Lecture 1: Course logistics, homework 0

STATS 202: Data mining and analysis

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September 23, 2019

(Slide credits: Sergio Bacallado)

Syllabus

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- **Class website:** stats202.stanford.edu.

Prediction challenges

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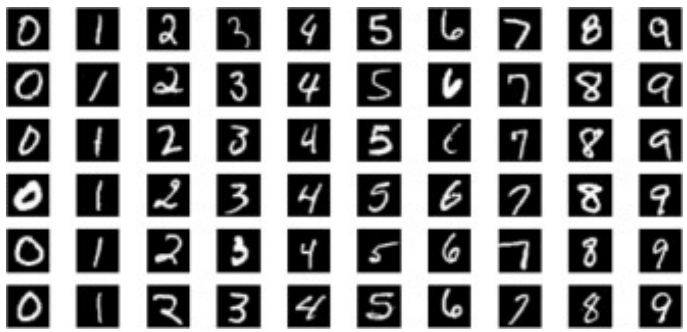

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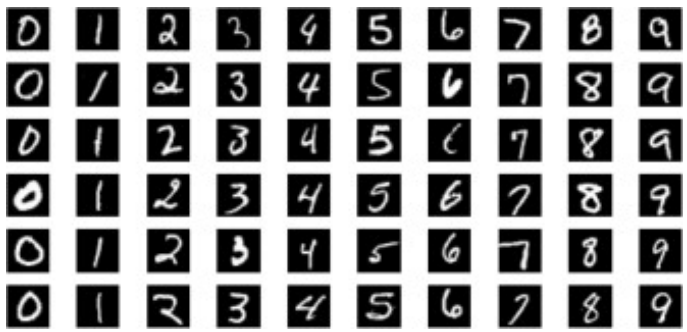

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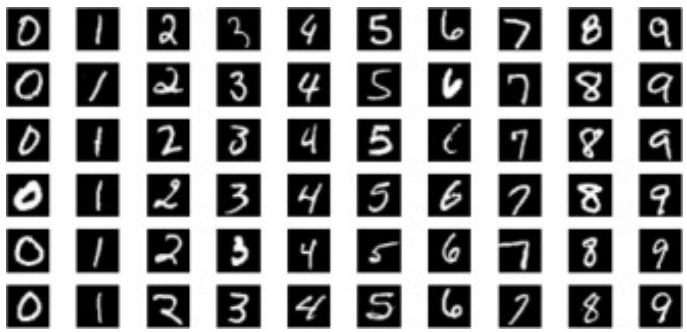

You are also given a test set of unlabeled datapoints.

Your job is to assign a label (digit) to each image in the test set as accurately as possible.

The Netflix prize

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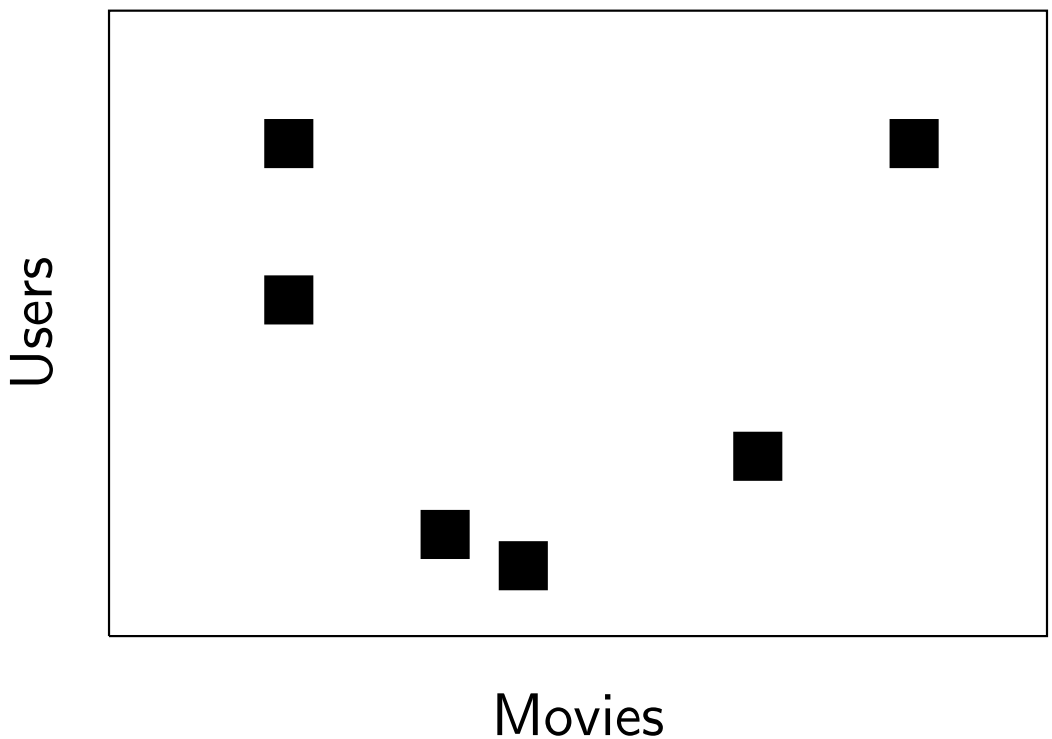

Only 1% of the 100 million possible user-movie rating pairs were revealed

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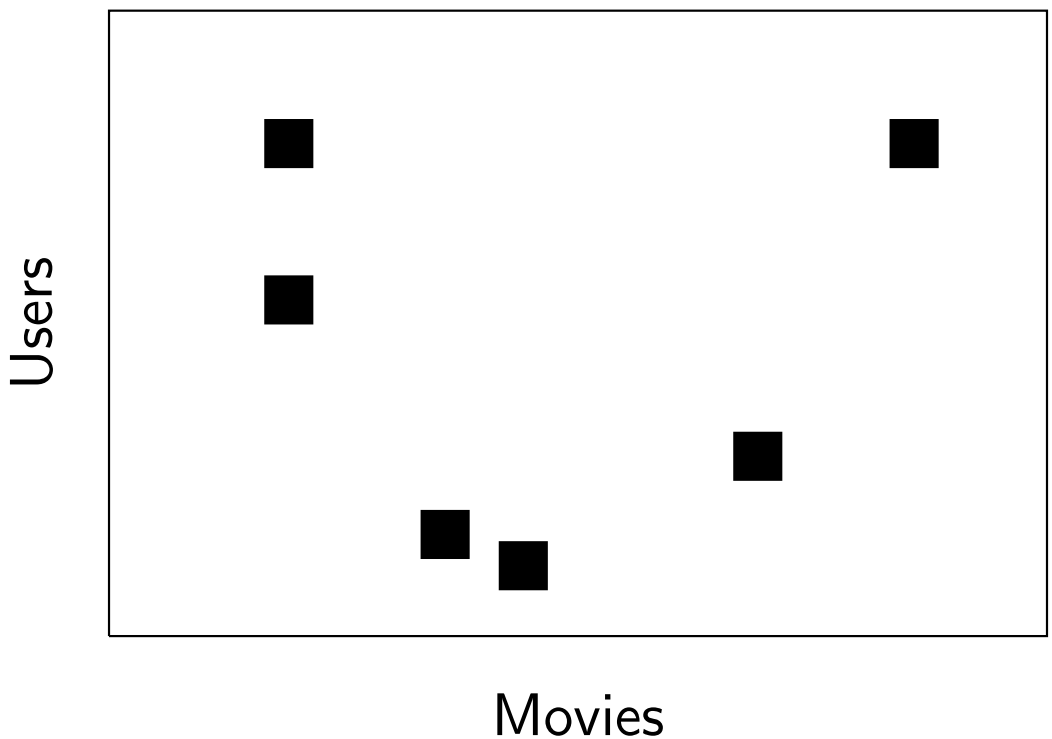


The challenge was to predict the unseen ratings

Kaggle

Company founded in 2010.

Business model:

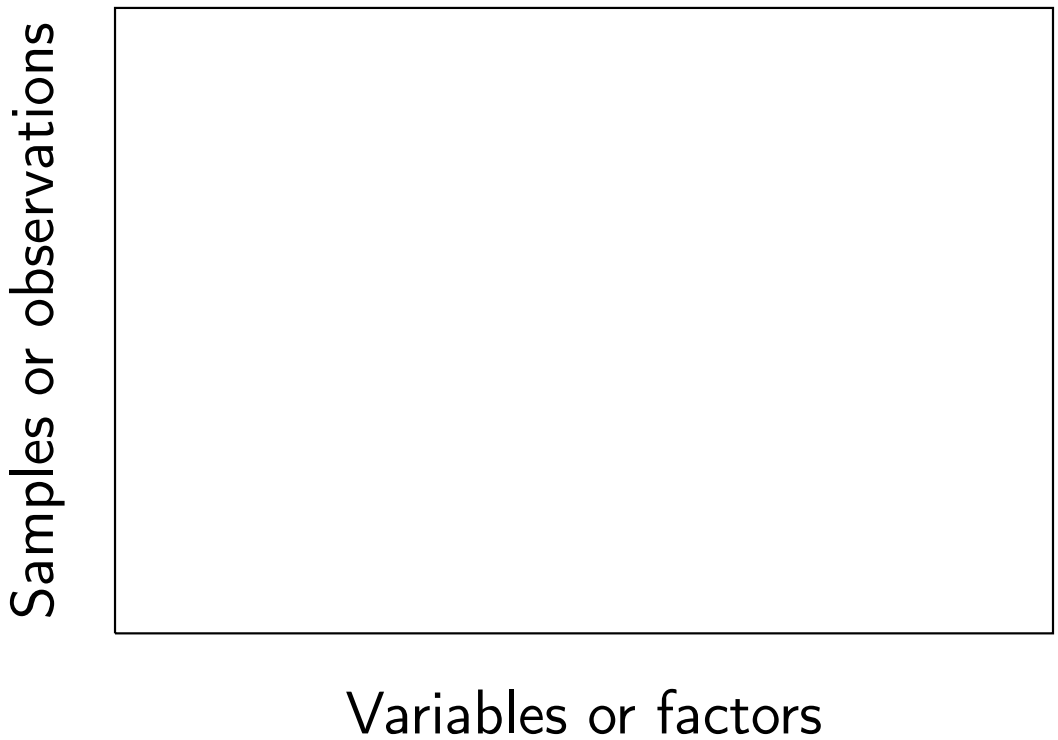
- Organize prediction competitions hosted online.
- Offer companies consulting services from Kaggle "masters".

Kaggle-in-class is a competition engine offered to degree-granting institutions for free. Stats 202 was the first class to use it!

This quarter you will team up with up to three students and participate in a Kaggle challenge TBD.

Supervised vs. unsupervised learning

In **unsupervised learning** we seek to understand the relationships between variables in a data matrix:



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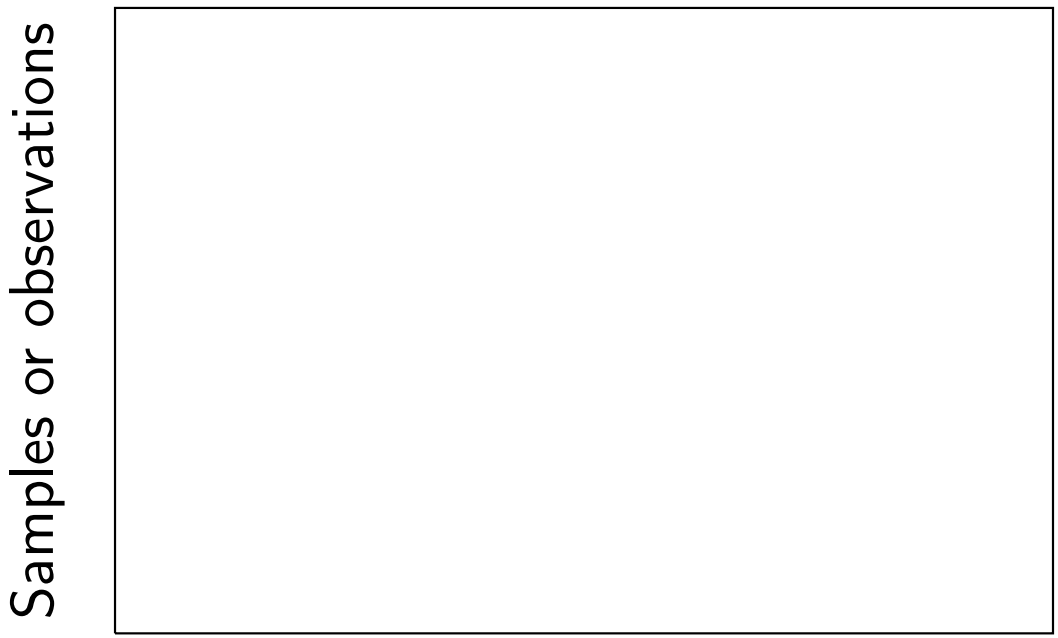

Quantitative variables, eg. weight, height, number of children, ...

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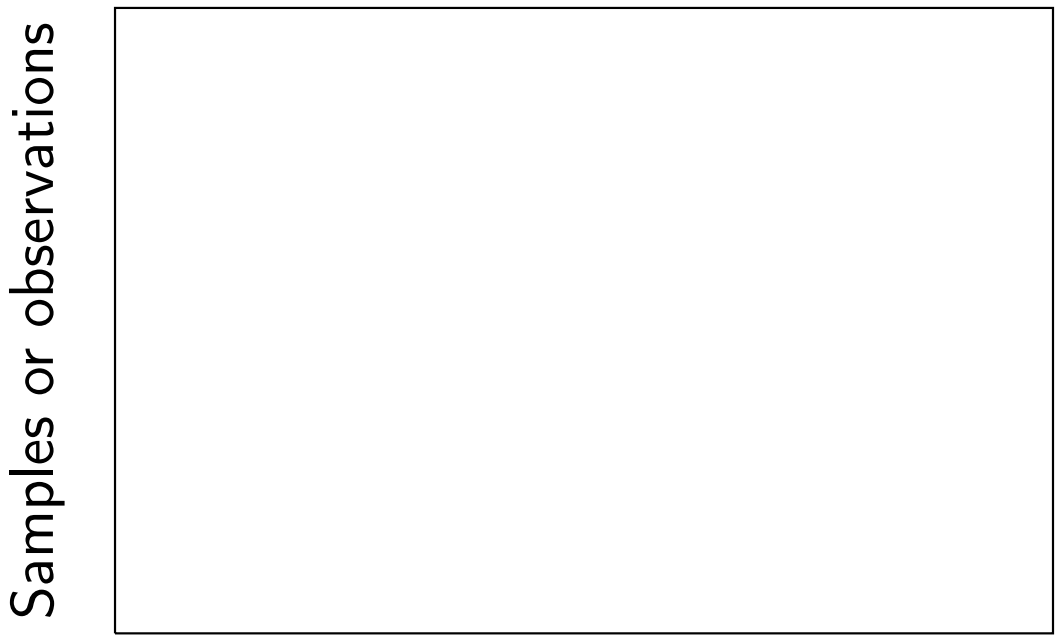

Qualitative variables, eg. college major, profession, gender, ...

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Our goal is to:

- Find meaningful relationships between the variables.

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Our goal is to:

- Find meaningful relationships between the variables. Correlation analysis.
- Find low-dimensional representations of the data which make it easy to visualize the variables. PCA, ICA, isomap, locally linear embeddings, etc.
- Find meaningful groupings of the data. Clustering.

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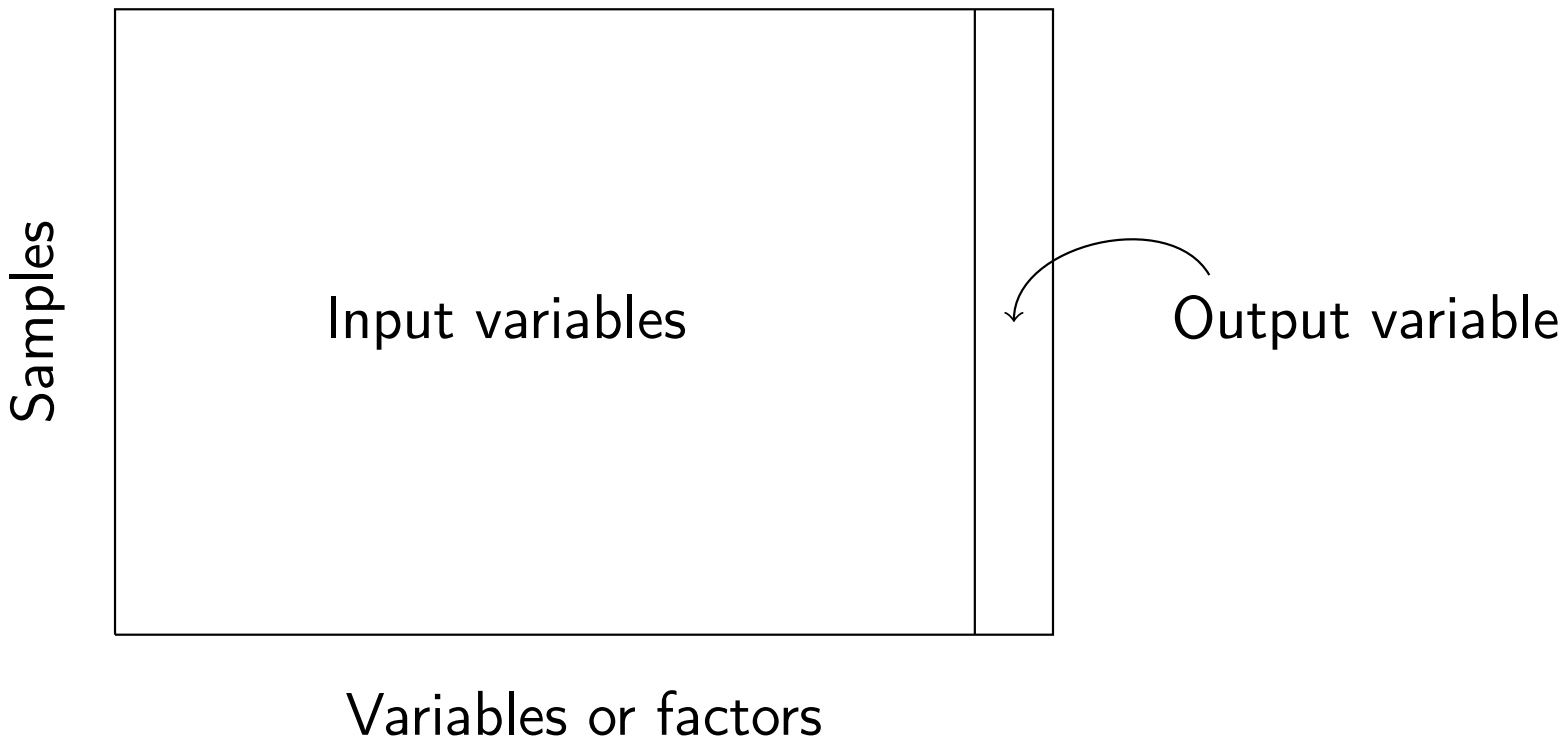
In **supervised learning**, there are *input* variables, and *output* variables:



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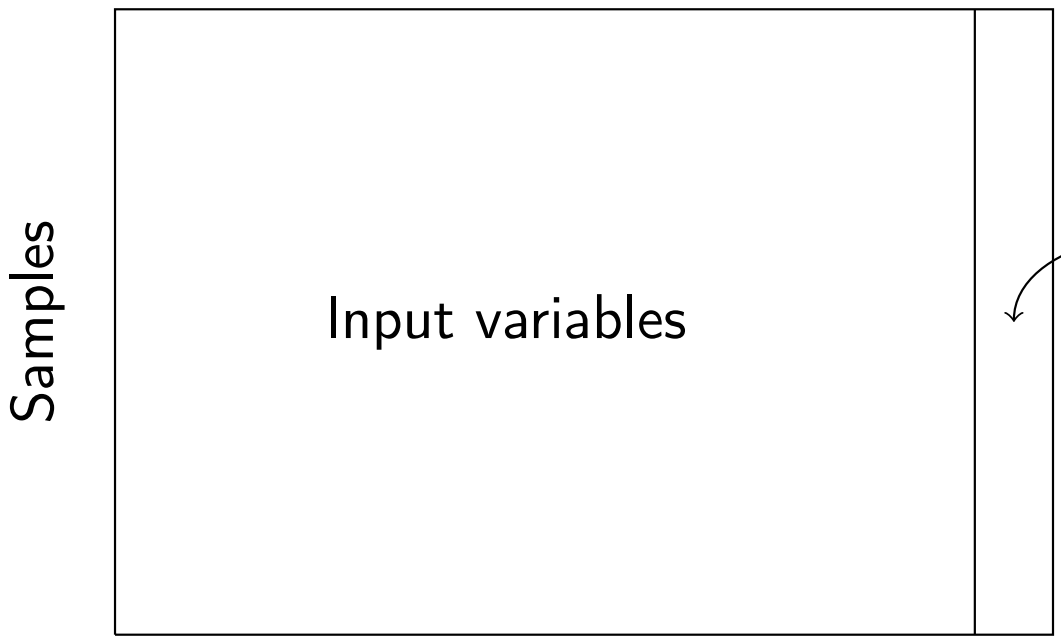

If quantitative, we say this is a regression problem

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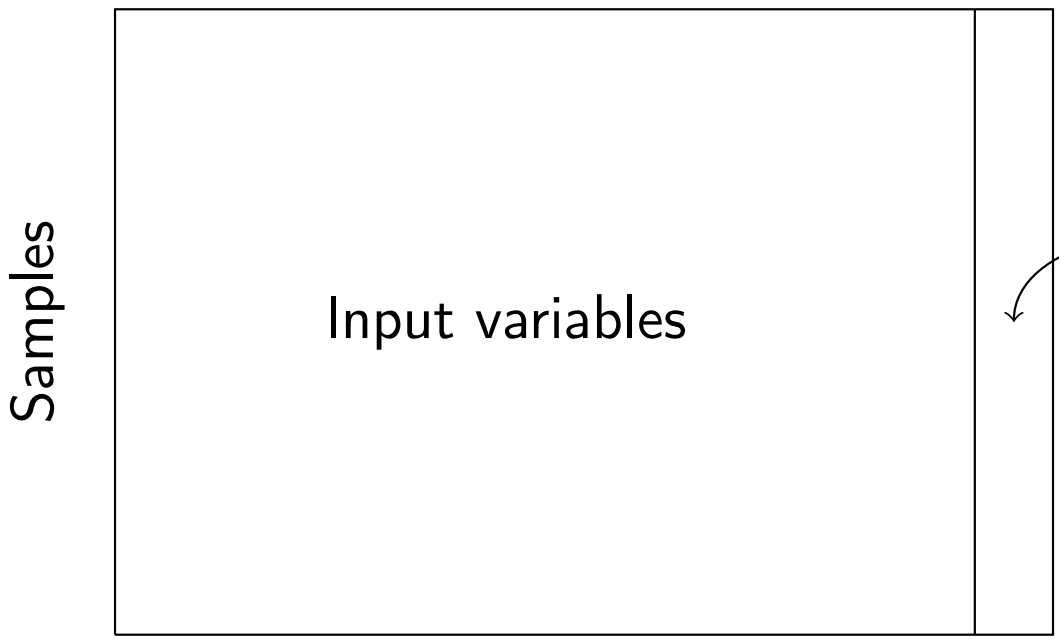

If qualitative (categorical), we say this is a classification problem

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If X is the vector of inputs for a particular sample. The output variable is modeled by:

$$Y = f(X) + \underbrace{\varepsilon}_{\text{Random error}}$$

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Our goal is to learn the function f, using a set of training samples.

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Motivations:

- **Prediction:** Useful when the input variable is readily available, but the output variable is not.

  Example: Predict stock prices next month using data from last year.

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Motivations:

- **Prediction:** Useful when the input variable is readily available, but the output variable is not.
- **Inference:** A model for f can help us understand the structure of the data — which variables influence the output, and which don't? What is the relationship between each variable and the output, e.g. linear, non-linear?

  Example: What is the influence of genetic variations on the incidence of heart disease.