Institut et hôpital neurologiques de Montréal
Montreal Neurological Institute and Hospital

Machine Learning

McGill | Centre universitaire de santé McGill McGill University Health Centre

Machine Learning

- Automatically find patterns in data
- Create useful representations
- Supervised vs. unsupervised

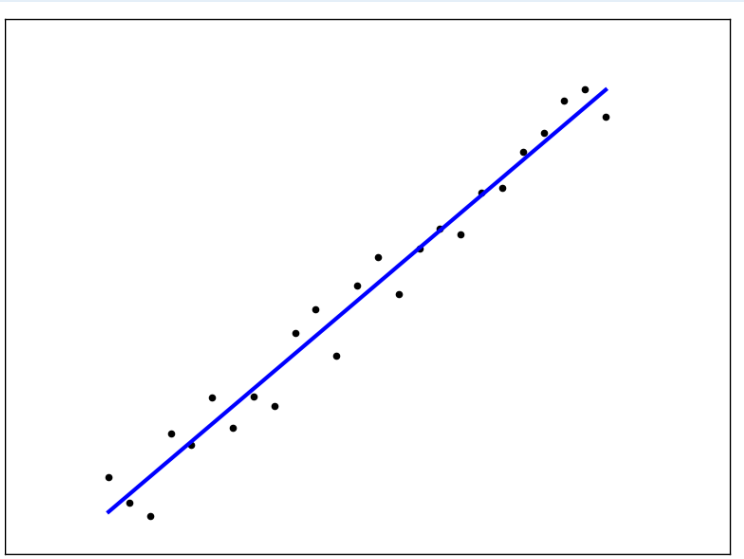
Regression

Linear regression:

$$y = ax + b$$

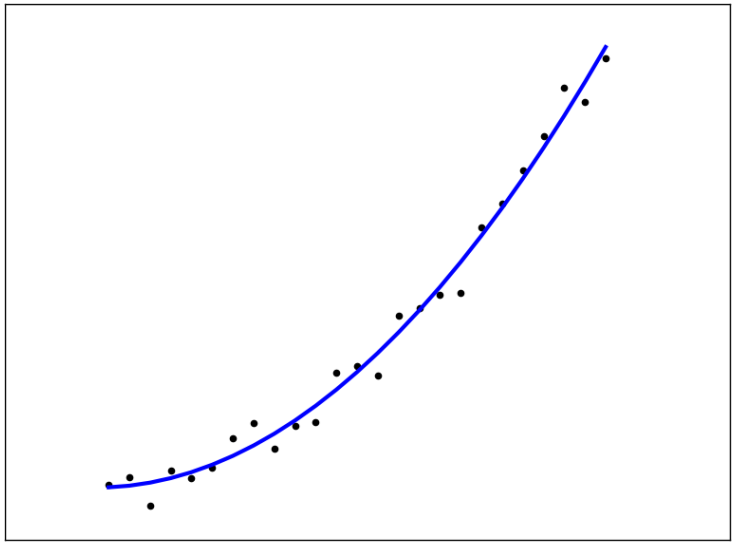
output

input data



Polynomial regression:

$$y = ax^2 + bx + c$$

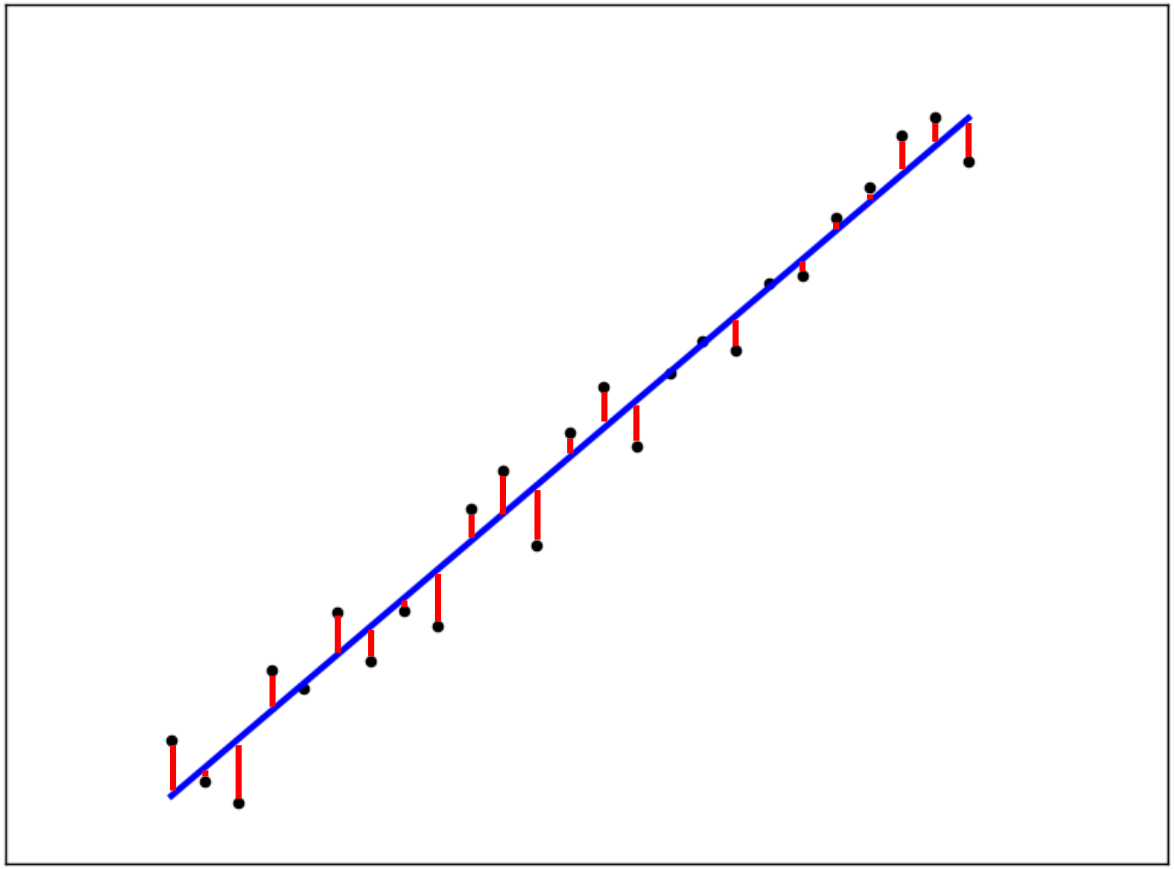


Regression

Mean Squared Error

$$\frac{1}{N}\sum(y - (ax + b))^2$$

- +/- error same effect
- Penalizes very wrong predictions

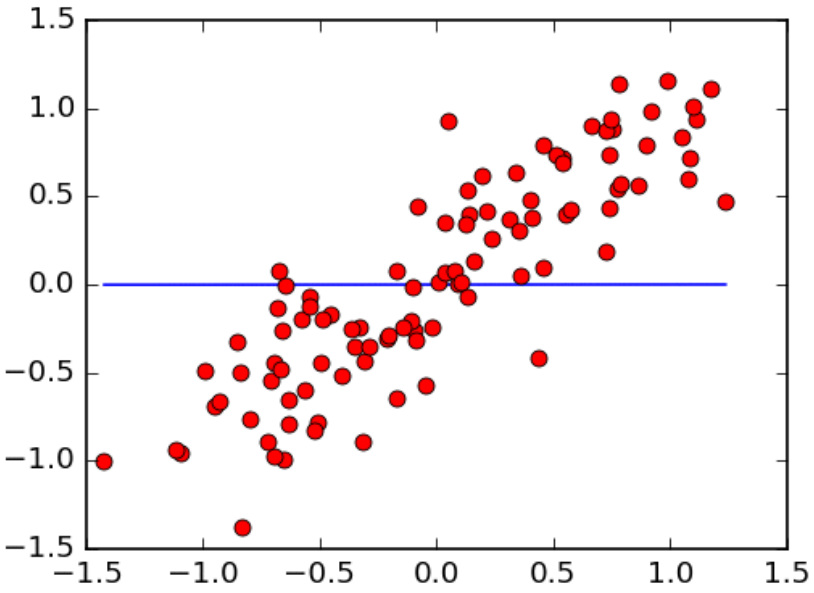


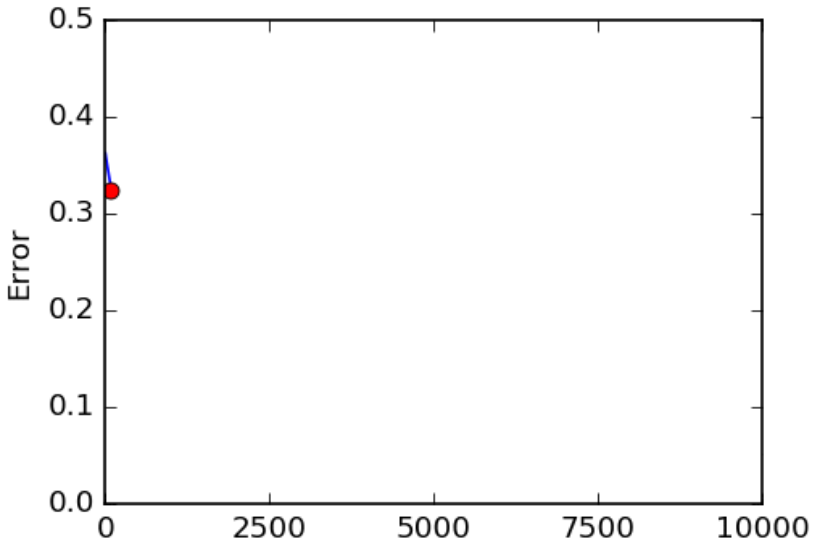
Gradient Descent

Initialize parameters (a, b) randomly

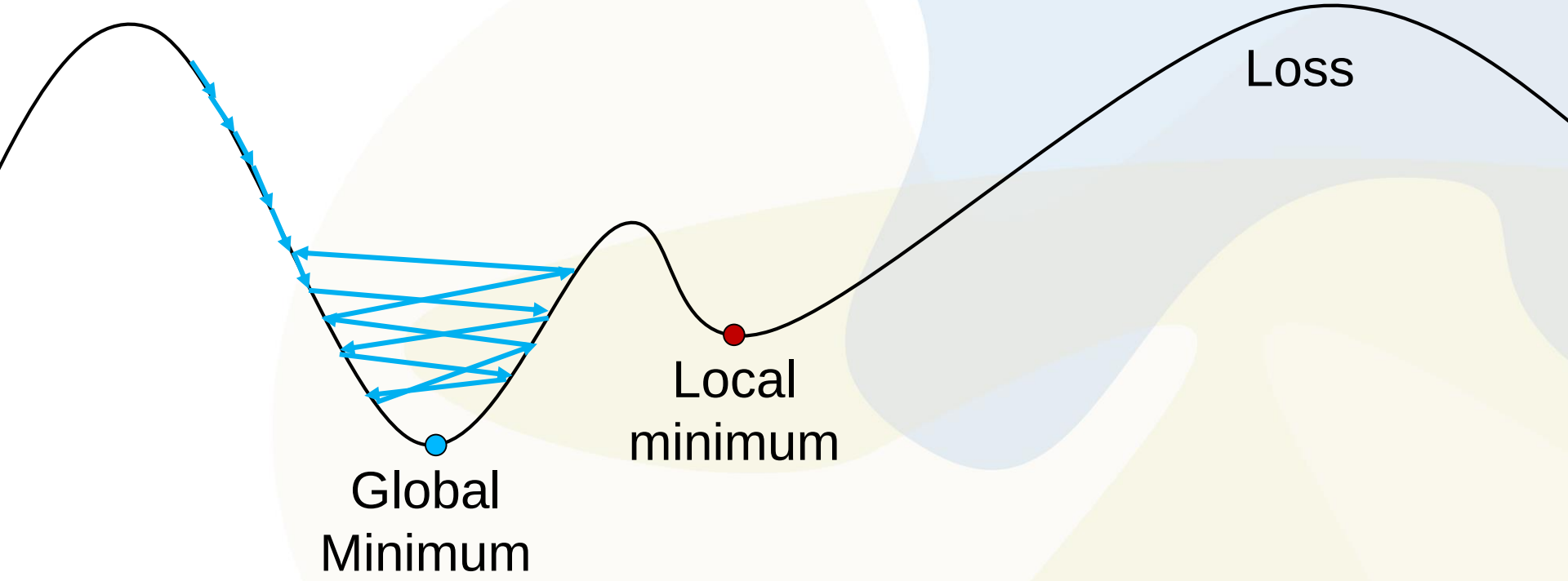
Iterate between:

1. Computing **loss** (mean squared error)
2. Updating parameters in direction of **gradient**

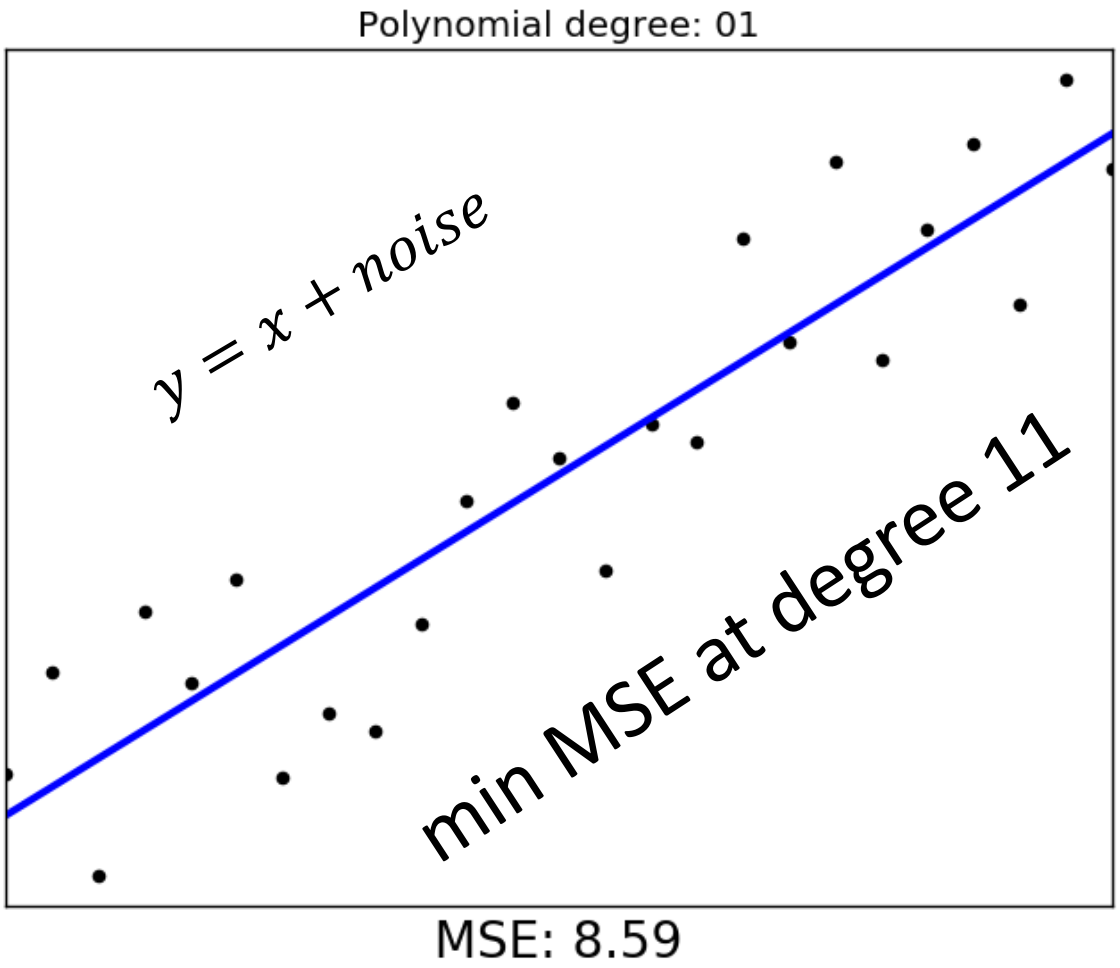




Gradient Descent



Regression

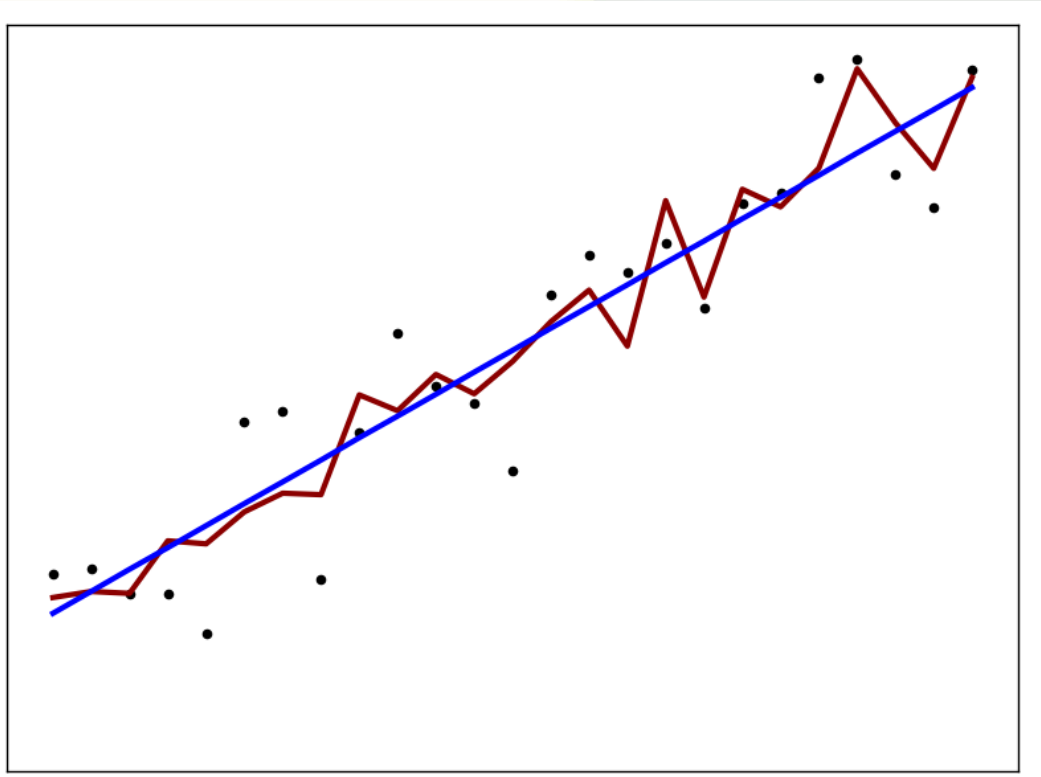


Regularization

Lasso

Linear regression:

$$y = ax_1 + bx_2 + cx_3 + dx_4 + ex_5 + fx_6 + g$$



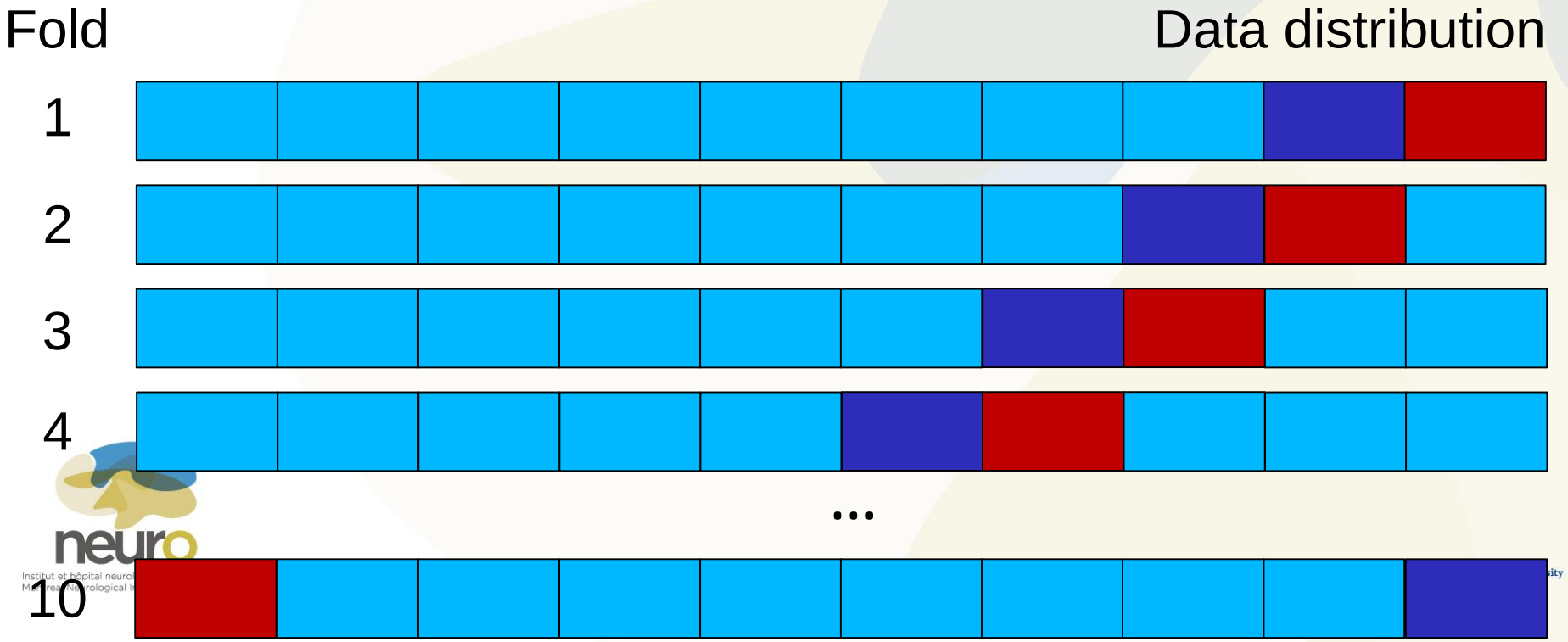
Regularization

- Constrain parameters:
  - To be sparse (L1/Lasso)
  - To be small (L2/ridge)

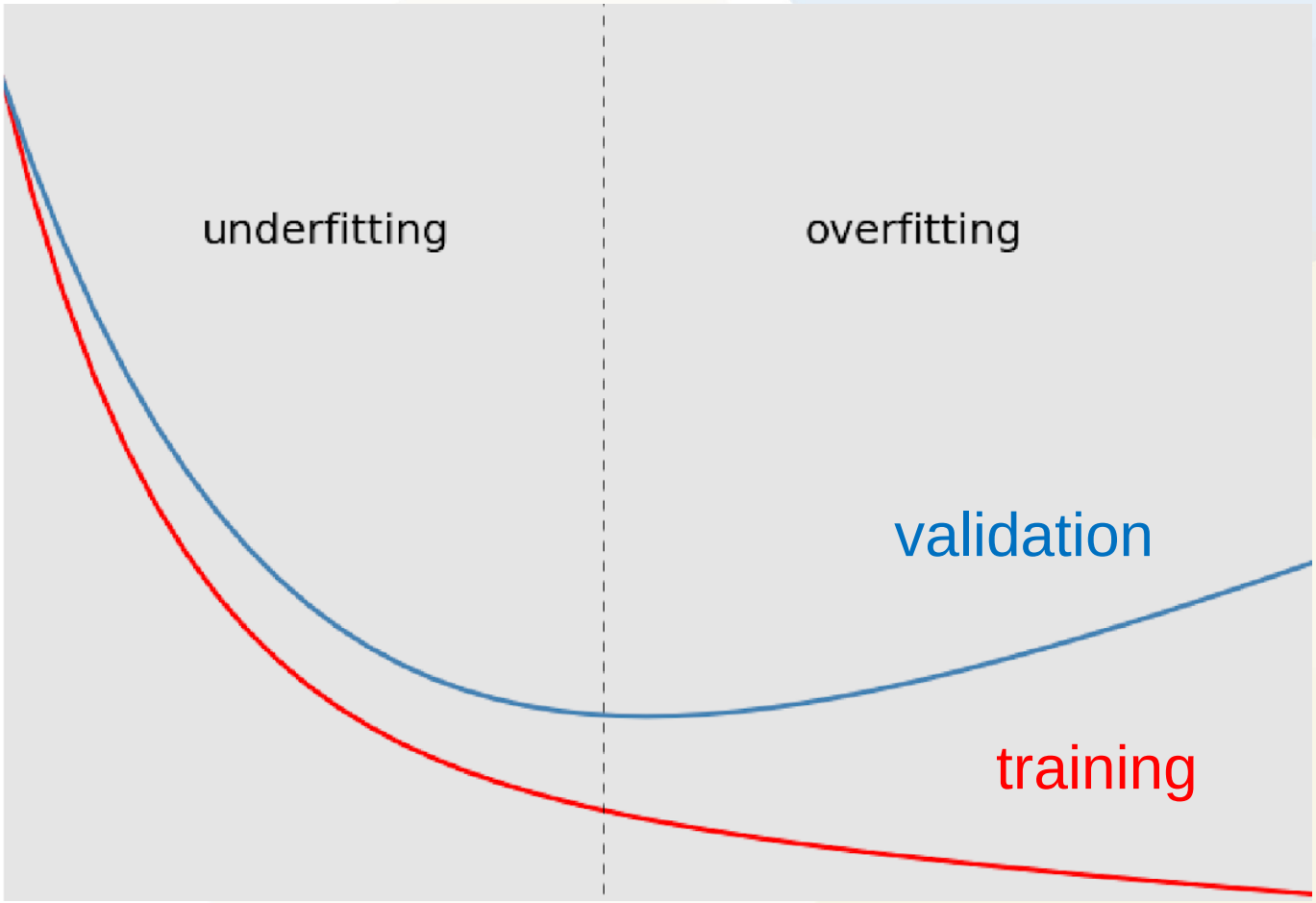
- For neural networks, stop training early

Cross-Validation

- Train model parameters on **training** set
- Choose hyper-parameters with **validation** set
- Report error on **test** set

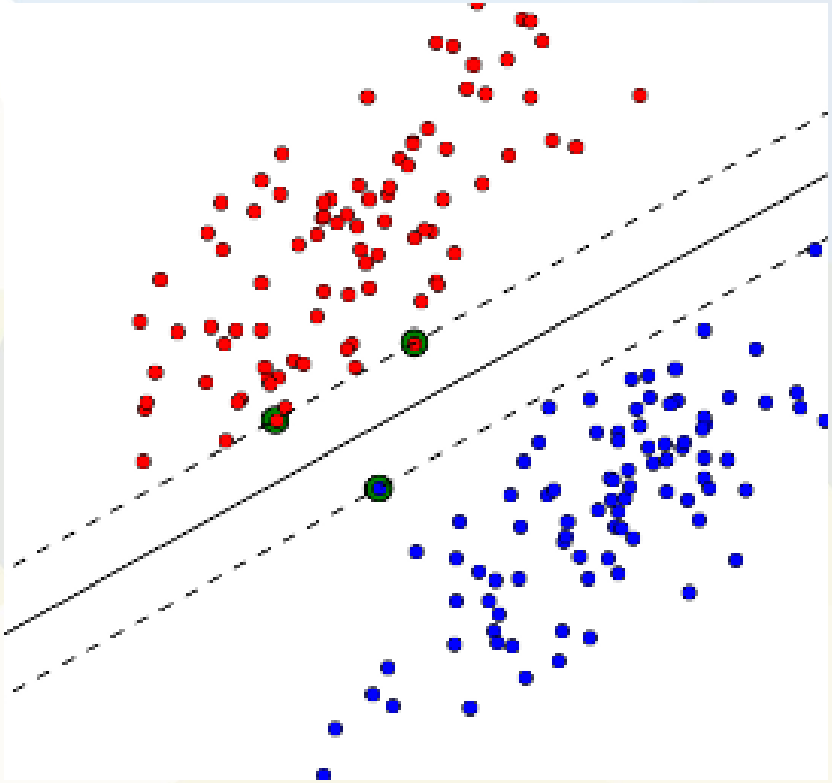


Overfitting



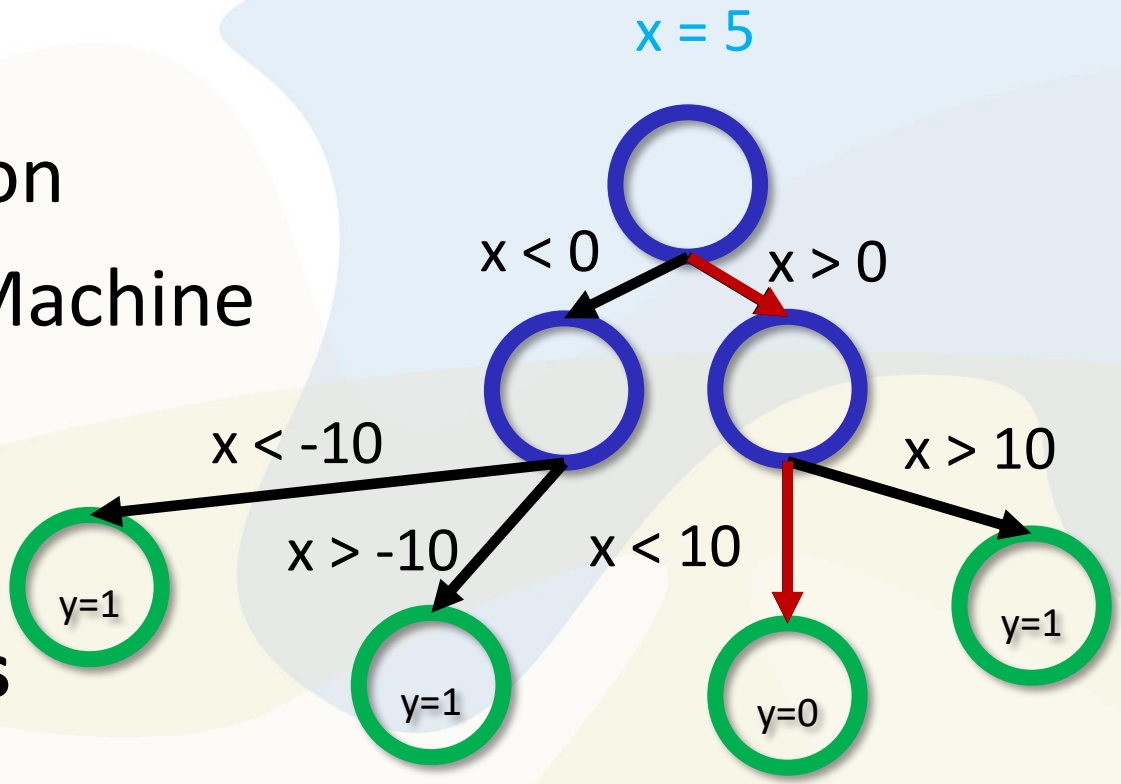
Classification

- Logistic Regression
- Support Vector Machine



Classification

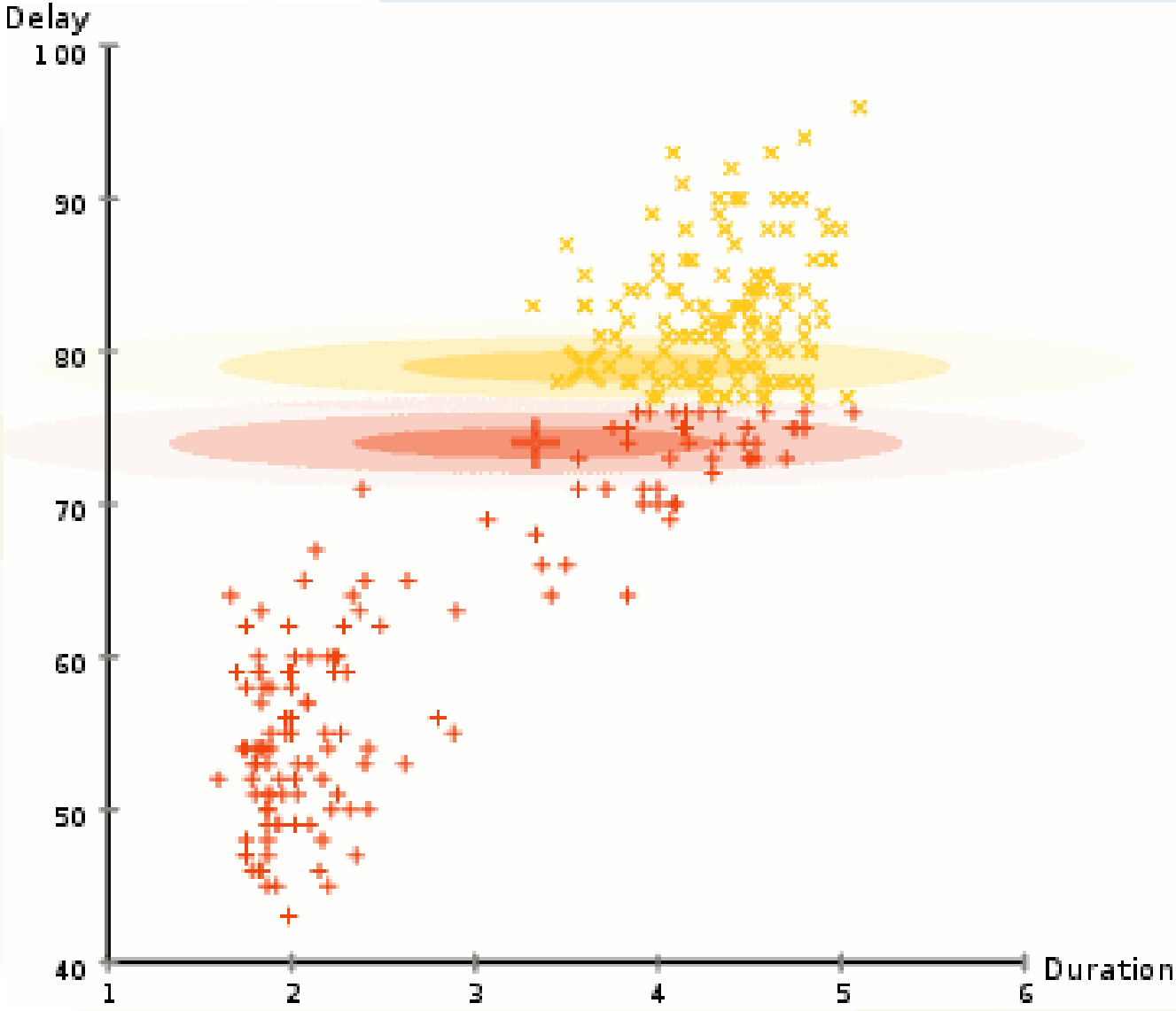
- Logistic Regression
- Support Vector Machine
- Decision Trees
- Random Forests
- **Neural Networks**



Unsupervised Learning

Clustering:

- K-means
- Mixture of Gaussians



neuro
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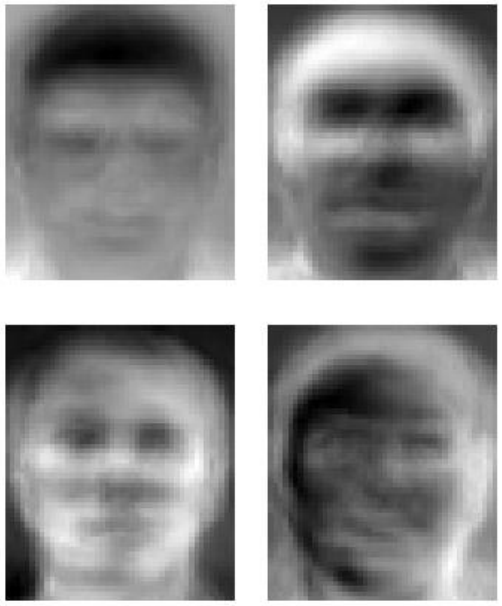
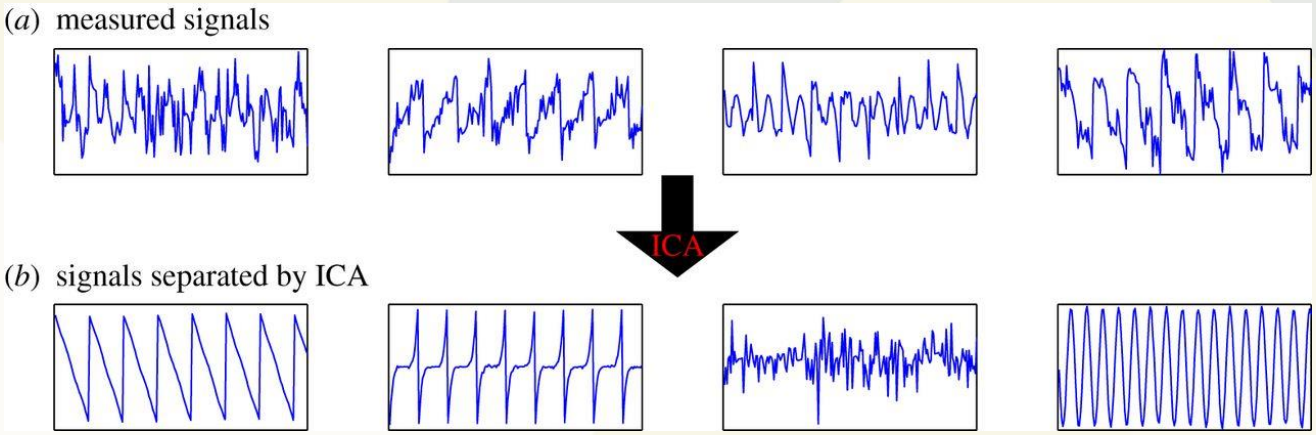
Unsupervised Learning

Dimensionality Reduction:

- Principal Component Analysis
- Independent Component Analysis





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