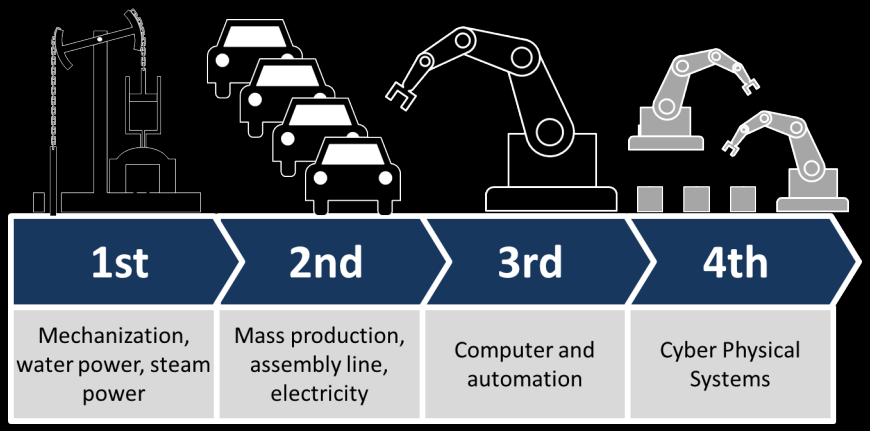
THE FUTURE OF WORK

THE FOURTH INDUSTRIAL REVOLUTION AND THE IMPACT ON MASS EMPLOYMENT

BRIEF BIO

- Lead a global research and innovation team for a 90 Billion dollar technology company
- One of the first 8 Distinguished Engineers at Cisco Systems (there are now ~60)
- 52 patents granted, ~30 pending

THE INDUSTRIAL REVOLUTION(S)

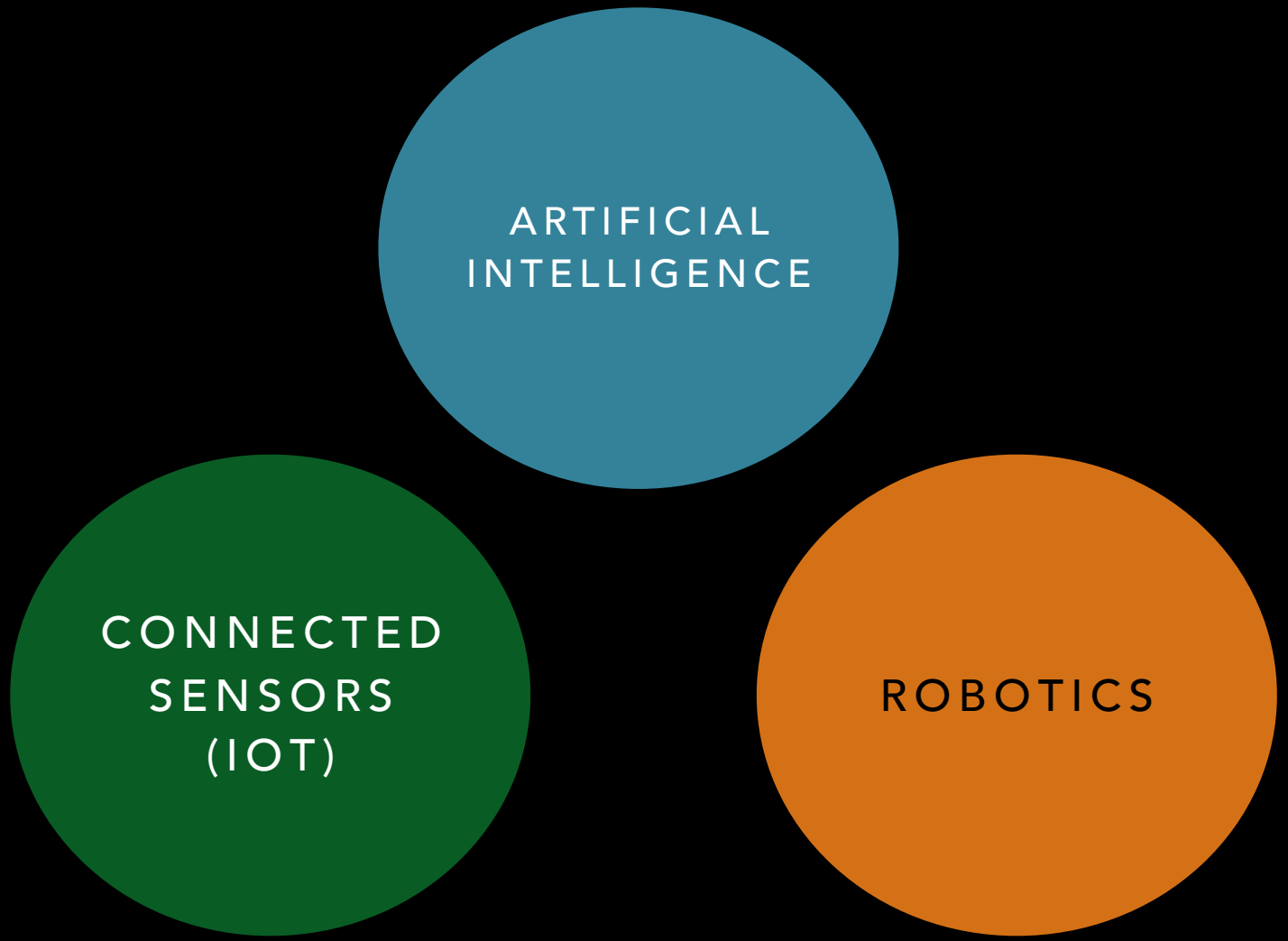


- **The 'first' industrial revolution**: 1760-1840
  - Mechanization of labor
- **The 'second' industrial revolution**: 1870-1914
  - Enhancing the machines
  - Removing spacial time / distance relationships (Trains, Ships and Telegraph)
- **The 'third' industrial revolution: 1940's-2000's**
  - Rise of the computer
  - Introducing the robots
- **The 'fourth' industrial revolution: 2000's …**
  - Connected Sensors (IoT)
  - Artificial Intelligence
  - Robotics

IMPACT OF THE PREVIOUS INDUSTRIAL REVOLUTIONS

- Economy grew, greater productivity
- Standard of living increased for ***most***
- Unemployment ***grew***…
  - Especially amongst un-skilled / under-skilled and disenfranchised people

POWERING THE FOURTH INDUSTRIAL REVOLUTION



HOW WILL WE EXPERIENCE THIS REVOLUTION?

- **Human-assist**
    - Machines and algorithms designed explicitly to make human life better
- **Human-augment**
    - Machines and algorithms that are designed to provide deeper insights to humans, allowing them to do more, faster
- **Human replacement**
    - Machines and algorithms that are designed to remove human error from work patterns or to make more efficient work patterns

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EVERYTHING IS CONNECTED (IOT)

SENSORS ARE EVERYWHERE

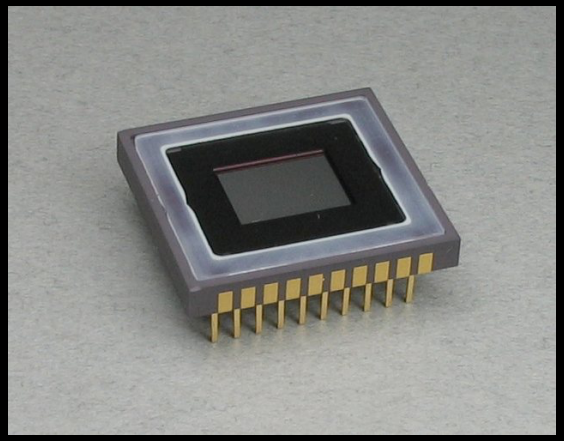
Image

BioChemical

Chemical

Mechanical

Monitoring



https://commons.wikimedia.org/wiki/File:CCD_Image_sensor.jpg

https://commons.wikimedia.org/wiki/File:Carbon_monoxide_alarm.jpg#globalusage

EVERYTHING IS CONNECTED

- Sensors are everywhere; cameras, switches, motion detection, accelerometers, etc
- Some are embedded in places you can see, some not
- All captured data *is <u>used</u> for something*, or someone to instruct an action
    - The data collected by your phone might surprise you

EVERYTHING IS CONNECTED, CONT

- Automobiles have many sensors, which will become increasingly ‘interesting’ as vehicles become connected
- The combination of the collection of data and other technologies like AI start to change the role of humans in society
    - Social ‘Credit’ systems

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ARTIFICIAL INTELLIGENCE

https://terminator.fandom.com/wiki/Skynet

ARTIFICIAL INTELLIGENCE MILESTONES

Neural Network - Imagenet

2012 AD

GPU Acceleration

2009 AD

Neural Networks

2000 AD

Academic Discipline formed -
Nilsson's Book on Learning Machines

1959 AD

Automata with Intelligence

300 BC +

People with no idea about AI saying it will take over the world:

My Neural Network:

CHIHUAHUA VS MUFFIN

- Training is an essential part of every AI system
  - Supervised - feed it to learn the pattern
  - Unsupervised - let it learn on its own
- How to select the right data to get to the right outcome?

https://cdn-images-1.medium.com/max/1600/1*SVeDXiWfTR5_1X2ct5THVA.jpeg

MACHINE / DEEP LEARNING

- Results are probabilistic, meaning the output is a ranked order of probability
- Its simpler to identify a finite amount of ‘known’ things
- When there is a lot of variability in the data, errors emerge
  - Example 1: Image recognition, Chihuahua - Muffin conundrum
  - Example 2: Image classification, Doppelgänger effect
- Understanding and uncovering bias in algorithms is challenging

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RISE OF THE ROBOTS

https://www.bostondynamics.com

ROBOTICS MILESTONES

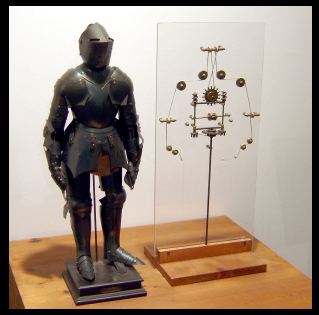
Roomba

Military Robots

Nanorobots

1961 Unimate: Devol

1937 Elektro: Westinghouse



1738 Mechanical Duck: Vaucanson

1495 Humanoid design: Davinci

~1023 BC: YAN SHI

hoto by Erik Möller. Leonardo da Vinci. Mensch - Erfinder - Genie exhibit, Berlin 2005. -

Daderot - Self-photographed

https://store.irobot.com

RISE OF THE ROBOTS

- Robots can be programmed to do most things humans can, but…
  - They don’t need sleep
  - They don’t need paychecks
  - They don’t unionize…
  - They do need some ‘care and feeding’ but 1:10 or 1:20+ is the ratio of ‘technician to robot’

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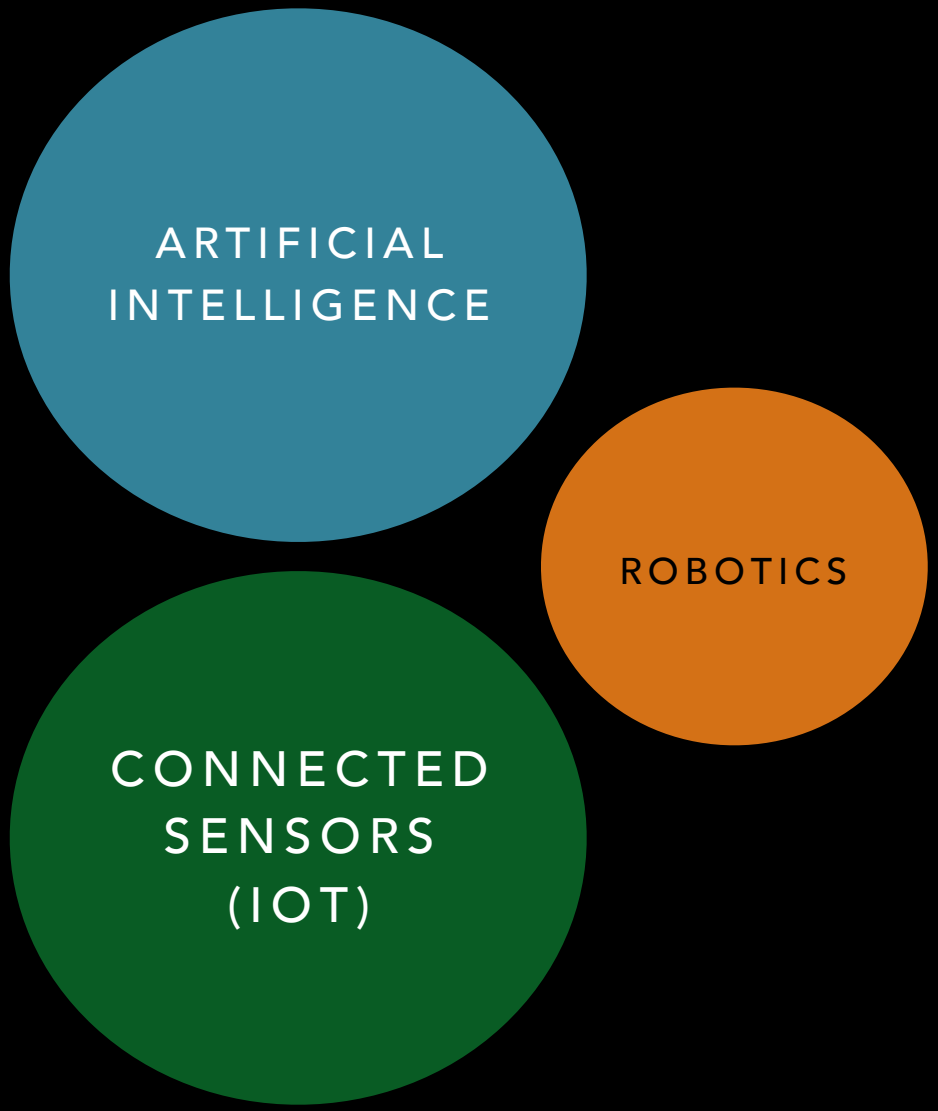
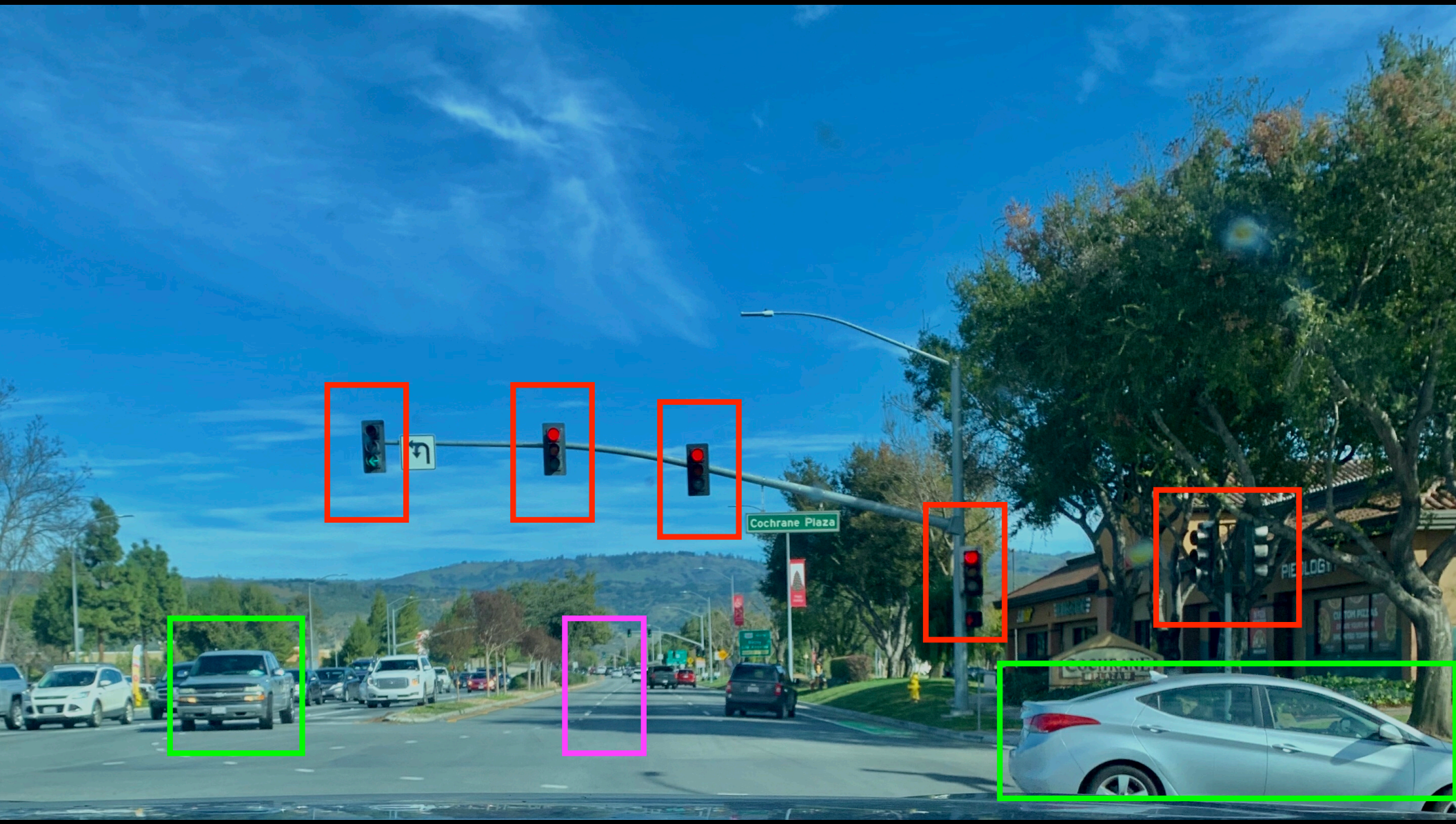
THE TECHNOLOGY INTERSECTION POINT

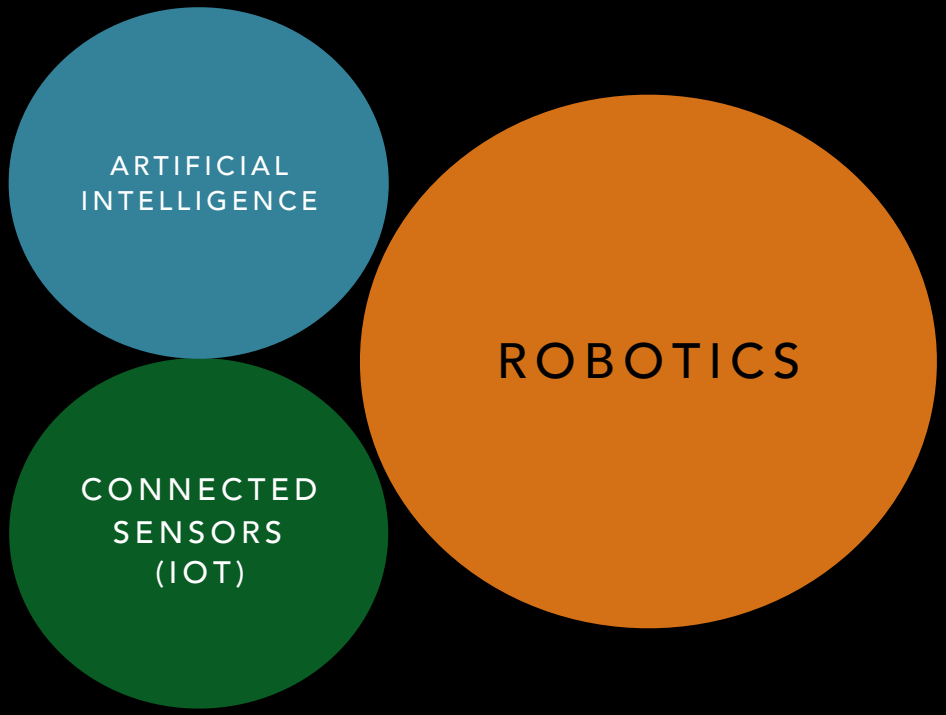
COMBINATIONS: EXAMPLE 1



- A connected car, filled with sensors
  - Uses Artificial Intelligence to drive autonomously within the lanes and defensively with other cars
  - It receives information about adverse road conditions ahead and charts a new path to the destination automatically


Cochrane Plaza

COMBINATIONS: EXAMPLE 2



Autonomous Warehouse:

- A self driving truck, delivers goods to a warehouse
- Robots scan the contents and unload the truck at the dock
- Robots takes the content into the warehouse and shelves them in the right place
- As an order is placed, other robots pick items from the shelves and pack into boxes
- Robots take the boxes to delivery trucks
- Autonomous delivery trucks deliver the packages at street level
- Drones take packages from the truck and deliver to door, once delivered the drones send delivery information back 'home'

Zero human engagement, across the supply chain. Unless the machines break, then a few technicians will address this anomaly.

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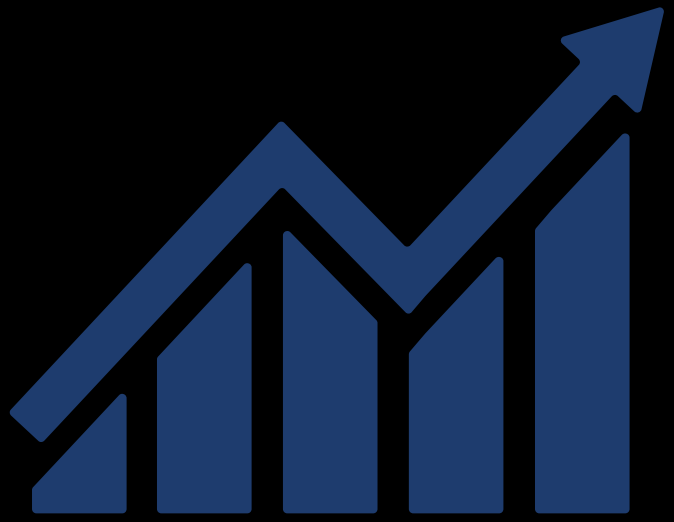
THE HUMAN ASPECT

THE BUSINESS DESIRE



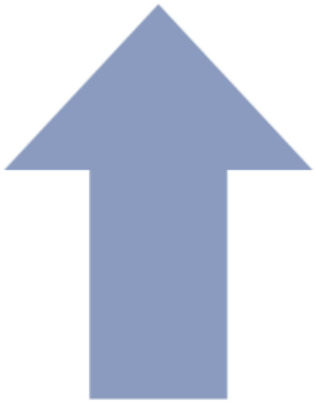
- Automated and unattended low skill (repeatable) process
    - Cheap with high quality

OR

- High skill / labor intensive processes
    - Expensive with variable quality

Table 2: Top emerging and declining jobs in the US

Top 10 emerging jobs



1. Big Data Architects
2. Automation Technicians
3. Renewable Energy Engineers
4. Automation Engineers
5. Organisational Development Specialists
6. New Technology Specialists
7. IT Administrators
8. Digital Transformation Specialists
9. IT Project Managers
10. Data Analysts (General)

Top 10 declining jobs

1. Team Assemblers
2. Secretaries and Administrative Assistants, except Legal, Medical and Executive
3. Inspectors, Testers, Sorters, Samplers and Weighers
4. Drilling and Boring Machine Tool Setters, Operators and Tenders, Metal and Plastic
5. Electrical and Electronic Equipment Assemblers
6. Milling and Planing Machine Setters, Operators and Tenders, Metal and Plastic
7. Data Entry Keyers
8. Paper Goods Machine Setters, Operators and Tenders
9. Bookkeeping, Accounting and Auditing Clerks
10. Cashiers

Sources: US Bureau of Labor Statistics and World Economic Forum's *Future of Jobs Report 2018*.

SKILLS DEMAND

Table 3: Comparing skills demand, 2018 vs. 2022, top ten

Today, 2018	Increasing, 2022	Declining, 2022
Analytical thinking and innovation	Analytical thinking and innovation	Manual dexterity, endurance and precision
Complex problem-solving	Active learning and learning strategies	Memory, verbal, auditory and spatial abilities
Critical thinking and analysis	Creativity, originality and initiative	Management of financial, material resources
Active learning and learning strategies	Technology design and programming	Technology installation and maintenance
Creativity, originality and initiative	Critical thinking and analysis	Reading, writing, math and active listening
Attention to detail, trustworthiness	Complex problem-solving	Management of personnel
Emotional intelligence	Leadership and social influence	Quality control and safety awareness
Reasoning, problem-solving and ideation	Emotional intelligence	Coordination and time management
Leadership and social influence	Reasoning, problem-solving and ideation	Visual, auditory and speech abilities
Coordination and time management	Systems analysis and evaluation	Technology use, monitoring and control

Source: World Economic Forum, *Future of Jobs Report 2018*.

MASS VS SELECTIVE EMPLOYMENT

- An example:
  - A online retailer has a massive warehouse in Tracy, CA
  - Today, it employs about 3000 employees, working 3 shifts 24/7
  - When we shift to intelligent robotics, how many will remain employed?
    - My experience says about ~30 technicians will be able to cover robot repair (given 24/7 operations)
    - What about the rest of the 2970 people?

THE FOURTH INDUSTRIAL REVOLUTION WORKFORCE

- Under-skilled workers will need to be trained new skills… but in which domains?
- Highly-skilled employees will be necessary, but there will be fewer of them.
- College or vocational schooling? Both will be necessary, but not in their current state, curriculums will need to adapt.
- The Fourth Industrial Revolution is upon us… what is the plan for the masses?

DOOM AND GLOOM OR OPPORTUNITY RICH ERA?

- It will be good for some
- It will be challenging for others
- The key to the distribution of good vs challenging will be in how we refactor the problem space:
  - Education reform
  - More accurate personal skills matching
  - Wall St and the financial cycle, shifting expectations on growth , profitability and margins

- We have to directly influence the world we want to live in and how we wish to see labor engagement and opportunity for all
- What will you do to build the world you want to see?

Thank You