Machines and Humans, Better Together?

Tom Coughlin, IEEE Consumer Electronics Society Future Directions Chair, IEEE Fellow (2018)

IEEE

Symbiotic Autonomous Systems (SAS)

https://symbiotic-autonomous-systems.ieee.org

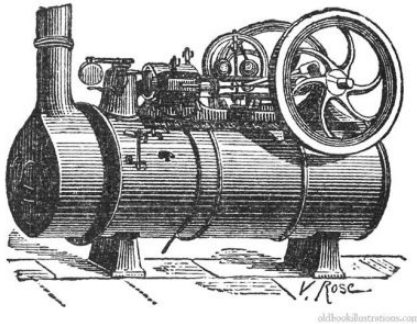
- An IEEE global effort (IEEE Future Directions Committee)
  - Involving most IEEE Societies
  - Leveraging on tens of Conferences every year
  - Steering Education Initiatives
  - Involving Industry
  - Taking the lead in Societal Impact
  - Creating a Map of the Future with
    - Technology evolution
    - Economics driver
    - Social Impact

Symbiotic Autonomous Systems (SAS) (2)

- Emergence of a new Science
  - Complex Systems
  - Converging Technologies
  - IoT and Big Data as a whole
  - Bio and Computers
  - Social Issues
  - Ethical Issues
- Symbiotic System Science - SSS
  - Augmented Humans
  - Artefacts in symbiotic relationship

A New Generation of Tools

- People have always used tools to enhance their strength, entertain themselves and others or to enhance their memory
- The next generation of tools incorporate digital technologies such as computing, communications and memory
- Declining technology costs and widespread network technology bring these technologies to everything—this is often called the IoT
- The result is that everything we make becomes a autonomous or semi-autonomous tool, a “robot”



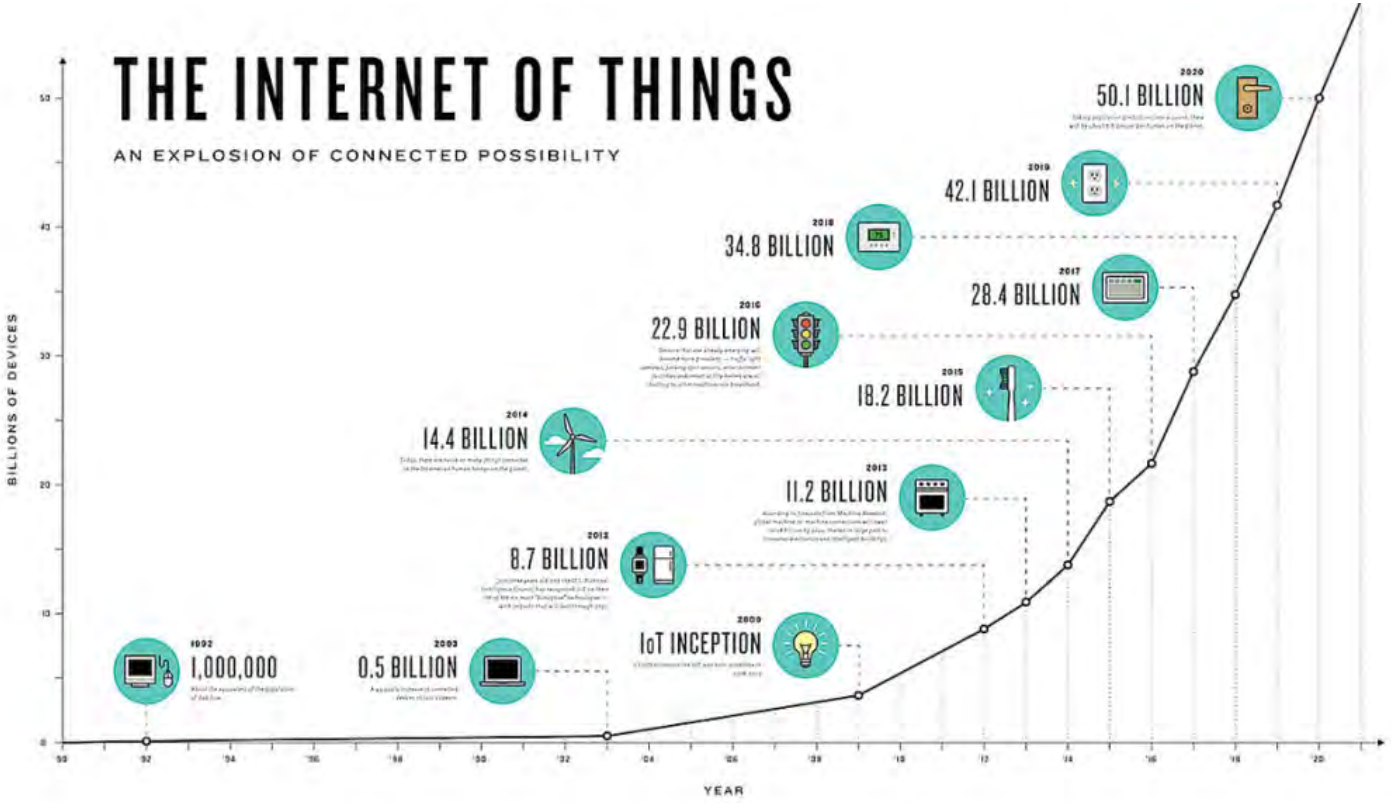


Image from NCTA, Internet and Television Association

Today's Technology

- Several interacting systems characterize complex environments
  - Smart Cities
  - Industry 4.0
  - Home IoT
- Humans, Systems, Infrastructures
- Could we see the emergence of something new
- A new meaning and approach to "control"

Credit: profresearchreports

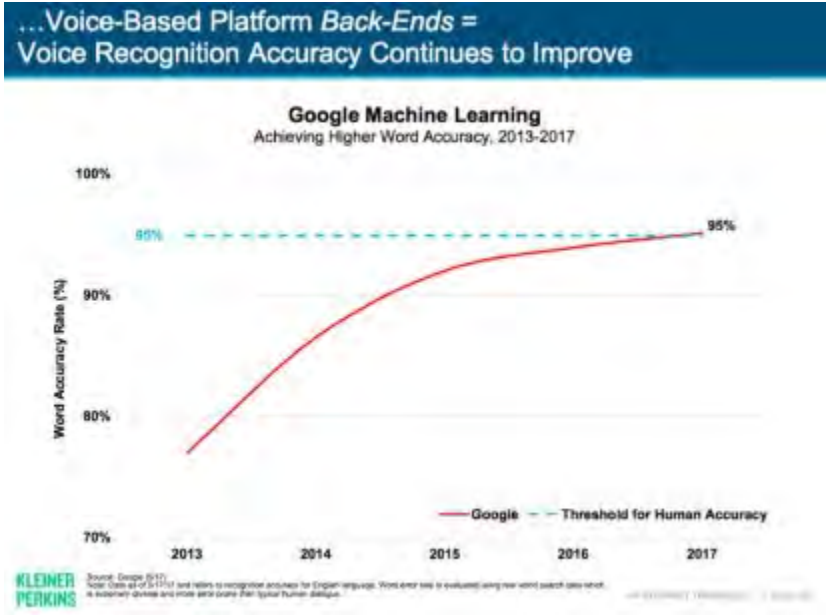
The value in most data is in its interpretation

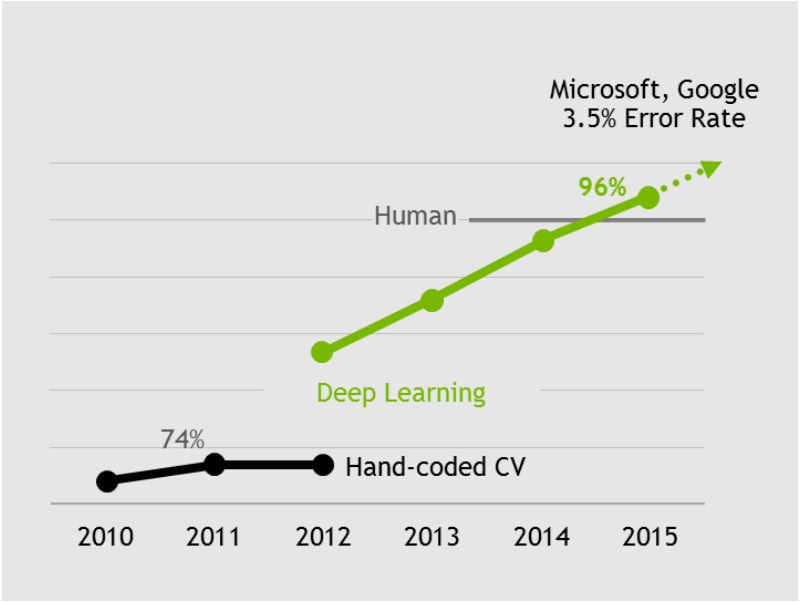
- Most data, for instance from a sensor, doesn't have long term value but does have immediate value
  - It can tell you that a processing oven in a factory is overheating and needs to be modified
  - It can be part of the information in a driver assistance system that helps provide you with a warning of a possible collision or helps park your car
- Even data that we want to keep (like photographs or videos) loses value if we don't know where it is or what it has in it
- Data wants to be processed—these processes create value from the raw data
- Faster and more accurate interpretation of data creates value

Artificial intelligence

- This is a broad term that refers to the creation of computer algorithms that can take a large amount of data and find connections and dependencies in that data
- Some of the most valuable approaches in AI involve computer programs that can learn from data that represents actual situations
- This is called machine learning
- Machine learning is behind things like IBM's Watson, self-driving cars, voice and image recognition and increasingly many applications that run on our home or personal consumer devices

Voice and Image Recognition Improvements



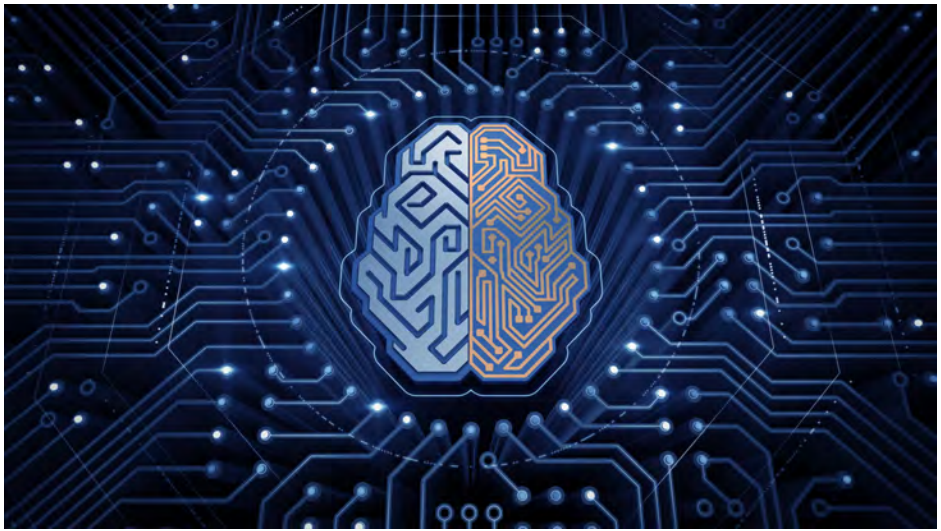


- Machine recognition abilities are matching or exceeding humans

AI and consumer interactions

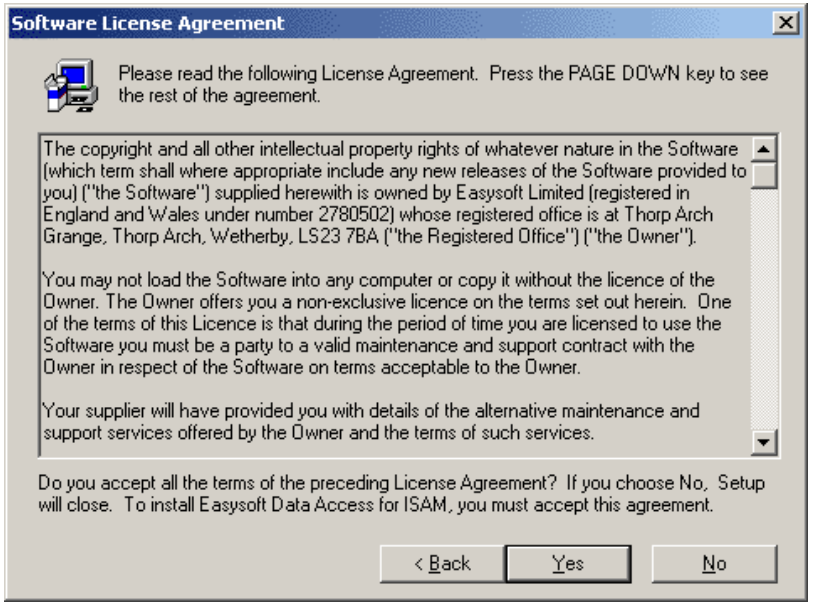
- Voice controlled devices powered by AI are in our homes and mobile devices (Alexa, Siri, Google Home)
- User authentication using AI, such as with the Apple IOS 11 image recognition, will become common
- As processing power increases in data centers and in our home and personal appliances use of AI and intelligent algorithms will increase

AI and consumer interactions (2)



- These technologies could be used to provide useful services and deep access to our own collections of data
- They also can provide data to on-line service providers to sell us things or possible even more intrusive activities

Will we own things?

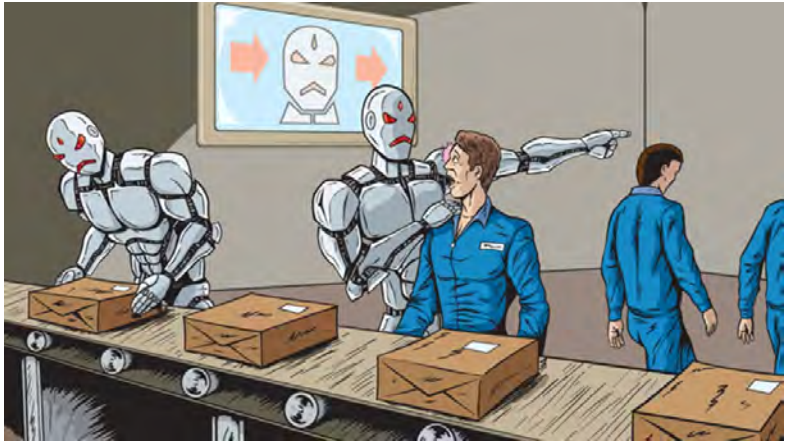


Joshua A.T. Fairfield, Owned: Property, Privacy and the New Digital Serfdom, Cambridge Univ. Press, 2017

- According to Joshua Fairfield's Owned* "courts and policy makers have struggled with how to apply property law to things they can't touch", like software
- Also copyright laws govern computer code and restricts the ability to make a copy of that code, e.g. into a computer memory
- Even though you have "bought" a digital device you can't use it unless you agree to the licensing terms
- Do you want to have to sign a software license to use your car or your house?
- Fairfield points out that this trend could lead to the end of what most of us think as ownership, and the creation of a type of digital serfdom, where nobody really owns their things

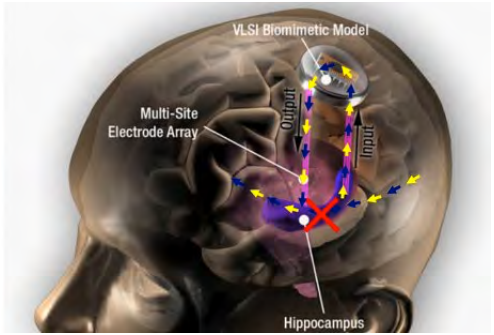
Will AI replace me?

- Some people worry that AI creates new types of automation that can do the jobs of many white collar workers and thus replace them the way that blue collar jobs have been replaced by traditional automation
- Activities that involve judgement and integration of multiple input are increasingly possible using computer algorithms
- Could an AI be a doctor, a lawyer, an engineer, a scientist?



Will AI make me better?

High Tech Racing Prostheses for leg-less runners

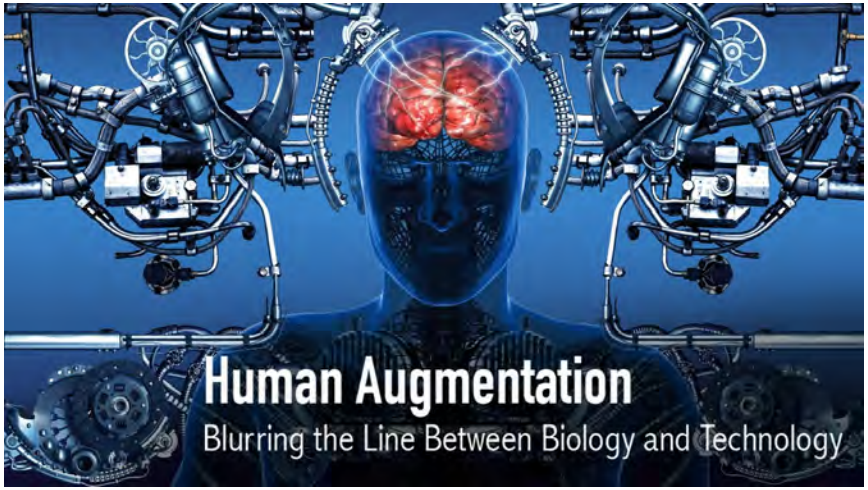


Kernal brain prosthetic to help people with memory problems. From IEEE Spectrum, 2016

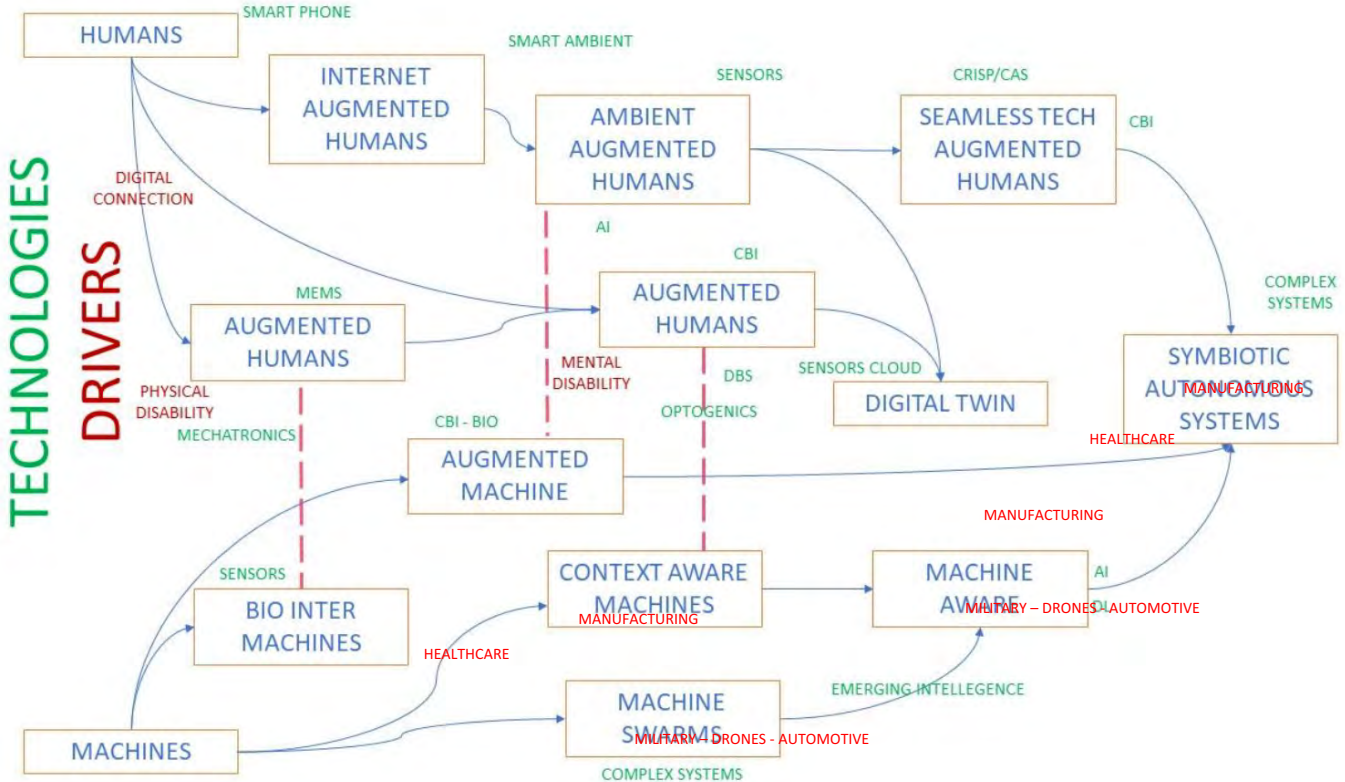
- Our mobile devices running apps allow us to plan our days, remember things and find information when we need it.
- Technology can create prosthetic devices that can help us with problems and deficiencies
- AI can be used to help us even more, e.g. to drive our cars better care for our families, etc.

Or will we become the machines?

- Some people have suggested that we will avoid being replaced by machines if we become the machines—sort of an ultimate augmentation
- This concept is often referred to as transhumanism
- This leads to a lot of philosophical questions about what is a human

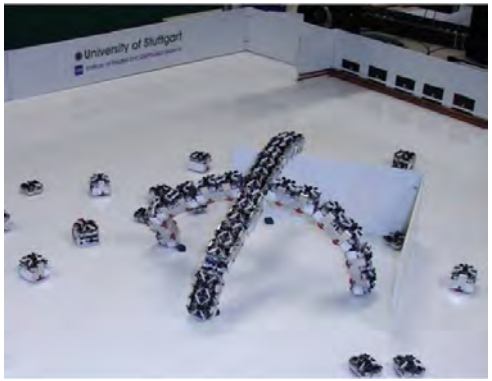


Who are we and when will they be we?

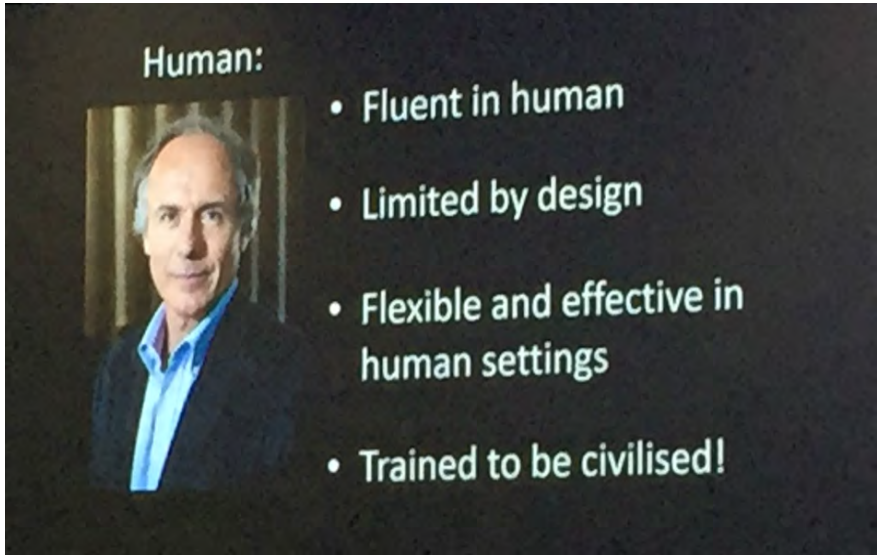


Emergence

- Self Evolving Autonomous Systems
  - Self learning
  - Decision making
  - Decision taking
  - Replication
  - Evolution
  - Consciousness?
- Autonomous Systems Interactions
  - Context interactions
  - Emergent behavior /intelligence
- Emergence of new Systems



Can machines really replace humans?



- Machines can act ”like” a human but humans are actually human
- The limitations of humans is part of the power of being a human
- Machines must live in a society of humans
- Automation provides mass-produced goods but also has enabled the rise of human crafts—e.g. microbreweries, bakeries
- We should resist the temptation to let humans dumb down—we need to be smarter than ever!
- **“you’re better than brilliant. You’re brilliantly human**.” Dr. Alan Finkel, Chief Scientist for Australia (at the 2017 IEEE Sections Congress)

Better together?

- Humans have always been tool makers
- Our robots and AI are the next level of tools
- If we raise them right, robots won't become our masters
- We could be better together
- We could be more human
- Even as some of use include more machines in our bodies
- Our AI and robots could give us more time to be human
- Truly, we live in interesting times…