1. INTRODUCTION

⇨ The field of study that gives computers the **ability to learn** without being explicitly programmed.

⇨A computer program is said to learn from **experience** E with respect to some class of **tasks** T and **performance** measure P, if its performance at tasks in T, as measured by P, improves with experience E.

- **Example: playing checkers.**

  E = the experience of playing many games of checkers

  T = the task of playing checkers.

  P = the probability that the program will win the next game.

Machine Learning

- Grew out of work in AI
- New capability for computers

Examples:

- Database mining
  Large datasets from growth of automation/web.
  E.g., Web click data, medical records, biology, engineering
- Applications can't program by hand.
  E.g., Autonomous helicopter, handwriting recognition, most of Natural Language Processing (NLP), Computer Vision.
- Self-customizing programs
  E.g., Amazon, Netflix product recommendations
- Understanding human learning (brain, real AI).

⇨ **TYPES of ML**:

- ➢ Supervised Learning
- ➢ Unsupervised Learning
- ➢ Others: Reinforcement learning, Recommender systems.

⇨ SUPERVISED LEARNING:

"right answers" are given.

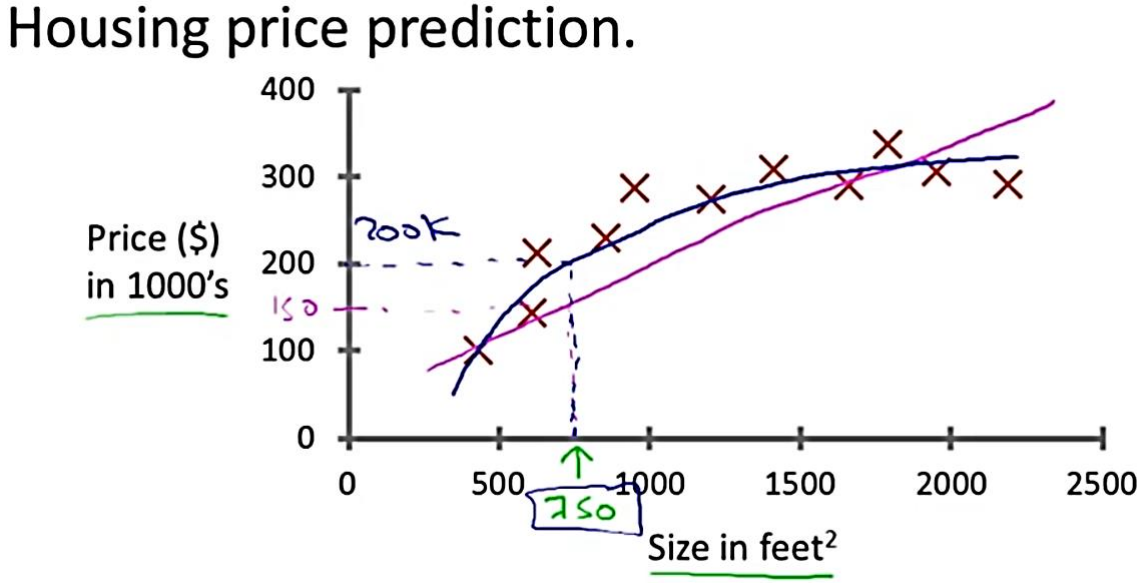
"computer predicts more right answers"

In supervised learning, we are given a data set and already know what our correct output should look like, having the idea that there is a relationship between the input and the output.

Types of Problems: Regression and Classification

- ➢ **Regression** → Continuous valued output: like a range 1-1000.
  We are trying to map input variables to some **continuous** fxn.
- ➢ **Classification** → Discrete valued output: like 1,2,3, 0, 10, etc.
  We are trying to map input variables into **discrete** categories.

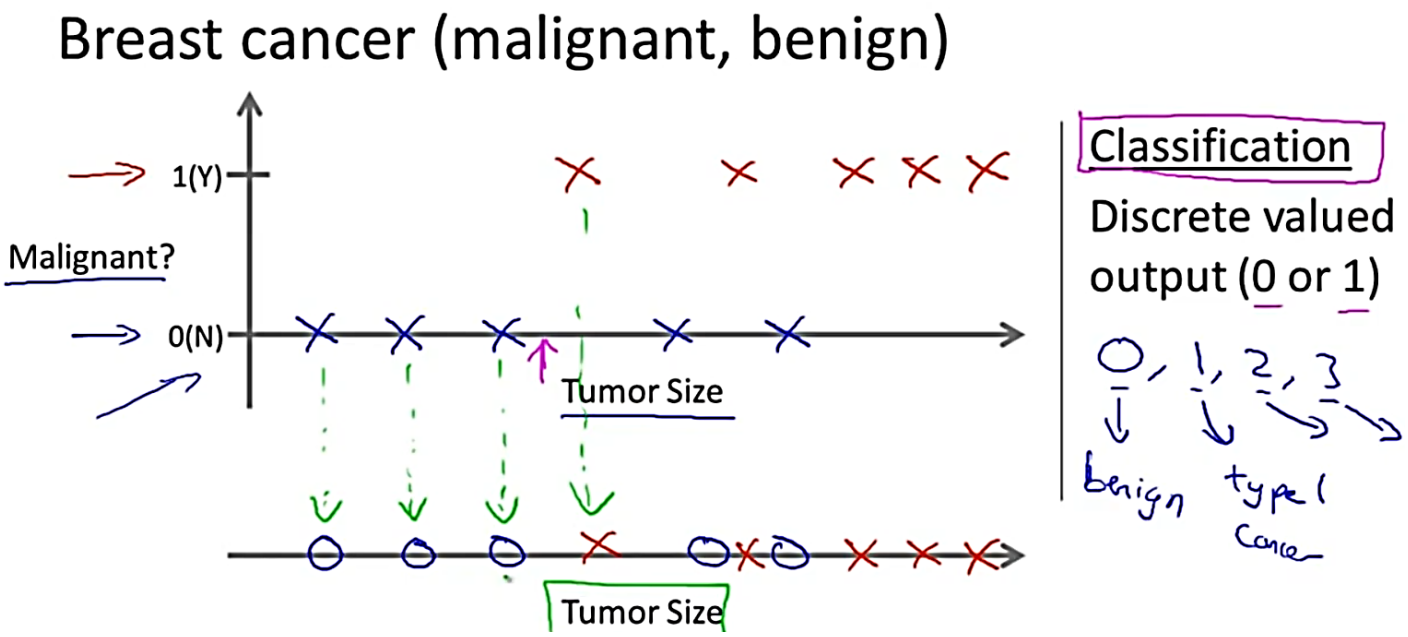
Example-1:



Price as a function of size is a continuous output →**Regression**

- We could turn this example into a **Classification** problem by making our output about whether the house *"sells for more or less than the asking price."*

Example-2:



- There can be more than one parameters for determining the output.

⇨ UNSUPERVISED LEARNING:

When we have no idea what our results should look like. We can **derive structure** from data where we **don't necessarily know the effect of variables**. We can derive this structure by **clustering** the data based on relationships among the variables in the data.

- There is **no** scope of **feedback**.

Clustering technique - Only data is given – no previous right answers are given. The **data is grouped** into categories automatically.

Examples:

- ➔ Google news topics.
- ➔ Organising college clusters
- ➔ Social network analysis
- ➔ Market segmentation
- ➔ Astronomical data analysis

Types: Clustering and Non-Clustering

- **Clustering** → Take a collection of 1,000,000 different genes, and find a way to **automatically group** these genes into groups that are **somehow similar** or related by different variables, such as lifespan, location, roles, and so on.

- **Non-Clustering** →

➔ **Cocktail party problem**

```
[W,s,v] = svd((repmat(sum(x.*x,1),size(x,1),1).*x)*x');
```

Allows you to **find structure** in a chaotic environment. (i.e. **identifying individual voices** and music from a mesh of sounds at a cocktail party).
