Introduction to Machine Learning

Leo Wang

September 16, 2021

1 Brief Introduction

Machine Learning is a study of computer algorithms that can improve automatically through experience and by the use of data. We give computers the ability to learn without being explicitly programmed. By the good use of the model, we could easily predict the output of the result.

2 Example

2.1 House Pricing Prediction

Given a house 750 square feet - how much could we sell? The **??** is an example of the house price. What is your prediction of the house price? Give 2 possible outcomes:

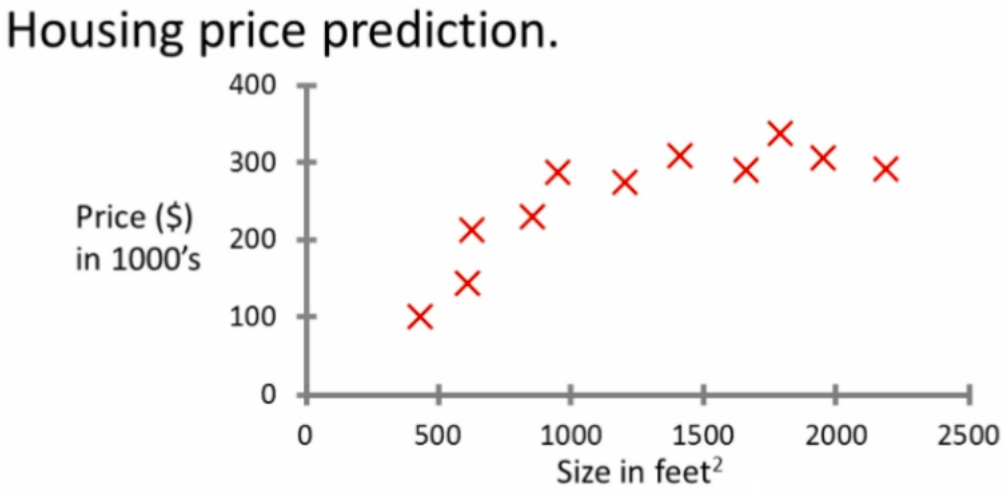

Figure 1: House Price

2.2 Classification-1

Given a picture could you identify different object? How do you identify different object?

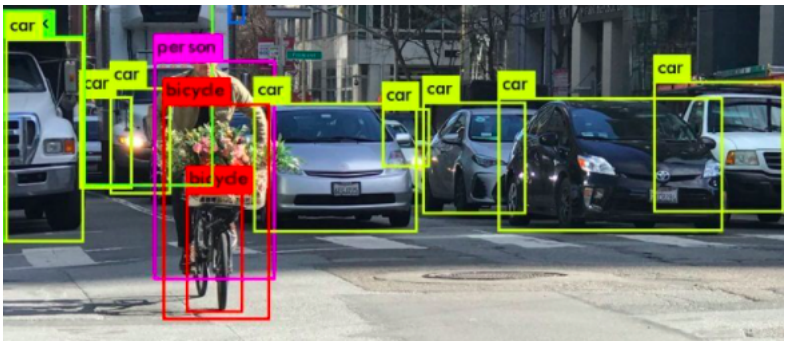

Figure 2: House Price

2.3 Classification-2

Could we identify from the data?

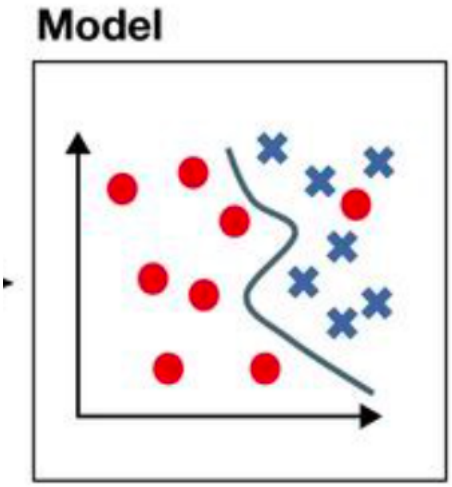

Figure 3: House Price

How about this kind of data

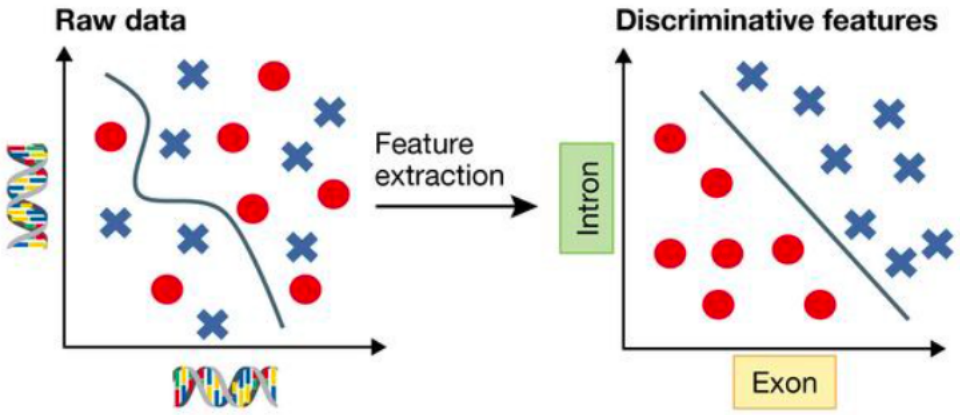

Figure 4: House Price

2.4 Quick Summarize

Machine Learning is a study of computer algorithms to capture the information human might easily recognize and to capture the information human are unable to realize.

3 How Machine Learning works?

1. Start a initial guess 2. Each time you change the parameters, you select the most possible result 3. Repeat the learning (Maybe local minimum) 4. Determine the result

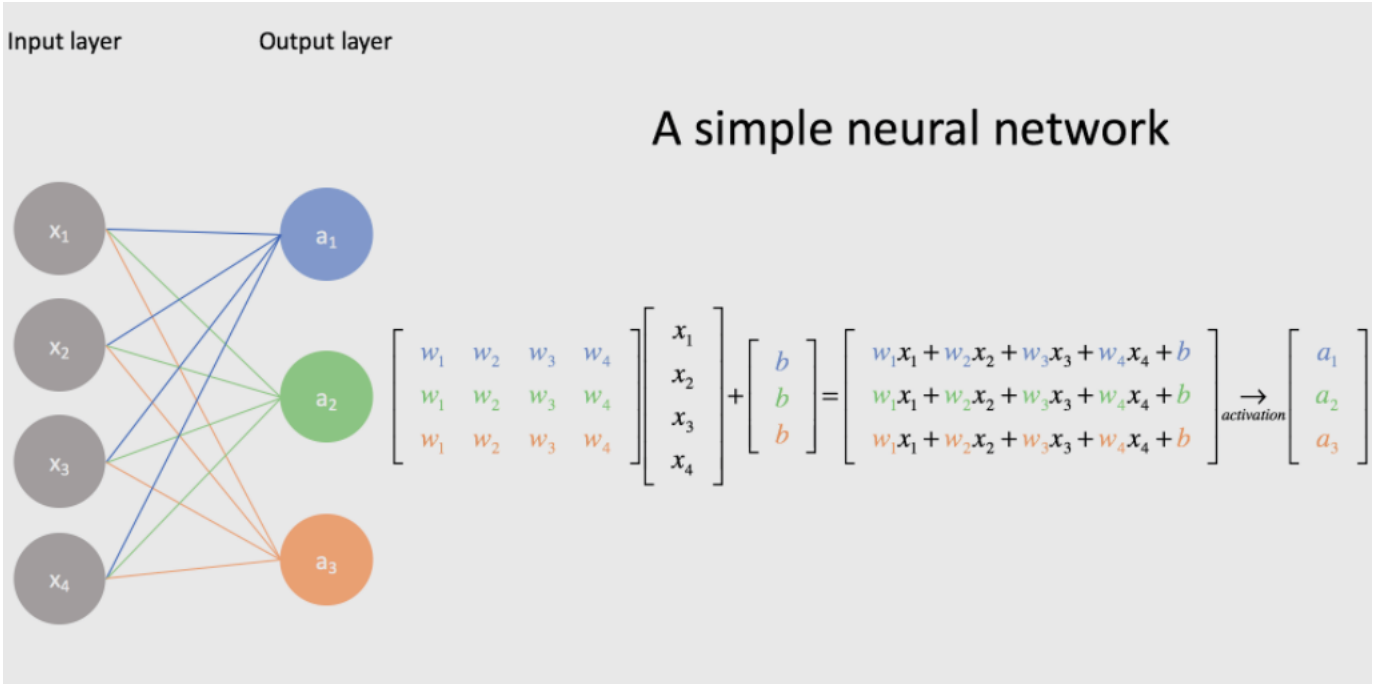

Figure 5: Matrix Calculation

$$\frac{\partial}{\partial \theta_j} J(\theta_0, \theta_1) = \frac{2}{2\theta_j} \cdot \frac{1}{2m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)} \right)^2$$

$$= \frac{2}{2\theta_j} \frac{1}{2m} \sum_{i=1}^{m} \left(\theta_0 + \theta_1 x^{(i)} - y^{(i)} \right)^2$$

$$\theta_0 \; j = 0 : \frac{\partial}{\partial \theta_0} J(\theta_0, \theta_1) = \frac{1}{m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)} \right)$$

$$\theta_1 \; j = 1 : \frac{\partial}{\partial \theta_1} J(\theta_0, \theta_1) = \frac{1}{m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)} \right) \cdot x^{(i)}$$

Figure 6: House Price

4 Machine Learning for carpark

Figure 7: Normal Parking

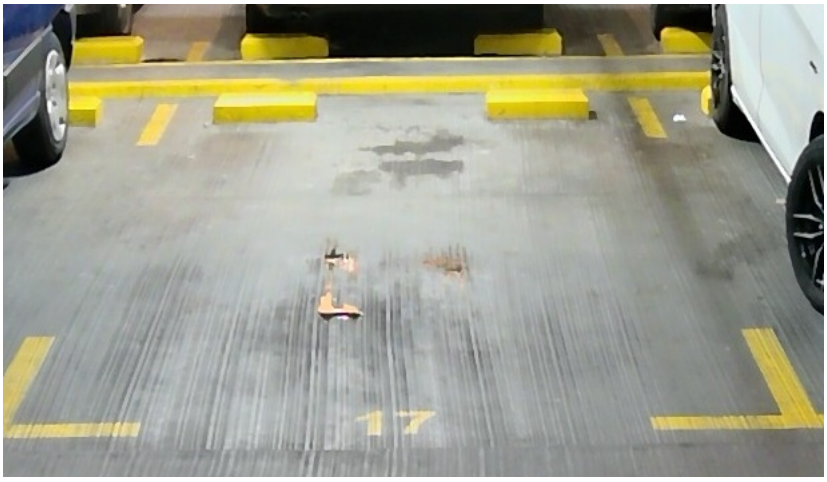

Figure 8: Empty Parking

Figure 9: Block Parking

Figure 10: Fail

Figure 11: Platenum-noise

Figure 12: Platenum

Figure 13: Classification

Figure 14: Classification