



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Introduction to ML

Lecture 0: Course Introduction

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Prerequisites and Preparation

- Recommended preparation: basic probability, statistics, linear algebra, calculus, optimization.
(Math alert!)
- Experience in Python programming languages

What we will learn in this course

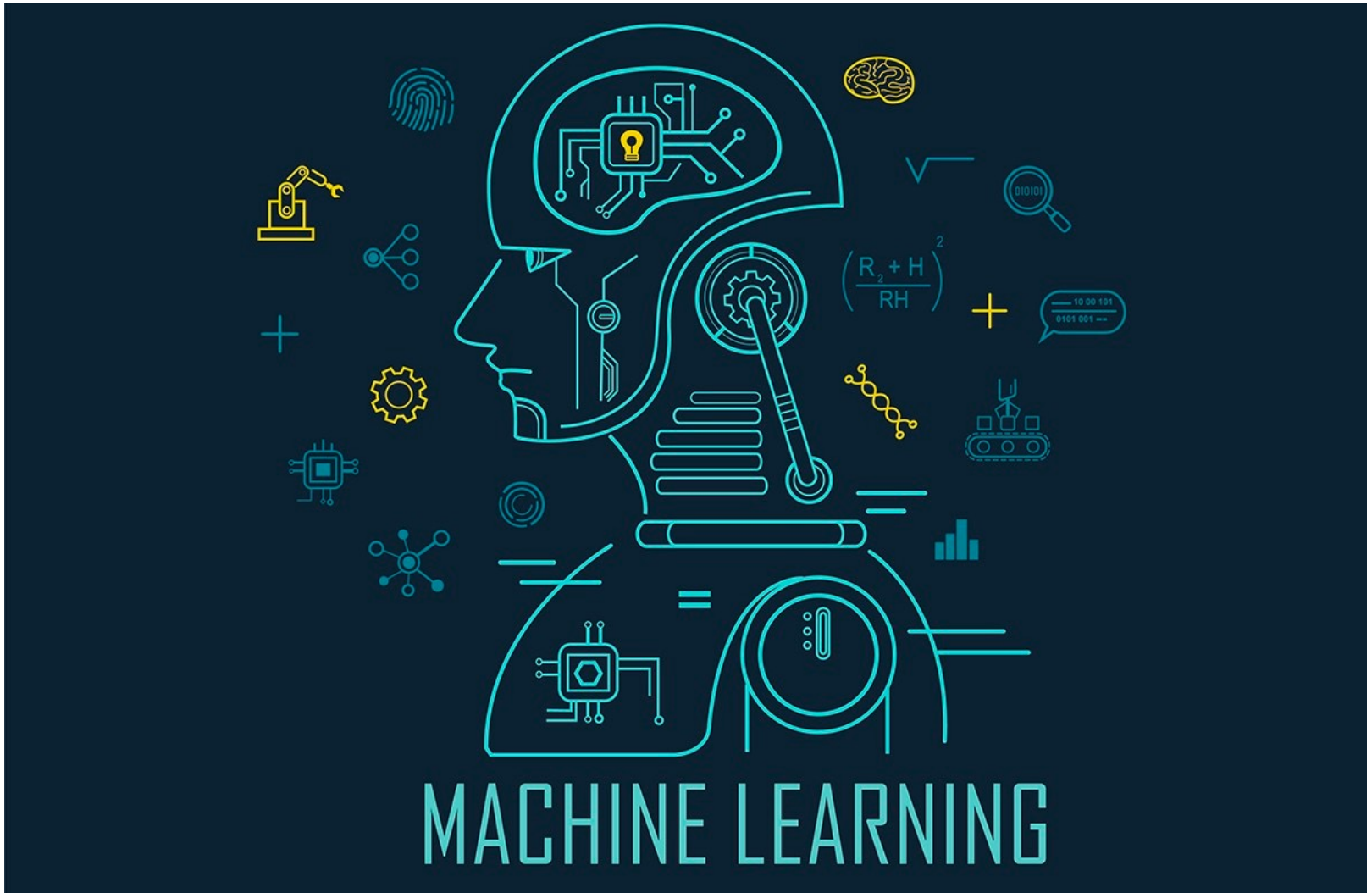
- Basic ML concepts and techniques
- Fundamentals about machine learning (easy! math involved)
- Basics of neural networks and deep learning
- A bit about ML in computer vision applications (computer vision is the best testbed for ML)
- Attention: we **do NOT** teach how to build ChatGPT yet, you will learn it in my next course, but you can try 😊

Goals

By the end of the course,

- Be an expert in ML (understand the internals of ML algorithms)
- Be able to build ML applications (know which algorithms to use when)
- Be able to start ML research (read research papers)

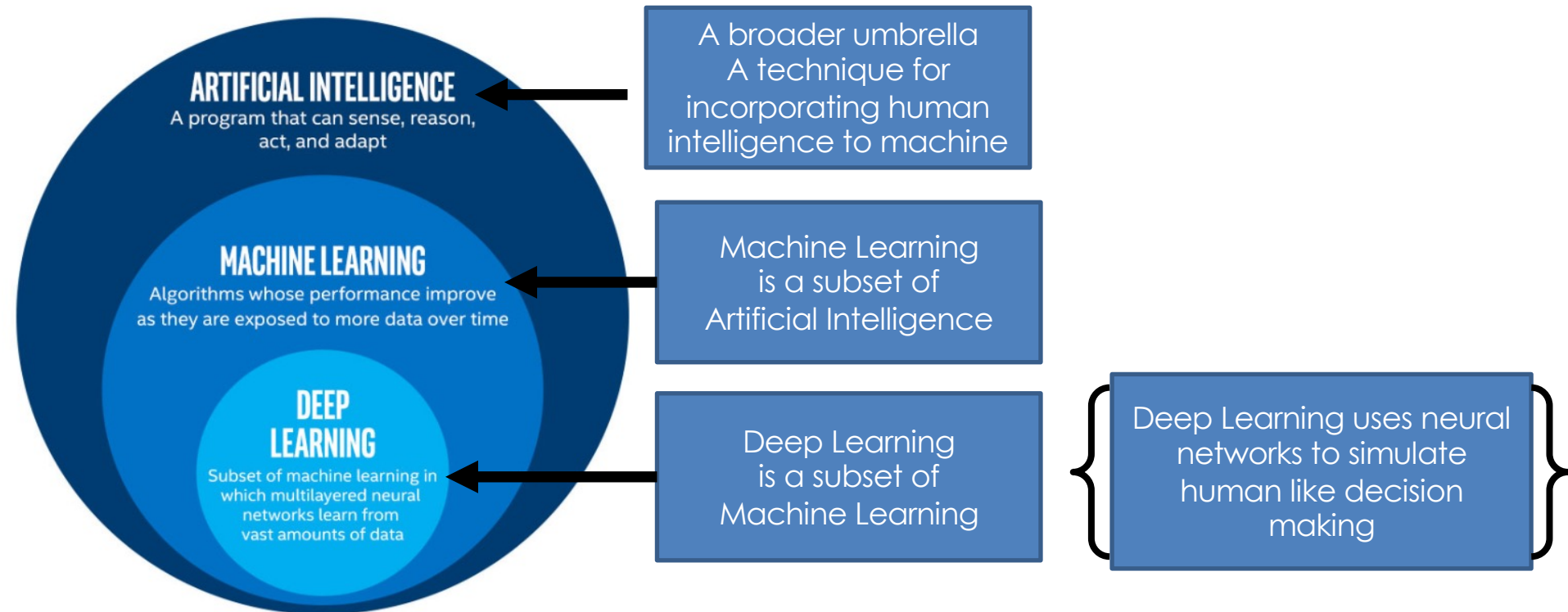
Lecture 2: Introduction to ML



Source: <https://www.smaartt.com/knowledge/wp-content/uploads/2020/05/CX2.jpeg>

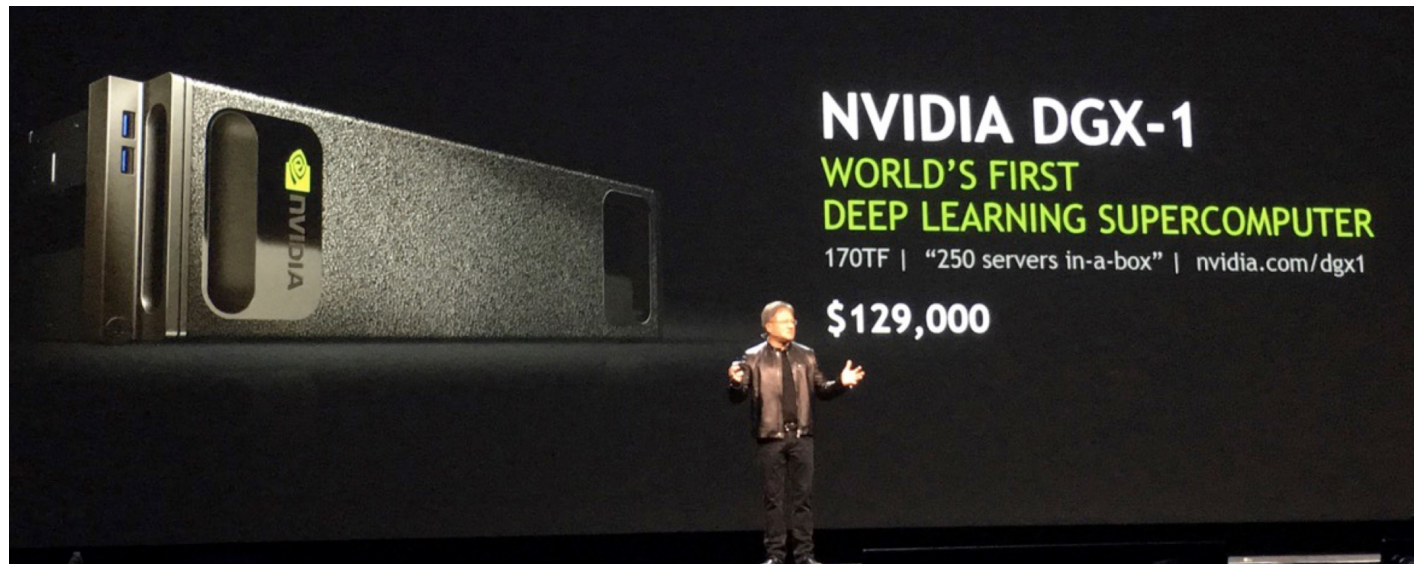
What is ML?

- Now we know the general concept of AI, so what is machine learning (ML) then?



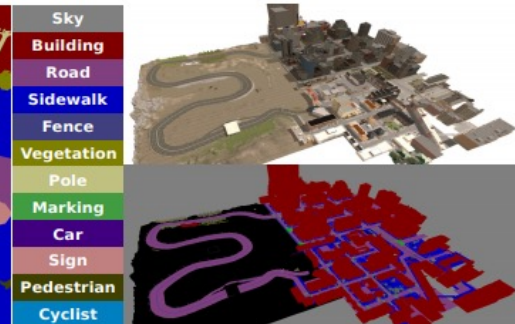
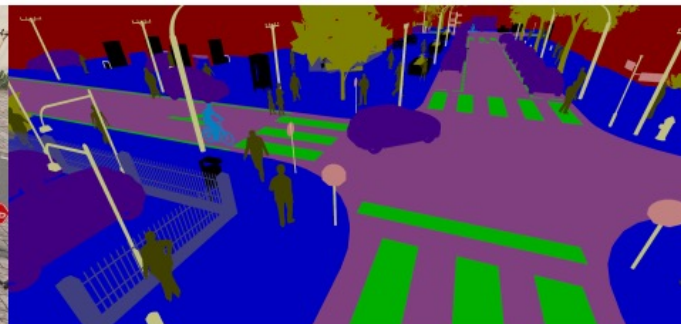
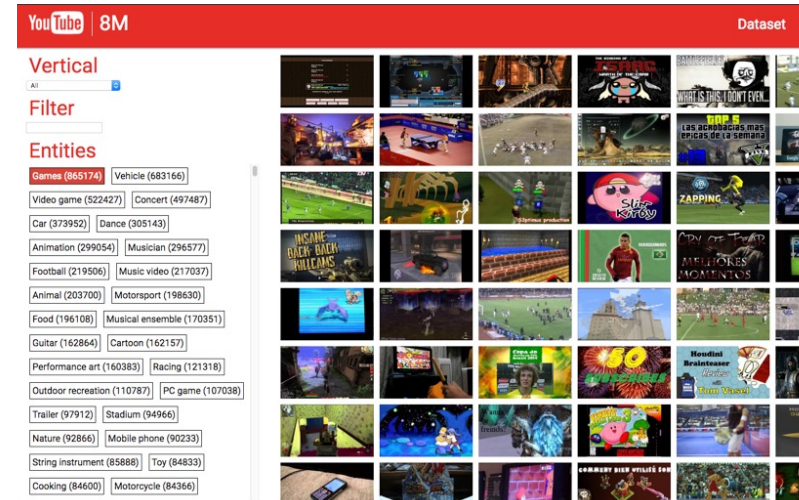
What accounts for recent successes in AI/ML?

- Faster computers
 - The IBM 704 vacuum tube machine that played chess in 1958 could do about **50,000 calculations per second**
- Powerful GPUs – highly parallelism



What accounts for recent successes in AI/ML?

- Big data and Crowdsourcing (labeled datasets)



ML applications



Computer vision

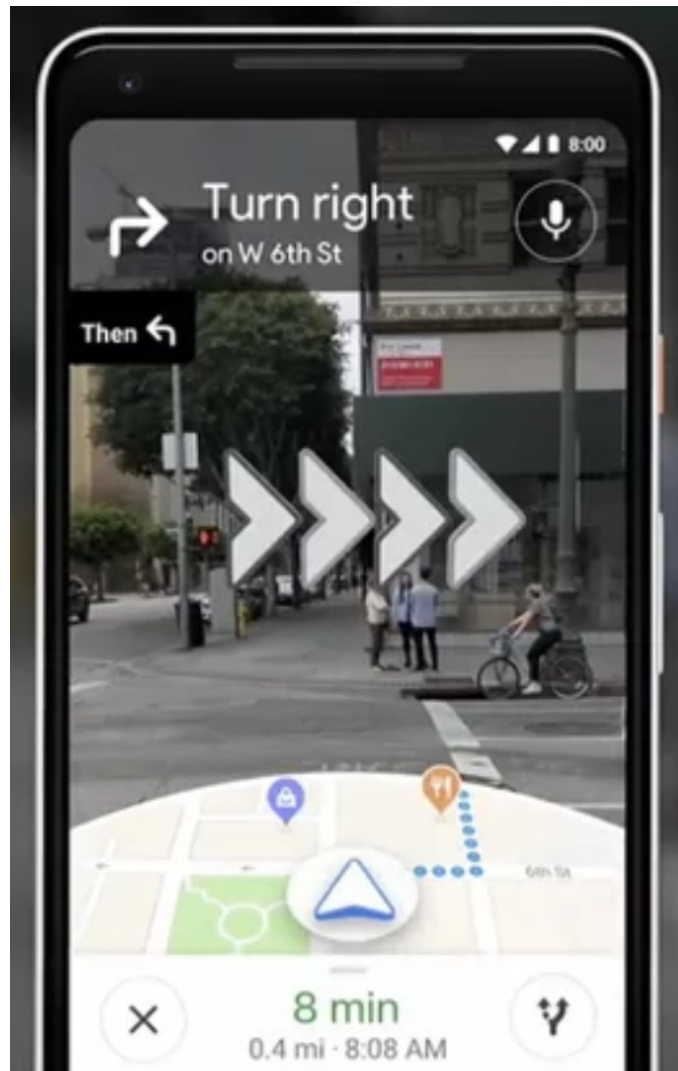


- Facebook accessibility tools for the visually impaired



Technology behind Snapchat lenses

Computer vision



Speech and natural language



Skype Translator

Break down the language barrier with your friends, family and colleagues.

Our online translator can help you communicate in 7 languages for voice calls, and in more than 50 languages while instant messaging.

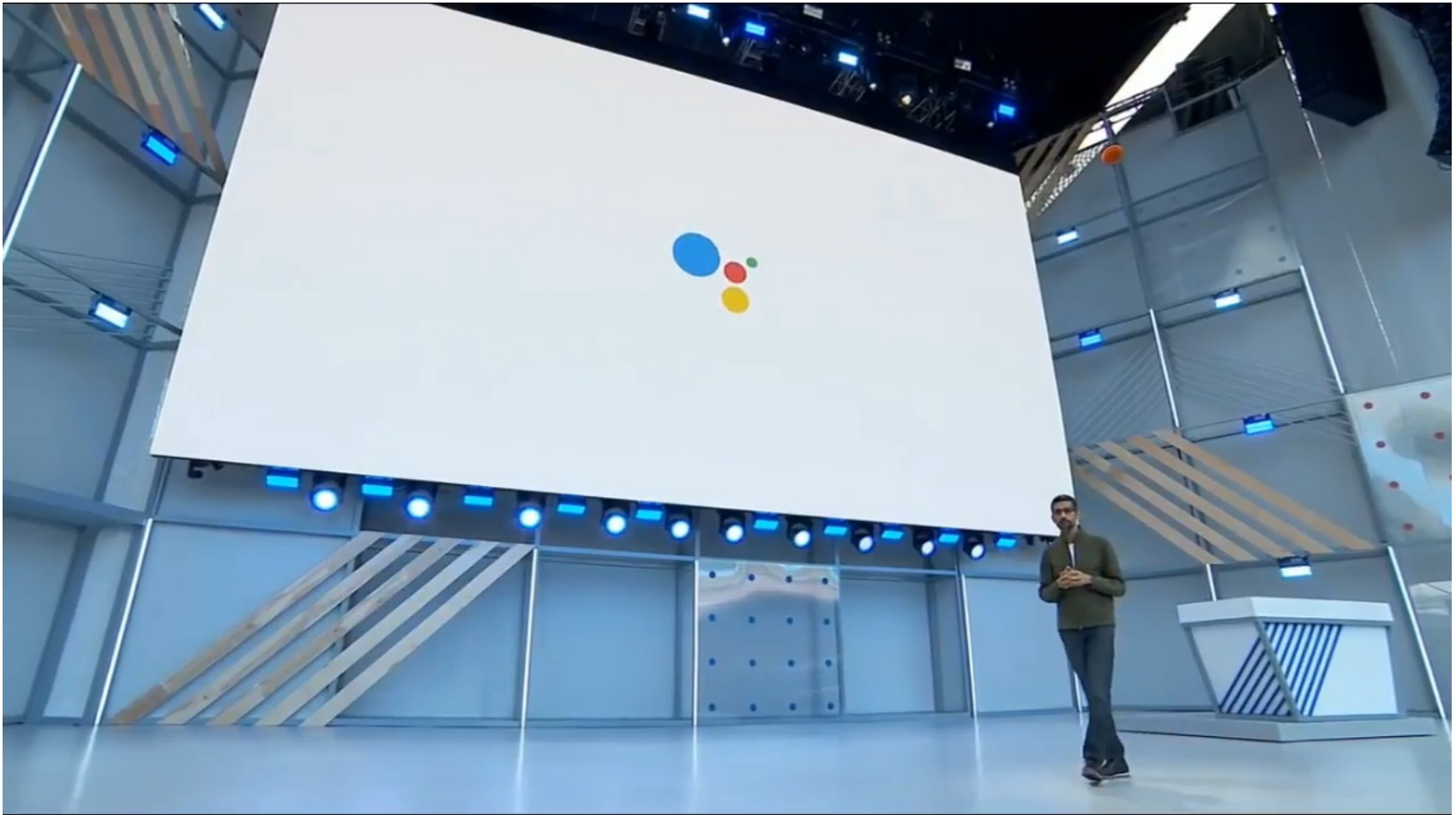
Skype Translator uses machine learning. So the more you use it, the better it gets. Thanks for being patient as the technology graduates from Preview mode.



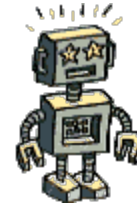
Google Translate App

- Translate between 103 languages by typing
- Offline: Translate 52 languages when you have no Internet
- Instant camera translation: Use your camera to translate text instantly in 30 languages
- Camera Mode: Take pictures of text for higher-quality translations in 37 languages
- Conversation Mode: Two-way instant speech translation in 32 languages
- Handwriting: Draw characters instead of using the keyboard in 93 languages

Speech recognition and natural language processing (NLP)



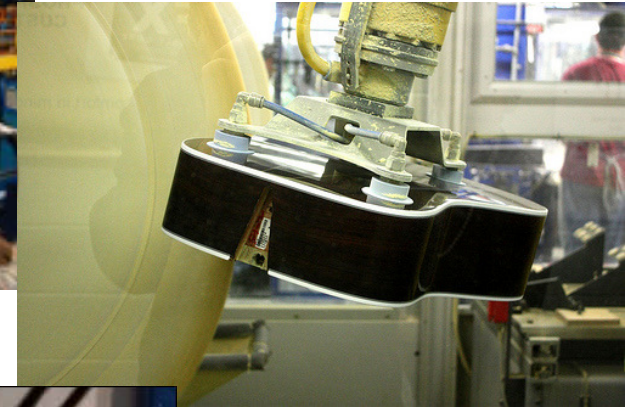
Robotics and ML



- Areas that robots are used:
 - Industrial robots
 - Military, government and space robots
 - Service robots for home, healthcare, laboratory
- Why are robots used?
 - Dangerous tasks or in hazardous environments
 - Repetitive tasks
 - High precision tasks or those requiring high quality
 - Labor savings
- Control technologies:
 - Autonomous (self-controlled), tele-operated (remote control)

Industrial Robots

- Uses for robots in manufacturing:
 - Welding
 - Painting
 - Cutting
 - Dispensing
 - Assembly
 - Polishing/Finishing
 - Material Handling
 - Packaging, Palletizing
 - Machine loading



Military/Government Robots

- iRobot PackBot



- Remotec Andros



Credit: Lee Giles

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Space Robots

- Mars Rovers – Spirit and Opportunity
 - Autonomous navigation features with human remote control and oversight



Service Robots

- Many uses...
 - Cleaning & Housekeeping
 - Humanitarian Demining
 - Rehabilitation
 - Inspection
 - Agriculture & Harvesting
 - Lawn Mowers
 - Surveillance
 - Mining Applications
 - Construction
 - Automatic Refilling
 - Fire Fighters
 - Search & Rescue



iRobot Roomba vacuum
cleaner robot

Medical/Healthcare Applications

DaVinci surgical robot by Intuitive Surgical.

St. Elizabeth Hospital is one of the local hospitals using this robot. You can see this robot in person during an open house ([website](#)).



Credit: Lee Giles

Japanese health care assistant suit (HAL - Hybrid Assistive Limb)

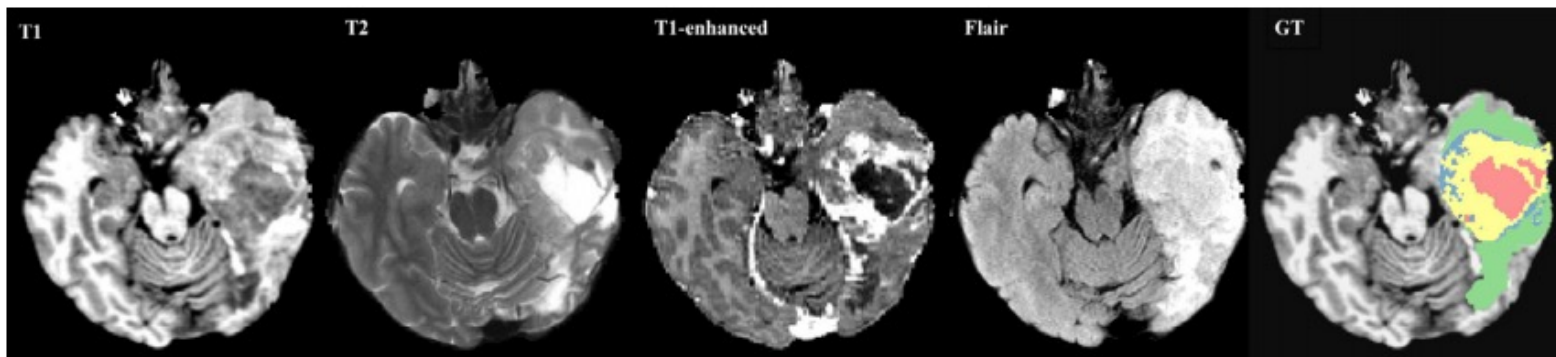


Also... Mind-controlled wheelchair using NI LabVIEW

Medical/Healthcare

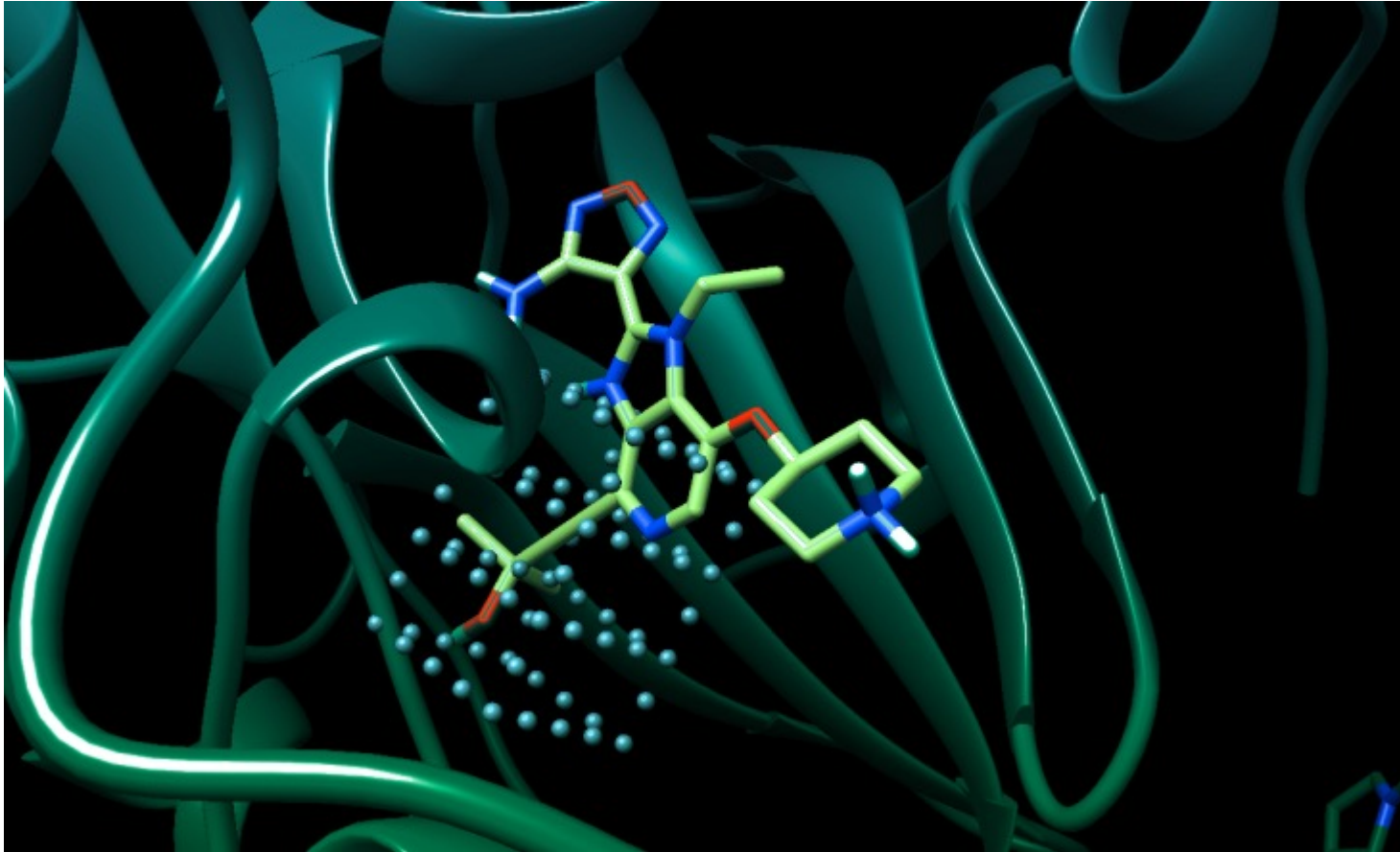


AI beats human pathologists at detecting cancer



Medical/Healthcare

Drug discovery



[Atomwise](#), which uses deep learning to shorten the process of discovering new drugs

Autonomous vehicles

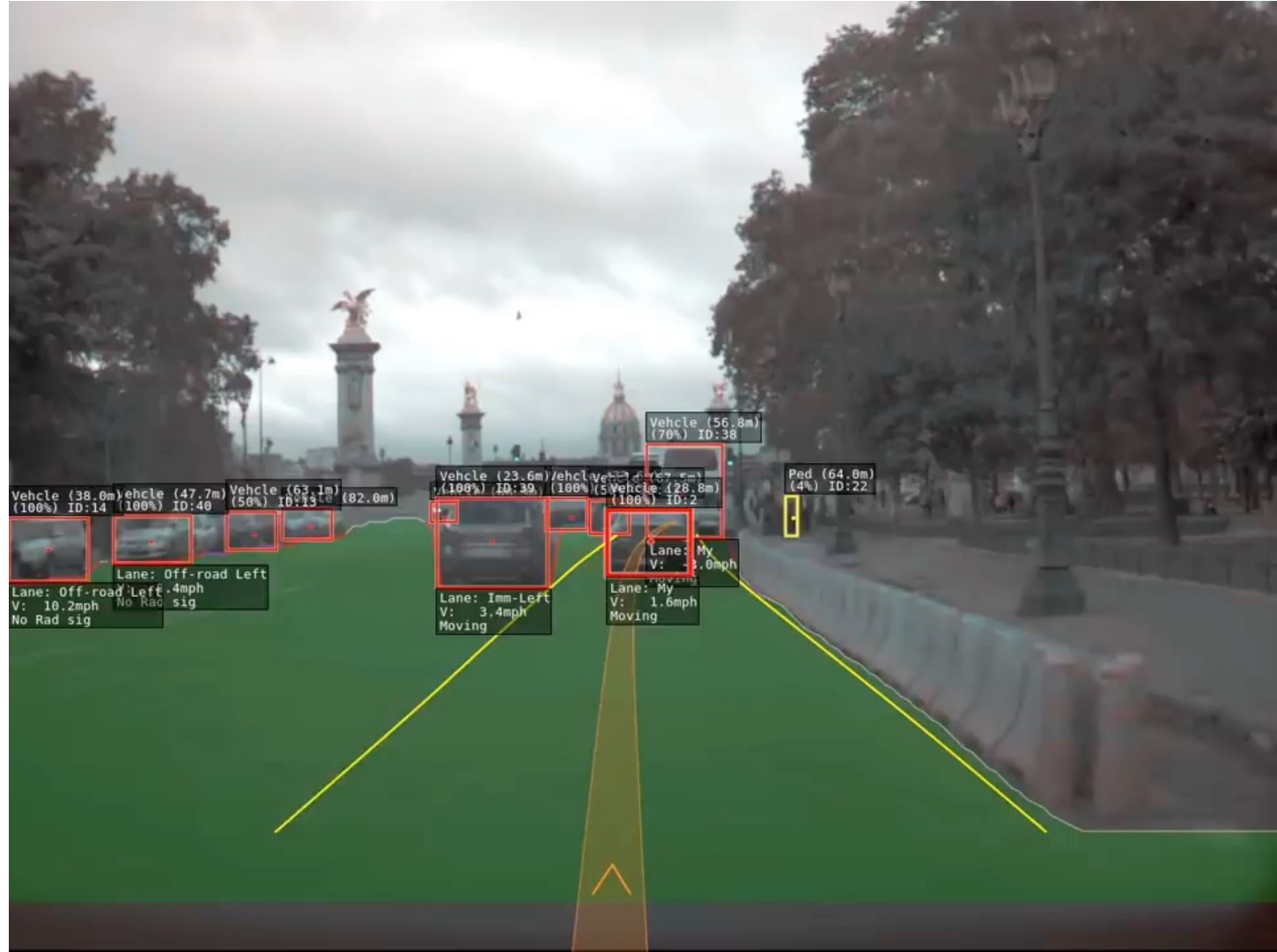
- First challenge in 2004
- 150 miles off-road course in the Mojave desert
- Given a set of GPS “breadcrumbs”, vehicles were required to drive 100% autonomously
- \$1M Prize, authorized by congress to the fastest team



Credit: Stephen Welch



Tesla is getting very impressive results from only camera + radar sensors, leveraging **large labeled datasets** and **deep learning**.



Credit: Stephen Welch

Game



OpenAI defeating Humans at 'Dota 2'

Other applications

- Security (e.g., cybersecurity)
- Education
- Music
- Virtual assistant
- Sales
-

Much more!

100 STARTUPS USING ARTIFICIAL INTELLIGENCE TO TRANSFORM INDUSTRIES

CONVERSATIONAL AI/ BOTS



VISION



AUTO



ROBOTICS



CYBERSECURITY



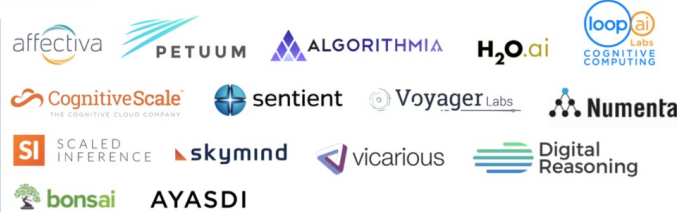
BUSINESS INTELLIGENCE & ANALYTICS



AD, SALES, CRM



CORE AI



HEALTHCARE



THE
INNOVATION
SUMMIT

CBINSIGHTS

TEXT ANALYSIS/ GENERATION



IOT/IIOT



COMMERCE



FINTECH & INSURANCE



OTHER



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Questions?

