How to define "bird" or some objects in general in a program?
Hard to define directly - instead, learn from data

1. don't know how to solve the problem directly
2. But I can obtain a **dataset** that describes what I want my computer to do
3. Write a program that **learns the desired behavior from the data**

2012: AlexNet wins ImageNet challenge, started deep learning era
2016: ML surpasses human accuracy

Some Applications:
- Image Generation: input text, output images
- Medicine: predict the probability of different diseases from chest X-ray
- Sustainability: produce fine-grained maps of poverty based on satellite imagery
- Translation
- ChatGPT
- Game-playing: AlphaGo gained dataset through self-play, predict a good move
- Robotics: social assistive robots for children with autism spectrum disorder

Topics to be covered:
- Supervised learning
    ○ regression
    ○ classification
    ○ linear models
    ○ deep learning: learning meaningful vector representations of inputs by composing **non-linear**
                        operations
- Unsupervised learning
    ○ Clustering: finding sub populations within datasets
    ○ Dimensionality reduction: visualizing high-dimensional data
- Reinforcement learning
    ○ Bandit problems: trading off exploration vs exploitation
    ○ RL: learning how to maximize rewards
- Additional topics
    ○ Adversarial examples: hidden ways machine learning models can be fooled
    ○ Fairness: how to ensure responsible deployment of machine learning systems