

Artificial Intelligence & Manufacturing 4.0

S Sadagopan, IIT-Bangalore
BFW R & D Dr. Kalam Center for Innovation
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Talk summary

- Artificial Intelligence over decades
- Manufacturing over decades
- Three generations of computer networking
 - Connecting computers, connecting computers & people and
Connecting computers, people & things
- IoT, 3-D Manufacturing, Big Data, Analytics, Intelligent robots, Self-driving cars, Drones, New materials..
- Software eating the world!
- India perspective
- Some “ask” from we the academia and academic administrators
- Summary and Q&A

Artificial intelligence over the decades

- Making computers do intelligent things – play chess, answer questions, understand natural language
- Some “clever” systems appeared so promising that AI community made tall claims and got into disgrace
- Expert systems were the only “usable” products of first generation AI focused on single tasks
- First generation robots once again focused on single tasks; cameras were expensive, image processing was expensive and could not be done locally; no way to “connect” to larger “computing power”
- Natural language processing had to wait for “Web-scale learning” for usage by everyone, deep learning methods like ANN needed computational power

Yesterday's AI – ELIZA Interaction (60's)

(Program) Maybe your life has something to do with this.

- i too think so (User)

What makes you believe i too think so?

- because my indulging is spontaneous. i cannot control it

You mentioned that you love it and you are busted coz you do it so much?

- Yes

Go on, don't be afraid.

- i lost most of my precious time which had to be put into academics

Perhaps your plans have something to do with this.

- of course ,they do

Is it because of the people you hang around with that you say of course they do?

- Maybe

I need a little more detail please.

Today's AI – Allo Interaction(2016)

(User) Who is Jayalalithaa”

- Here is her profile – Jayalalithaa Jayaram former Chief Minister of Tamil Nadu was actor politician who served five terms as the Chief Minister of Tamil Nadu for over fifteen years between 1991 and 2016 (Wikipedia) (Allo)

How old was she?

- She died on December 5, 2016 at the age of 68.

Manufacturing over decades

- Use of engines, use of electricity / mass production, use of computers to use of AI / Analytics/ Big Data / Deep learning / 3-D manufacturing
- Early CAD / CAM systems introduced programmability but not generic enough
- 3-D manufacturing and additive manufacturing use the power of programmability in a more fundamental way
- Supporting functions like manufacturing planning & logistics supported by ERP & Supply Chain
- DCS, Robots and CNC/DNC remained isolated “paradises”, often expensive, inflexible and could not benefit from the “ecosystem” that supported start-ups

Three generations of computer networking

- First generation “connected computers” for better efficiency and resource utilization
- Second generation “connected computers and people” resulting in new developments – PC, Internet, WWW, e-Mail, Facebook, Twitter, YouTube and Smartphones / Tablets
- Third generation will “connect computers, people and things” leading to very interesting things unseen so far – connected homes, connected cars, connected planes, virtual reality / augmented reality games, smart homes, smart cars / trains, smart cities and a smarter planet with significant impact on the way we live, work and play
- Next generation of manufacturing has to factor in this “new age”

IoT, 3-D Manufacturing, Big Data, Analytics, Intelligent robots, Self-driving cars, Drones, New materials..

- IoT will change manufacturing the way Facebook changed our perception of computers, Internet & smartphones
- 3-D manufacturing will not only change manufacturing but also logistics, end-user design, economics of scale (mass and class manufacturing), competitiveness of industries, global trade and economics, environmental issues like global warming
- Big Data and Analytics will enable de-centralized decisions about inspection
- Intelligent robots will use AI, deep learning, analytics, image processing
- Self-driving cars use AI, big data, analytics, image processing, natural language processing
- Drones use cameras, image processing, algorithms, AI, cloud
- New materials like Gorilla glass change our perception of engineered materials

Software eating the world!

- Software changed computers – Mainframes to PC, Desktop computing, Office applications, Internet, WWW, Social media
- Software changed communications – phones to smartphones, networks (telecom and computer networks), millions of users to billions (practically every human being on the planet) on 24/7 “always on” basis
- Software “decimated” industries – office automation (fax machines, stand alone copiers, printers), analog photography / cinematography, document courier..
- Software “changed” banking, ticketing, library, banking, trading, financial services, government services (identity, certificates (birth / death/ caste / property registration), transcripts)
- Software is changing manufacturing (3-D printing), transportation (drones), commerce (e-commerce)..

India perspective

- We have good quality engineers and technicians, but everyone wants to be a “software engineer”! Everyone wants to “run away” from engineering
- We can be truly “software powered engineers” for the world
- Can we be “holistic”?
- Can organizations look beyond “services”?
- Can engineers look beyond “package”?
- Can we look beyond “cost arbitrage”?

Some “ask” from we the academia and academic administrators

- Can manufacturing thinking in India go beyond metals (new materials) and mechanical engineering (auto, aerospace, electronic, food, fine chemicals, pharma, healthcare)
- Can the discipline grow out of mechanical engineering?
- Can you leverage software-dominated, multi-disciplinary, next generation manufacturing for India (both for internal consumption and export)?

Summary and Q&A

- Manufacturing will dramatically change in scope & size
- Software will play a key role
- India opportunity is huge
- If well planned and executed, India can be a leader
- Are YOU ready?
- Any questions?

Readings

- Suzanne Berger, “Making in America” – The MIT Press, 2013
- Marc Andreessen, “Why software is eating the world”, WSJ (August 20, 2011)
- “Top 10 AI Technologies”, FORBES, Jan 23, 2017