

CMP 414 & 765

Artificial Intelligence

with Machine Learning

• LIANG ZHAO

• LEHMAN COLLEGE

CITY UNIVERSITY OF NEW YORK

• Fall 2022

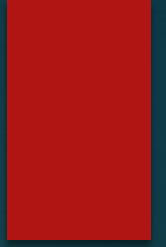
Scope of This Course

- ▶ Artificial Intelligence: A program that can sense, reason, act, and adapt
- ▶ **Machine Learning: A subset of Artificial intelligence, where program is guided by algorithms whose performance improve as they are exposed to more data over time**
- ▶ Deep Learning: Subset of machine learning in which deep neural networks are used to learn from large volume of data

Not included:

- Creating AI programs in computer games
- Designing StarWars-type robots

Why machine learning?



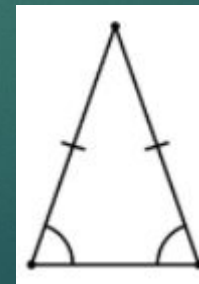
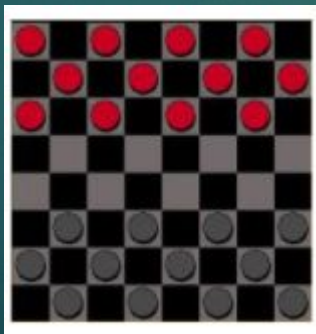
- ▶ 1950's: Can we make computers as smart as human?
- ▶ 2019: Can computers discover patterns from data?

Data:

- ▶ Numerical data
- ▶ Images
- ▶ Sound
- ▶ Text
- ▶ Time Series

1950's: Birth of AI

- The name **artificial intelligence** was created in 1956.
- Goal: to build a system that could capture every aspect of intelligence.
- Computer science was in its infancy. People were ambitious.
- 1952: Samuel's program plays checkers at strong amateur level.
- 1955: Programs can prove geometric theorems.



1960's: First AI Winter

- “Machines will be capable, within twenty years, of doing any work a man can do.” - Herbert Simon
- “Within 10 years the problems of artificial intelligence will be substantially solved.” - Marvin Minsky
- “I visualize a time when we will be to robots what dogs are to humans, and I’m rooting for the machines.” - Claude Shannon

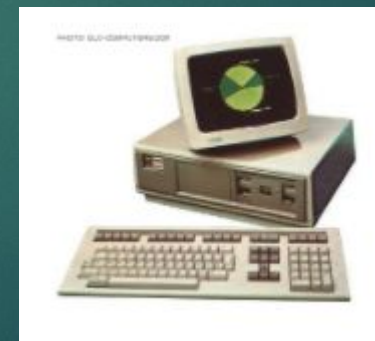
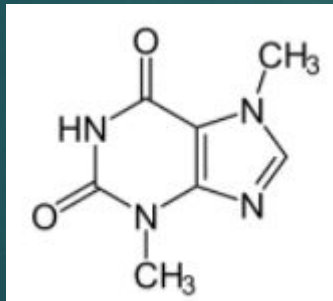
In 1966, the U.S. government stopped funding for machine translation, the most anticipated AI project at the time.

- Limited computation
- Limited information

1970 - 80's: Expert System

AI researchers looked to represent experts' knowledge with a set of computer-executable rules.

- DENDRAL: infer molecular structure from mass spectrometry
- MYCIN: diagnose blood infections, recommend antibiotics
- XCON: convert customer orders into parts specification



1990's Second AI Winter

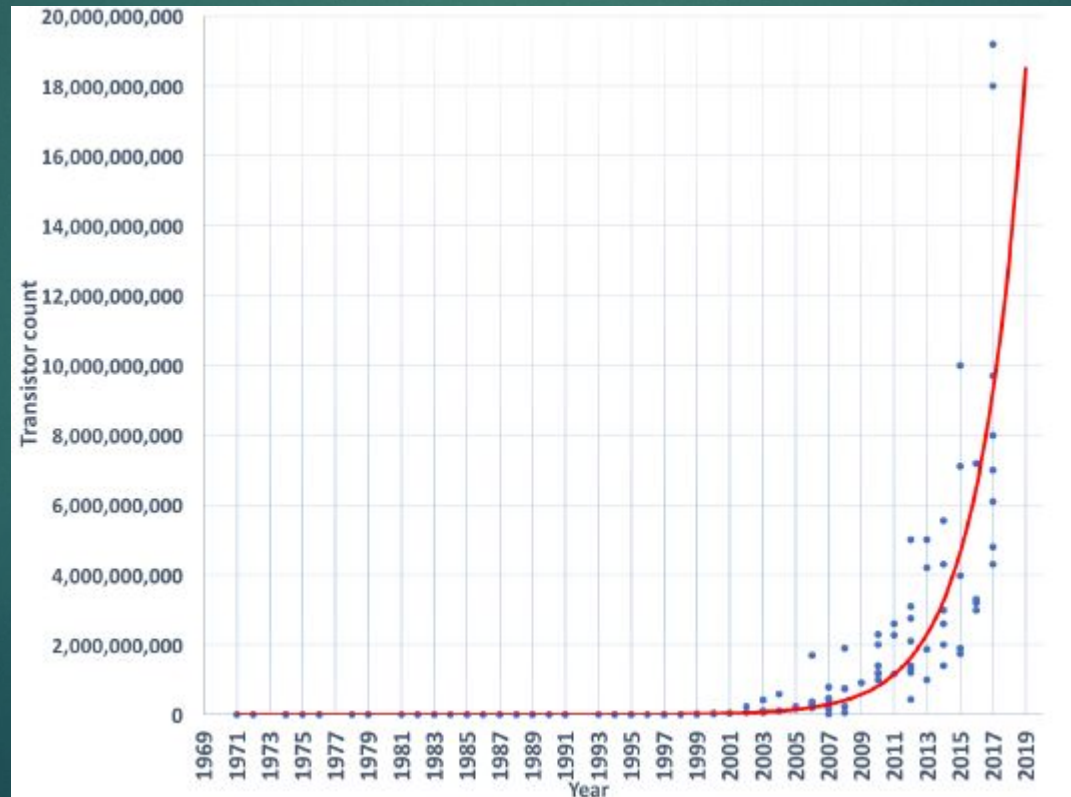
- Rules quickly became too complex to create and maintain
- Deterministic rules couldn't handle the uncertainty of the real world
- Computational resources and data are still too limited.

But still

- AI starts to have a real impact on industry.
- Foundations are being built for future development

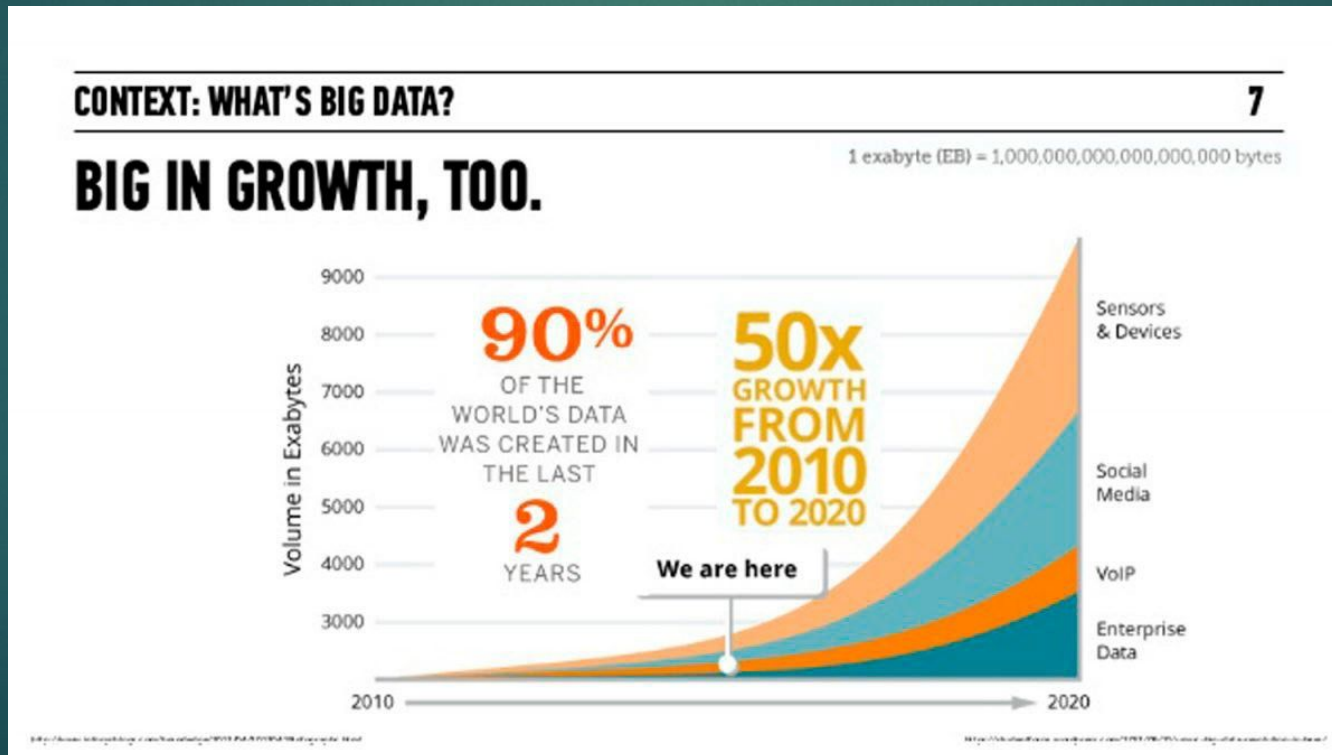
21st Century: Big Data and Machine Learning

- Computer processor speed and memory size has approximately doubled every two years



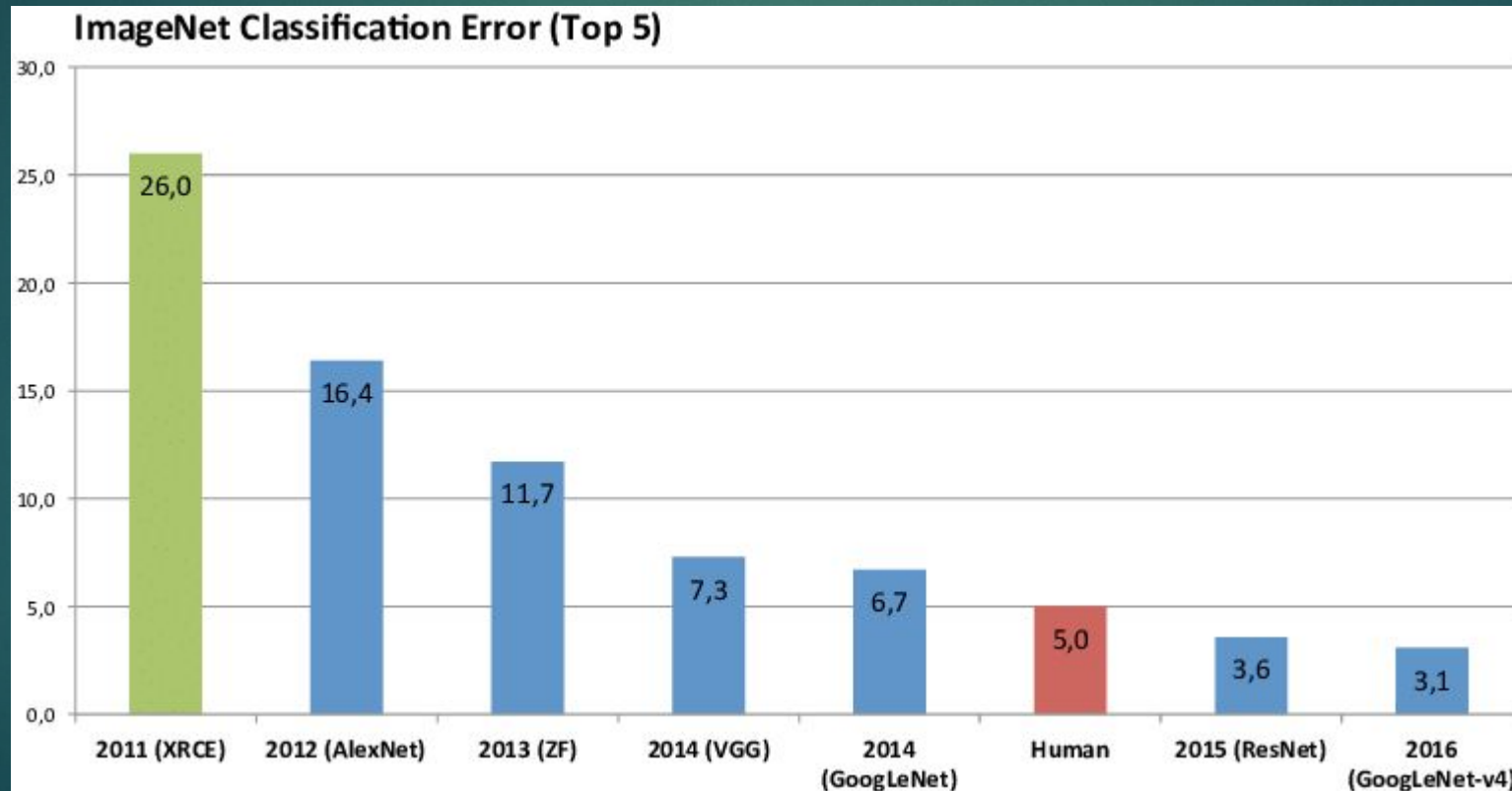
21st Century: Big Data and Machine Learning

- Growth of popularity for personal computers and the internet generates a huge amount of data.



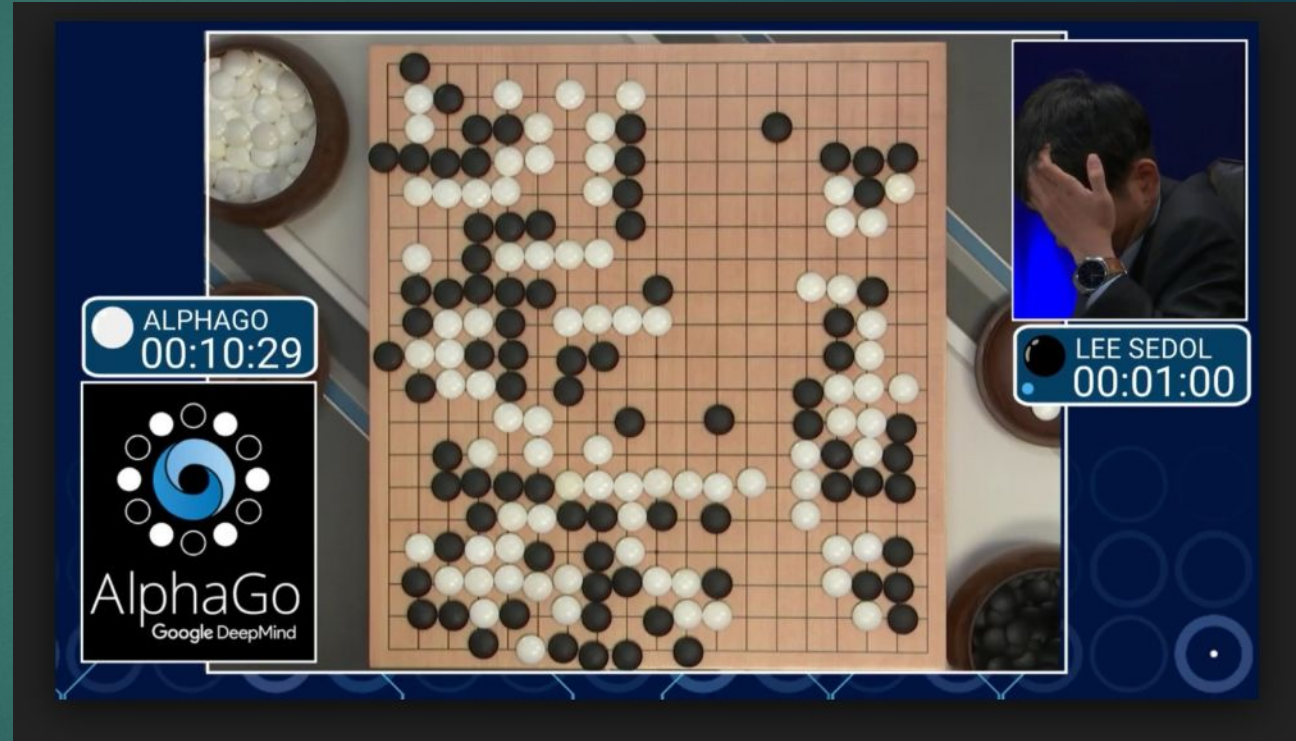
21st Century: Big Data and Machine Learning

- 2012: AlexNet obtains huge gains in object recognition.



21st Century: Big Data and Machine Learning

- ▶ Game AI
 - ▶ AlphaGo
 - ▶ AlphaZero
 - ▶ AlphaStar
- ▶ Google Assistant
- ▶ Auto Piloting
- ▶ Smart Healthcare



Course Description

- ▶ This course provides a broad introduction to applied machine learning models and algorithms:
 - Machine Learning concepts
 - Essential skills on handling, cleaning, and preparing data
 - General-purpose machine learning models
 - Training and tuning process on real-world data
 - Selecting and engineering features
 - Improving models using domain-specific knowledge

Course content

- ▶ This course will introduce models and algorithms through concrete working examples with a moderate amount of theory. Python will be used as the primary programming language.
- Mathematical understanding: 20%
- Data handling and exploration with python: 20%
- Model design and training: 30%
- Model evaluation and diagnostics: 30%

Learning Objectives

- ▶ At the end of the course, students should be able to:
 - Handle large volume of data using python scientific libraries.
 - Understand the concepts and procedures for the most common machine learning algorithms.
 - Given a particular learning task, build a machine learning model and train the model on the training dataset.
 - Tuning a machine learning model to improve its performance.

Grading Policy

- ▶ Students are expected to learn both the material covered in class and the material in the textbook and other assigned readings. Completing homework is an essential part of the learning experience.
- Homework: 20%
- Tests: 20%
- Midterm Project: 30%
- Final Project: 30%

Main Textbook

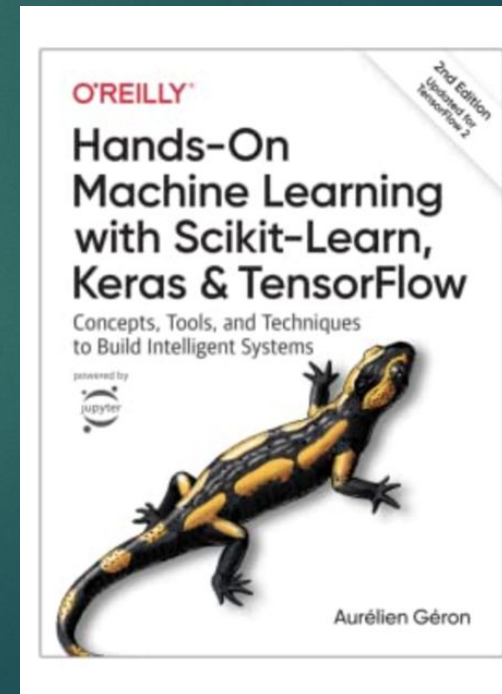
Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems By Aurélien Géron

Publisher : O'Reilly Media

Edition: 2nd edition (October 15, 2019)

ISBN-13: 978-1492032649

ISBN-10: 1492032646




Secondary Textbook

- ▶ Python for Data Analysis, 2nd Edition
- ▶ By William McKinney
 - Publisher: O'Reilly Media
 - Release Date: October 2017
 - ISBN-13: 978-1491957660
 - ISBN-10: 1491957662
 - Online version of the textbook:
<http://shop.oreilly.com/product/0636920050896.do>

Other Resources

- ▶ Python tutorial: <https://www.py4e.com/>
- ▶ Andrew Ng's ML course on Coursera:
<https://www.coursera.org/learn/machine-learning>
- ▶ Python codes for the textbook:
<https://github.com/ageron/handson-ml>
- ▶ Google Machine Learning Crash Course:
<https://developers.google.com/machine-learning/crash-course/>
- ▶ YouTube

- 
- Honor Code
 - Email
 - Blackboard
 - Github
 - Accommodating Disabilities