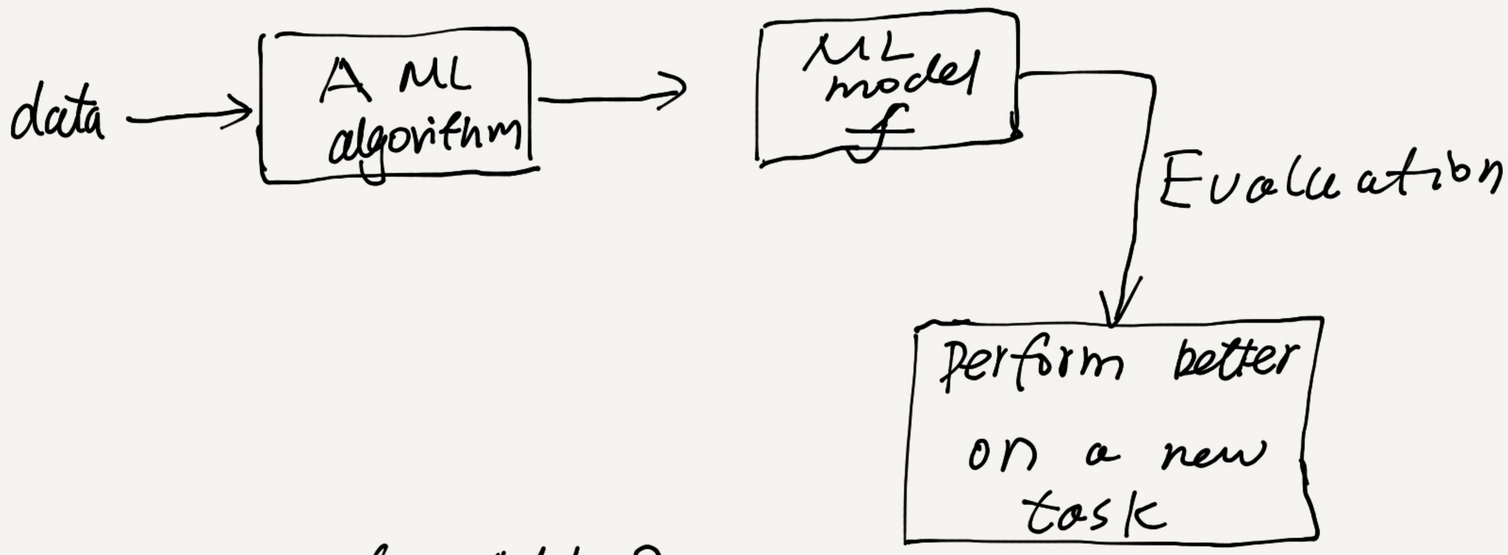
Lecture 4. Machine learning tasks and stages.

1. What is a ML algorithm?

A ML algorithm is able to learn from data



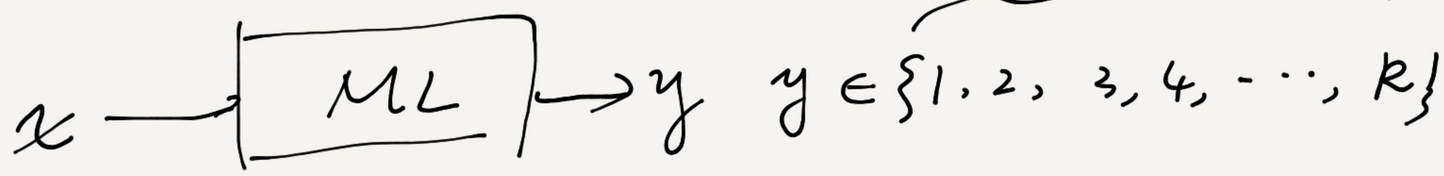
2. Why do we need ML?

① tackle tasks that are too difficult to solve by fixed programs designed by human beings.

② Develop understanding of principles that underlie intelligence.

2. ML Tasks.

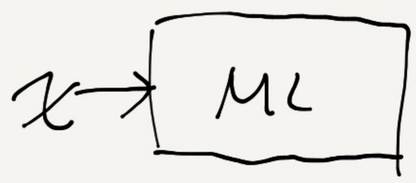
① Classification: ML algorithms are to classify input data samples into K categories / classes



Object recognition, face recognition, color classification.

semantic image segmentation: →

② Regression: predict the numerical output for a given input



y, e.g., $y \in R$ or $y \in [0, 1]$

product price prediction, weather prediction (Temp.), housing price.

...

③ ML Translation:

Translate between languages.

④ Anomaly detection.

We only defined normal data samples in our data set.

The ML algorithm will only learn from normal data.

Auto-encoder algorithm

⑤ Data imputation: apply ML to predict missing values.

$x = \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_d \end{pmatrix}$ d features $\longrightarrow$ $\begin{pmatrix} x_1 \\ (X) \\ x_3 \\ \vdots \\ x_d \end{pmatrix}$

perfect: we have all values for x

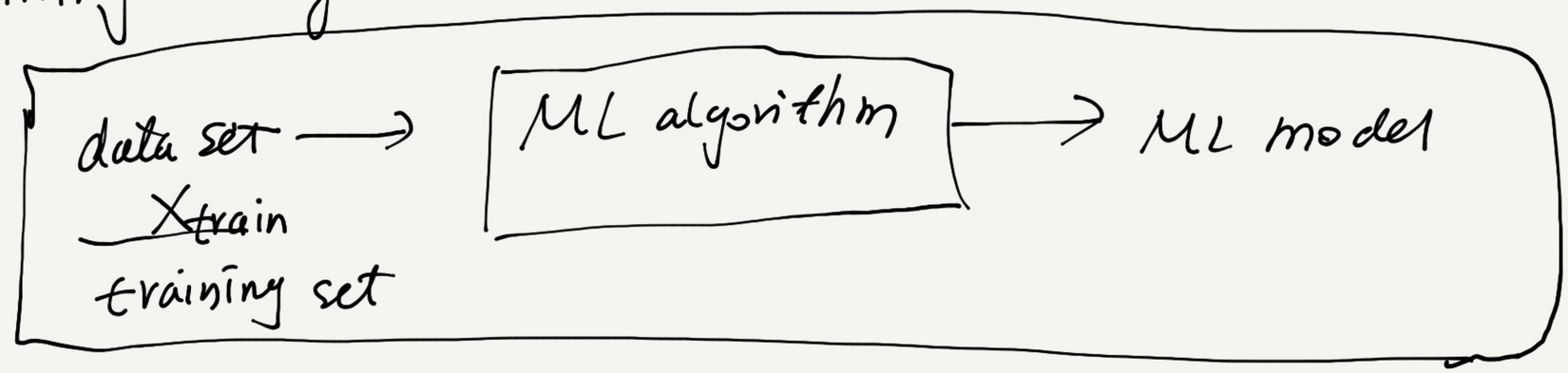
real-world: missing values

⑥ Denoising: remove noise from data.

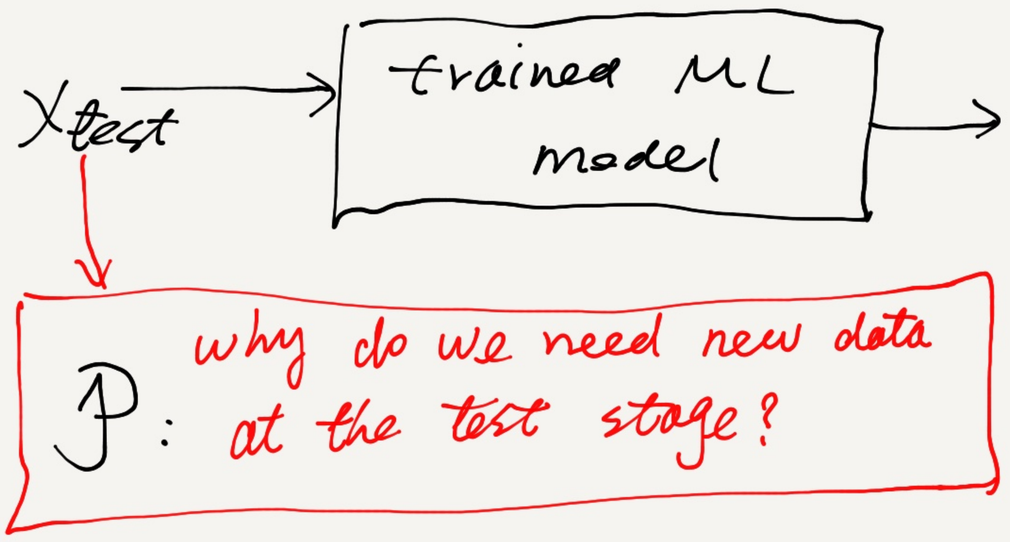
⑦ Content generation: generate new contents using ML.

3. Two stages of ML.

1) Training stage.



2) Test stage: Evaluate the model using new dataset X_{test}



e.g., accuracy, precision, recall, F_1 score, ...