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Introduction

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0.1 Programme of the course

Arguments treated:

1. **Motivation:** components of the learning problem and applications of Machine Learning. Supervised and unsupervised learning.
2. **Introduction:** the supervised learning problem, Data, Classes of models, Losses.
3. **Probabilistic models and assumptions on the data:** the regression function. Regression and Classification.
4. **When is a model good?:** model complexity, bias variance tradeoff/generalization (VC dimension, generalization error).
5. **Models for Regression:** linear Regression (scalar and multivariate), subset selection, linear-in-the-parameters models, regularization.
6. **Simple Models for Classification:** Logistic Regression, Perceptron, Naïve Bayes Classifier.
7. **Kernel Methods:** Support Vector Machines.
8. **Neural Networks.**
9. **Deep Learning:** Convolutional Neural Networks.
10. **Validation and Model Selection:** Generalization Error, Bias-Variance Trade-off, Cross Validation. Model complexity determination.
11. **Unsupervised learning:** Cluster analysis, K-means Clustering, EM estimation.
12. **Dimensionality reduction:** Principal Component Analysis (PCA).

Bibliography