering and Supercomputer Education Research Centre of Indian Institute of Science, Bangalore.

- ICT is the technology for the society
- It will draw upon the advances in all branches of Science and Engineering and will seamlessly merge with them.
- It will become more dependent on the advances in Social Sciences, Nano sciences and Biological Sciences.
- When it merges with society and biology, it will become as complex as the God Made systems.
- The today's world would merge symbiotically.
- Silicon will slowly and steadily replace at least functionally the Carbon- it is the Revenge of Silicon!
- Security in Socio- Technical world is very complex.
- When Silicon replaces carbon, the future ICT devices will make you 100 to 1000 times more efficient than you are today.
- The future computers will do more than computing – tend to look more and more like Humans- from calculating Engines, to Thinking Machines to Spiritual Machines! Larger memories AI make it more like humans- add Exploitability to AI.
- Quantitative Differential equation-based models to Machine learning from Instances – Data Centric Supercomputing Big Data Big Science.
- Your computer would start to look more and more like a human- you tend to build relationship with your computer.
- Seamlessly move between the you in the Physical World and the You in the Cyber World.
- Digital Physics going to lands of discovery where there are no 'lows but only lemma like in Computer Science.

What is meant by Convergence?

- The future innovations would lie in the interface of science and engineering
- In Technology follows law of accelerating returns
- 90% of what you see around would have been invented in the last few years
- In a career of an engineer, he would see 5 to 6 new areas emerge
- It is different from interdisciplinary science like – astrophysics
- Seamless Integration and emergence of a new discipline
- ICT is an example
- The term convergence is commonly used in reference to the synergistic combination of – for example –voice (and telephony features) data (and productivity applications) and video onto a single network. These previously separate technologies are now able to share resources and interact with each other creating new efficiencies.

Biotechnology

- Many of the key elements of the vast human nervous system exist at nano scale.
- The DNA molecule which is just about 3 Nano meters in width has been central to the development in biotechnology and biomedicine.
- The study and understanding of targeted drugs depend on nano particles as carriers.

- The whole mystery of the human genome and the way by which knowledge is encrypted is being revealed systematically using computers.

Cagno

- Increasingly computers would be used in sensing, perceiving, memorizing, actuating and controlling and in continuous learning.
- The sensing element that would play a critical role will come from nano technology
- The machines mimicking the human activities in large scale will be a reality.
- Neurobiology and brain machine interface will be the key technologies that will emerge to enhance the human life and quality

Convergence

- The line between living organisms and machines has just become a whole lot clearer.
- European researchers have developed “neuro-chips” in which living brain cells and silicon circuits are coupled together.
- The achievement could one day enable the creation of sophisticated neural prostheses to treat neurological disorders or the development of organic computers that crunch numbers using living neurons.
- Silicon implant that mimics the hippocampus, an area of the brain known for creating memories are in the anvil. Silicone implants have changed the field of health care to health repair.
- There are many more a whole new world of excitement

Personality capture

In the long run, we become seamless with our machines.

No other credible long-term futures have been proposed.

“Technology is becoming organic. Nature is becoming technologic” (Brian Arthur, SFI)

Humans will break physical disabilities through non-therapeutic means

Humans will transcend biology- thru Silicon Carbon mix-Singularity

You “Digital you” (Digital Twin)

“I would never upload my consciousness into a machine.”

“I enjoy leaving behind stories about my life for my children.”

Prediction: when someone’s mother dies in 2050, the digital mom will be “50% her.”

When a best friend dies in 2080. The digital best friend will be “80% him.”

Successive approximation, seamless integration, subtle transition.

When you can shift your own conscious perspective between you electronic and biological components, the encapsulation and transcendence of the biological may begin to feel like only growth, not death.

We wouldn’t have it any other way.

The future

- The new and emerging applications would focus on
- Expanding human cognition and communication
- Improving health and physical abilities (birth of super humans)
- Brain to machine, machine to brain interfaces
- Health implants
- Breaking physical disabilities
- Acting as barriers to communication between groups of humans
- National security
- In national security, the development of

- Uninhabited combat vehicles and surveillance, non-drug treatments for improving physical abilities, threat anticipation and response to chemical, biological, radiological and explosive warfare are a few that are likely to be dominant

Overall, the converged technology would become a far more attractive fertile ground both for fundamental research and business opportunities

The Overman

- “the advent of a new form” in relation to the same new modalities: the overman, neither human nor God, “which it is hoped, will not prove worse than its previous two forms”
- There is hope in the overhuman, this form that stems from a new play of forces located outside of the human, in the revenge of silicon over carbon, of the genetic components over the organism, of the agrammaticalities over the signifier (ibid.) Outside of the human?
- In which ways did silicon supersede carbon? How did the genetic components supersede the organism? on their own? Did the sands suddenly express a new life-force? No no no : man is still in charge, and overman is the compound form of forces in man which these new forces. Overman is the man taking charge of the animals, of the rocks (the inorganic life of silicon), of the being of language.
- Deleuze wrote, following Rimbaud, “Man who is even in charge of the animals (a code that can capture fragments from the codes.)

THE SINGULARITY –Ray Kurzweil

- We are entering a new era. “the Singularity”
- It is when Humans Transcend biology
- It’s merger between human intelligence and machine intelligence is going to create something bigger than itself.
- It’s the cutting edge of evolution on our planet. One can make a strong case that it is actually the cutting edge of the evolution of intelligence in general, because there’s no indication that it’s occurred anywhere else.
- What human beings are is a species that has undergone a cultural and technological evolution, and it’s the nature of evolution that is accelerating, and that its powers grow exponentially, and that’s what we’re talking about.
- It is in search of immortality of humans and even the globe
- The next stage of this will be to amplify our own intellectual powers with the results of our technology.

Ray Kurzweil: 2029: The Ever-Learning Society

- Learning now constitutes the primary focus of the human species.
- Human learning is accomplished using virtual teachers (and virtual libraries?).
- Learning is enhanced by widely available neural implants, which improve memory and perception but cannot yet download knowledge directly.
- Automated agents are learning, on their own without human assistance. Machines can now create significant new knowledge with little or no human intervention; unlike humans, machines easily share knowledge structures with one another.

A friend in need

- Google Home
- Alexa
- My smart phone
- Answers for everything you need
- Should you be the best doctor in town or is it enough if you know who is the best doctor in town

- Do you have to keep all info. In the brain or is it enough if you travel with or with an access to the info

Never Ending Language Learning (NELL)

- The question asked by Tom Mitchell and his team to CMU is “Humans learn many things, for years, and become better learners over time, then Why not machines?”
- Task is to acquire a growing competence without asymptote over years with multiple functions and where learning one thing improves ability to learn the next and to acquire data from humans and environment

NELL

- The inputs to NELL include
- An initial ontology defining hundreds of categories (e.g. person, sports Team, fruit, emotion) and relations (e.g. plays on team) (athlete, sports Team), plays instrument (musician, instrument) that NELL is expected to read about, and,
- 10 to 15 seed examples of each category and relation
- Given these inputs, plus a collection of 500 million web pages and access to the remainder of the web through search engine APIs, NELL runs 24 hours per day, continuously, to perform two ongoing tasks:
- Extract new instances of categories and relations.
- Learn to read better than yesterday.

NELL by Tom Mitchell and his team @ CMU

- NELL was programmed by its developers to be able to identify a basis set of fundamental semantic relationship between a few hundred predefined categories of data, such as cities, companies, emotions and sports teams. Since the beginning of 2010, the Carnegie Mellon research team has been running NELL around the clock, sifting through hundreds of millions of web pages looking for connections between the information it already knows and what it finds through its search process- to make new connections in a manner that is intended to mimic the way humans learn new information. For example, in encountering the word pair “Pikes Peak”, NELL would notice that both words are capitalized and deduce from the second word that it was the name of a mountain, and then build on the relationship of words surrounding those two words to deduce other connections.
- The goal of NELL and other semantic learning systems, such as IBM’s Watson system, is to be able to develop means of answering questions posed by users in natural language with no human intervention in the process. Oren Etzioni of the University of Washington lauded the system’s continuous learning. As if NELL is exercising curiosity on its own, with little human help”
- By October 2010, NELL has doubled the number of relationships it has available in its knowledge base and has learned 440,000 new facts, with an accuracy of 87% Team leader Tom M. Mitchell, chairman of the machine learning department of Carnegie Mellon described how NELL “self-corrects when it has more information, as it learns more”, though it does sometimes arrive at incorrect conclusions. Accumulated errors, such as the deduction that Internet Cookies were a kind of bad good, led NELL to deduce from the phrases “I deleted my internet cookies” and “I deleted my files” that “computer files” also belonged in the bad goods category. Clear errors like these are corrected every few weeks by the members of the research team and the system is allowed to continue its learning process.
- At present, NELL has accumulated a knowledge base of millions of asserted instances of thousands of different categories and relations.

IBM's Watson

- Watson is a question answering computer system capable of answering questions posed in natural language, developed in IBM's DeepQA project by a research team by principal investigator David Ferrucci.

AI 2.0: Harnessing Intelligence from many Sources

- Big Data Intelligence:
- Cross Media Intelligence
- Crowd Intelligence
- Augmented Intelligence
- UAV Intelligence

Guardian Angels and Cognition Amplifiers Augment Intelligence of Humankind

AI 2.0 Enable Guardian Angels for humankind

- A guardian Angel is a Personal Enduring Autonomic Intelligent Agent that Discovers and warns you about unanticipated Events That could impact your Safety security and Happiness
- Guardian Angels (Gats) are Examples of Use of AI 2.0 Technologies in Support of Humankind. They Use and Need.

Silicon Replacing Carbon

- Migrating from Computing Engines to Thinking Machines to Spiritual Machines

Strong Artificial Intelligence

- If we are a carbon-based complex computational collocation of atoms and we are conscious, then why wouldn't the same be true of sufficiently complex Silicon based computer –RK
- The Inevitable Birth of AI

Will Carbon come back through Graphene to help make complex man-made systems