Robotics

the field & its impact

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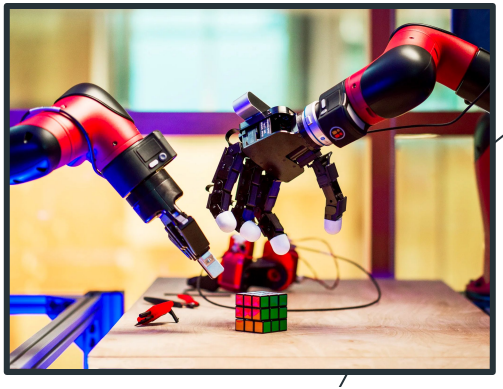
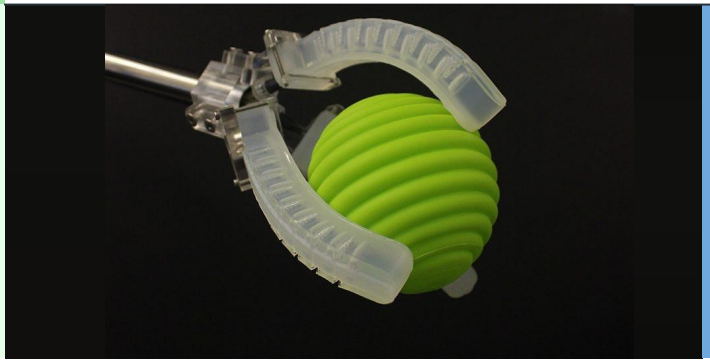
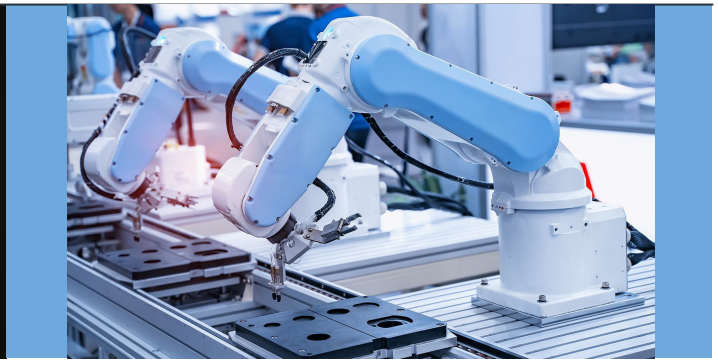
What is Robotics?

- Robotics is a combination of computer science and engineering. It deals with robots, from the creation and design to the implementation and functionality.
- But what is a robot? In essence, it's a machine that can do a sequence of tasks, usually repetitive ones with little to no human intervention.
- And the tasks these robots are programmed to carry out, are what makes the field of robotics so varied and diverse.



Robots at facebook trying to solve a Rubix Cube.

Soft Robots vs Hard Robots

	Soft Robots	Hard Robots
Properties	Easily formable	Stiff, holds more power
Materials	Cloth, silicone elastomers (polymers that have elastic properties, ex: rubber), gasses, hydraulic fluids, etc.	Steel, aluminum, plastics, iron, etc.
Usages	Human prosthetics, medical robots (will be covered), wearable robots, emergency rescue robots (will be covered), etc.	Assembly line arms, drones, Stop & Shop bots, cleaning robots, humanoid robots, etc.
Examples		

Medical Robots

- Medical robots are soft robots (as mentioned in the previous slide), which means they can travel safely through the human body without harming delicate vital organs.
- Many are small, millimeters in length, and used to traverse through narrow, hard-to-reach pathways such as the bronchi and bronchiole tubes in the lungs and perhaps even into the arteries of the brain.
- These robots could help tremendously in surgeries to give the surgeons a better image of the desired site as well as the severity of it without leaving lifelong scars in the process.
- And there's potential in the future for robot surgeons, robots who can do surgeries completely by themselves without human interference.

An experiment done at MIT of a "worm" robot and its traversal through simulated brain arteries.

Rescue Robots

Drones are often used for delivering packages, mapping the area, and giving the controller an aerial view of the terrain

- A rescue robot is designed to assist in the search for humans after a disaster. Examples of how they aid in rescue missions include but are not limited to searching nearby areas, mapping, moving/removing objects, sending supplies to those in need, evacuating the injured, and more.
- Rescue robots were used in the recognizable events of 9/11, the Fukushima-Daiichi nuclear disaster, and the Amatrice Post-Earthquake.
- The 9/11 disaster proved that when it comes to searching in destroyed terrain and gaining access to places humans and dogs can't reach, small robots are a vital piece in discovering survivors.
- During the Fukushima-Daiichi Nuclear Power Plant, when three of the six reactors melted down due to the hot fuel which burned through layers of steel walls and concrete floors, the company had to resort to using four-legged robots that can climb stairs and swim in reactors flooded with water. These quadruped robots have 3D scanners, sensors, and cameras to map the terrain, measure radiation levels, and hunt for the missing fuel.

Rescue Robots pt. II

IN ACTION Rescue robots used in the Amatrice Post-Earthquake:
TRADR UGVs (top)
DJI phantom (bottom)

- After the 6.2-magnitude Amatrice Earthquake, which sadly caused 234 deaths, the goal of the mission was to use robots to provide 3D textured models of the interior and exterior, which are then used to assess the damage done and plan future operations. They sent in multiple drones to achieve this, each equipped with video cameras and sensors.
- There are 3 types of robots mainly used in disaster relief missions: aerial (UAV; used to observe the situation of the affected areas; common components include cameras, lasers and/or radar sensors; AKA drones), ground (UGV; used to enter inclosed spaces to search for survivors), and marine (UMV).
- Currently scientists are working to create a system where each robot is able to communicate with others nearby to share its findings and maximize efficiency. Communication is essential, especially for aerials, whose observed areas should not overlap so as to be able to search over a larger range.

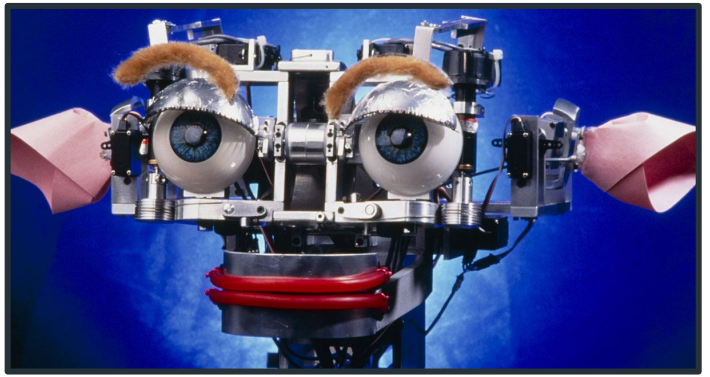
Social Robots ??!!

Social robots are built to communicate with humans and other robots in a way where both parties can be understood. They're primarily used to interact with customers, but they're also used for companionship (such as social engagement with the elderly), therapy treatments, and more.

Examples:

- ➔ TICO -> a robot used primarily in the education field; developed to increase children's motivation.
- ➔ Robear -> able to lift up to 80 kg, this nursing care robot is used to lift patients from beds and into wheelchairs.
- ➔ Kismet -> a robot that is designed to understand and show emotion when interacting with humans.
- ➔ Bandit -> a robot designed to help children with autism, motivate the elderley to exercise, and provide therapies to stroke patients
- ➔ Jibo -> a robot designed to assist all ages in school and healthcare. Jibo displays a wide range of emotions with the intent of forming emotional connections with humans.

TICO (top) and Kismet (bottom) are social robots



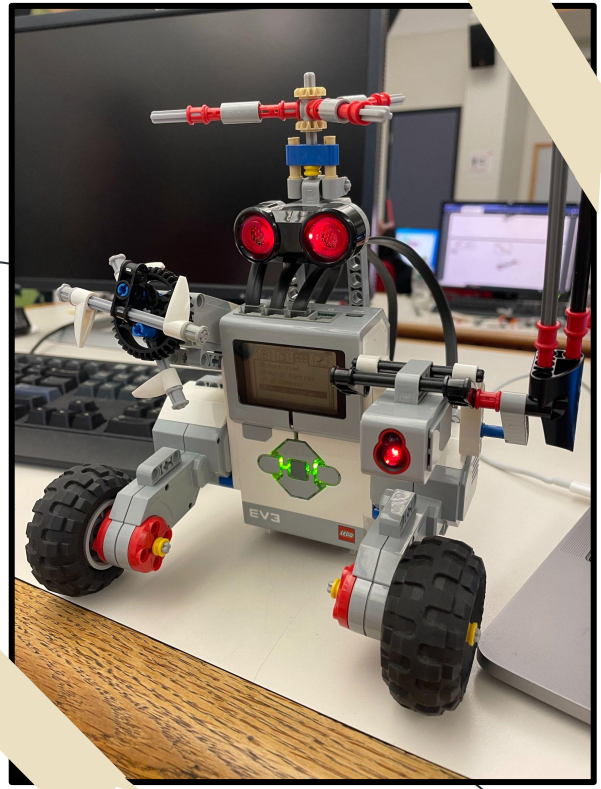
Why? Are robots really worth investing our futures into?

Advantages	Disadvantages
Can complete tasks efficiently	They have to be designed to meet exact requirements
Can go into places that humans are unable to	They do not have the same judgment that humans do
Can have a level of accuracy & precision higher than human capabilities	They can be difficult to program and are limited to what they are programmed for
Their work is very consistent	They might leave people unemployed because they fill in too many jobs
Can give humans useful data that might be hard to acquire	They can create large class divides

The Origin of Robots

- Robots actually originated in literature from a play in the 1920's made by Karel Čapek
- "Robot" comes from a Czech word that means forced labor, drudgery, and hard work
- Robots were not like the robots we think of today, and were used to manufacture products
- The first robot was made in 1954 by an inventor in Kentucky

A photo from the RUR play (Top left). A poster for the RUR play (Right), and Unimate (Bottom left)



A picture of Child, a lego mindstorm robot we made :)

LEGO Mindstorm

The kit contains an NXT brick (the “head” of the robot; used to program the robot and provide the power and control), three electrical motors: two large motors and one medium motor, as well as five sensors: one color sensor, two touch sensors, one ultrasonic sensor, and one gyro sensor (for angular velocity). It also includes seven cables to connect each electrical component to the NXT brick and one USB cable.

QUIZ TIME!

Question 1

What is a robot?

A machine that can execute tasks with little to no human intervention	A kind of goldfish
A human-controlled machine that can assist humans in many different fields	A machine or algorithm that can be used to assist humans

Question II

What kind of robot would you use for surgeries?

Hard	Industrial
Personal	Soft

Question III

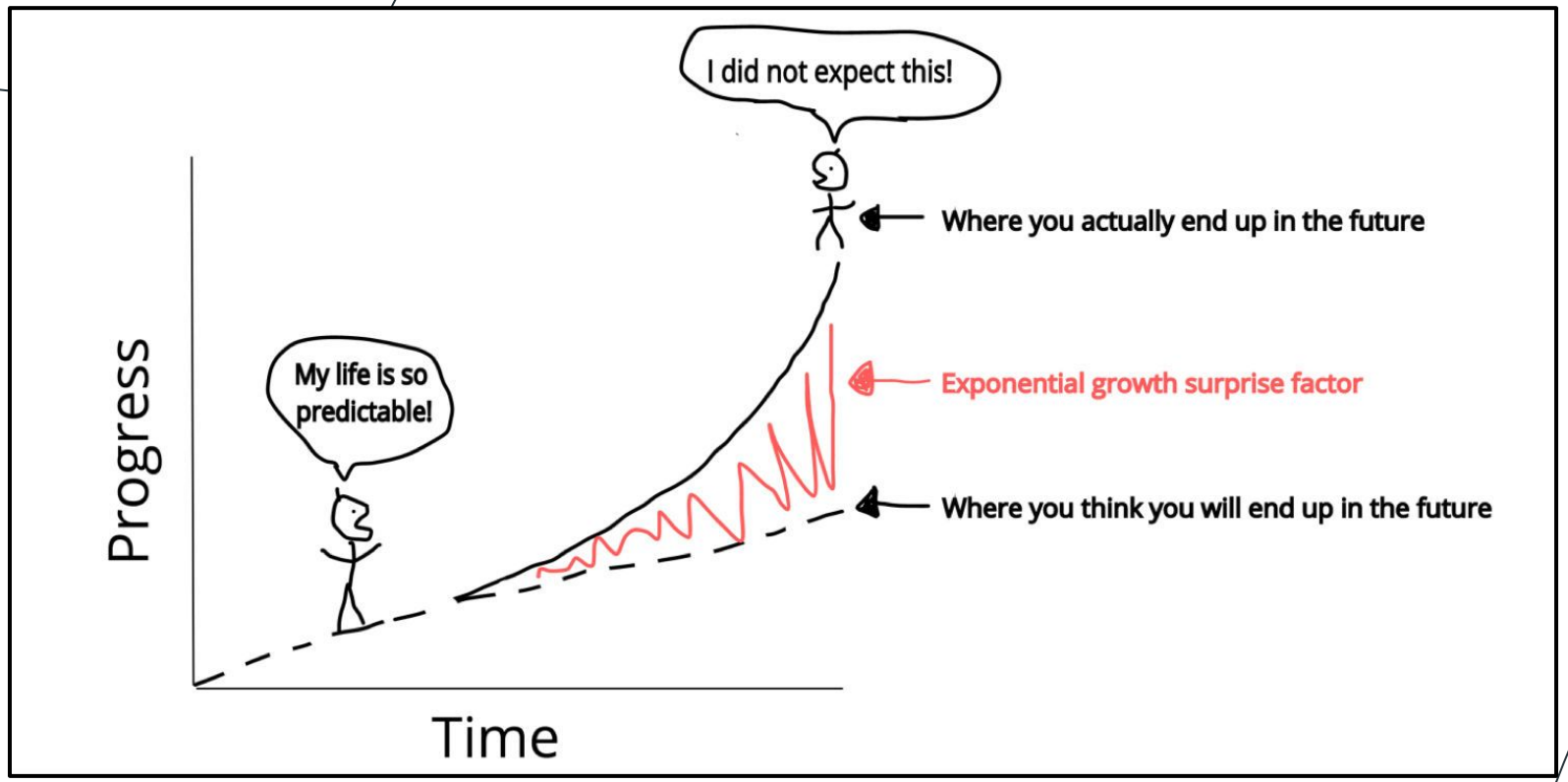
What kind of robot would you use in a factory?

Soft	Hard
Social	Rescue

Question IV

As of 2022, what percentage of women work in robotics?

0-20%	21-40%
41 - 60%	60-100%


I did not expect this!
Where you actually end up in the future
Exponential growth surprise factor
Where you think you will end up in the future
My life is so predictable!
Progress
Time

QUESTIONS???

Resources

Links

- The Legacy of 9/11 for Disaster Robotics
- Robots come to the rescue after Fukushima Daiichi nuclear disaster - 60 Minutes - CBS News
- The Rise of Social Robots: How AI Can Help Us Flourish
- 50 Interesting Robot Facts You Should Know - Facts.net
- What is social robot? - Definition from WhatIs.com
- Bandit - ROBOTS: Your Guide to the World of Robotics
- https://jibo.com/
- Check Out These 11 Weird Robots That Make Us Laugh, Cringe, and Say 'Whoa'
- The Mars Rovers | NASA Space Place – NASA Science for Kids
- Deployment of ground and aerial robots in earthquake-struck Amatrice in Italy (brief report) | IEEE Conference Publication
- Rescue Robotics: An Introduction | iRevolutions

Images

- https://media.wired.com/photos/5cdef92d38916b321aa0c474/master/pass/Facebook-Robots-00.jpg
- https://www.therobotreport.com/wp-content/uploads/2018/03/Soft-Robotic-Gripper-Square-e1519826771367.jpg
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