A Brief Introduction on Machine Learning

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- Supervised:

  - Training examples must have class labels
  - Data distribution is assumed to be fixed
  - Relies on the Statistical Learning Theory
  - Classification-oriented

- Unsupervised:

  - Training examples without class labels
  - Attempts to find some data structure according to the input space
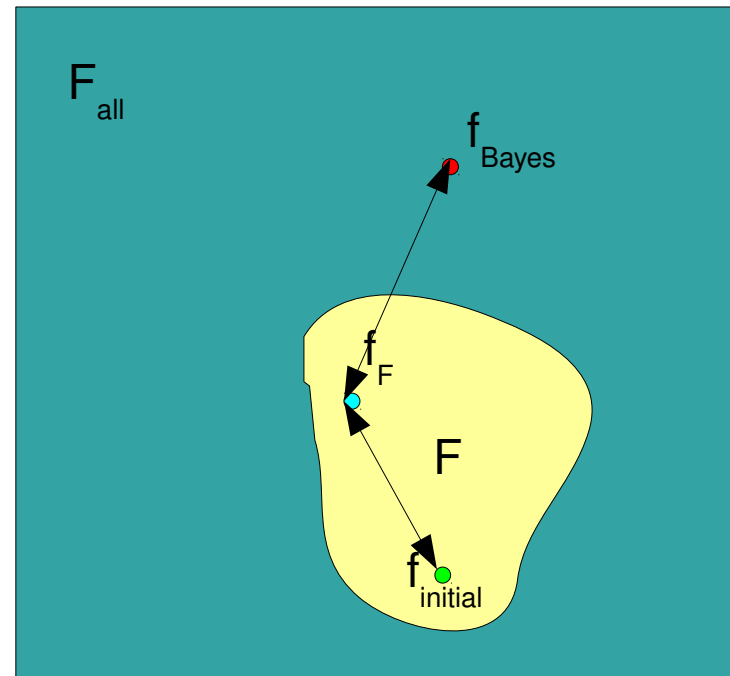 - Little formal frameworks to rely on

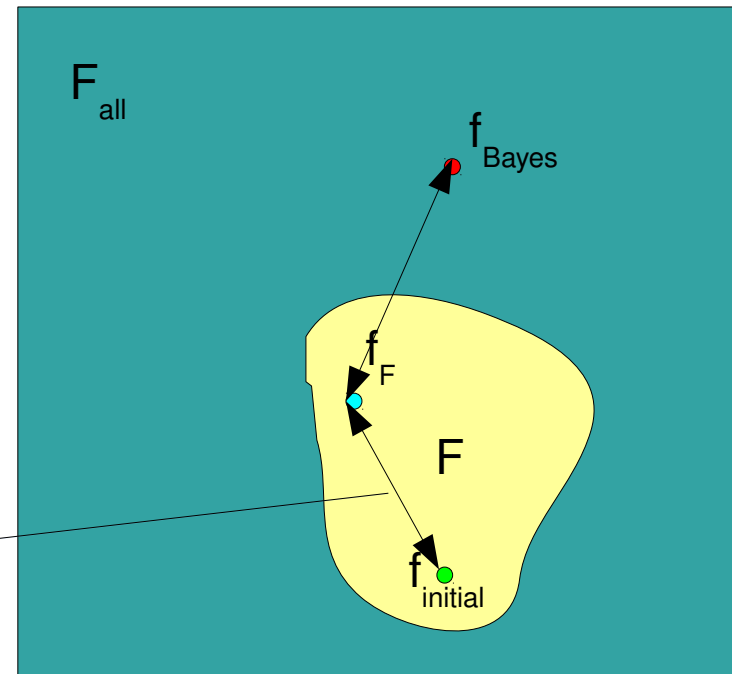- The dichotomy associated to the Bias-Variance Dilemma

- How a given algorithm converges to its best solution
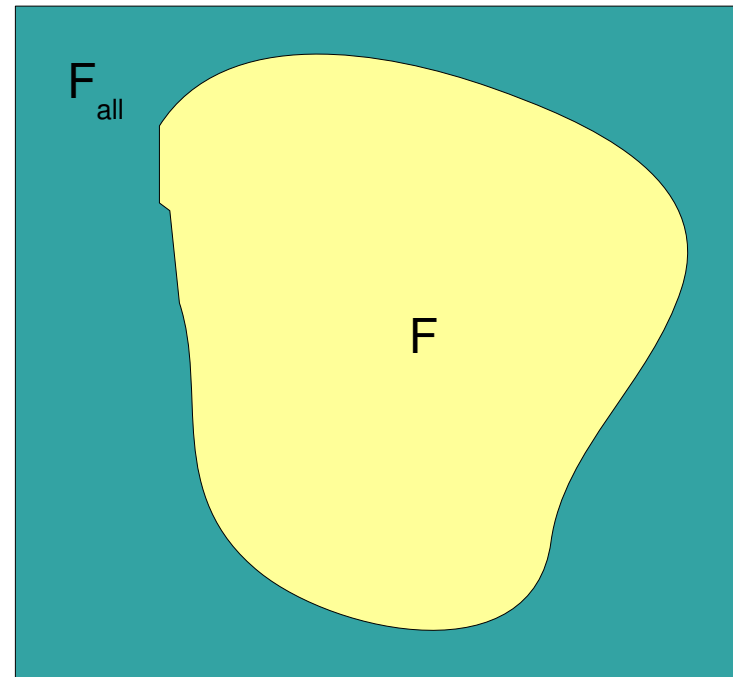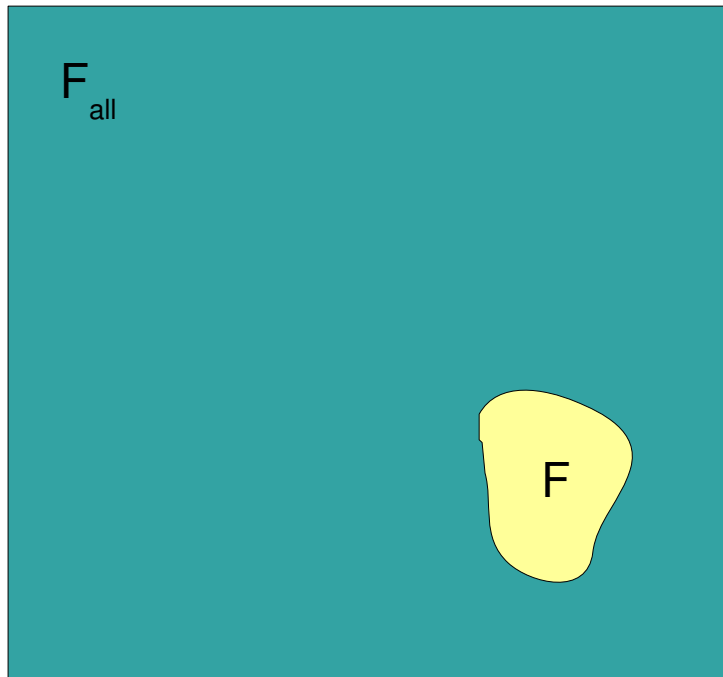
Main concept: Bias-Variance Dilemma

- How a given algorithm converges to its best solution

Estimation error:
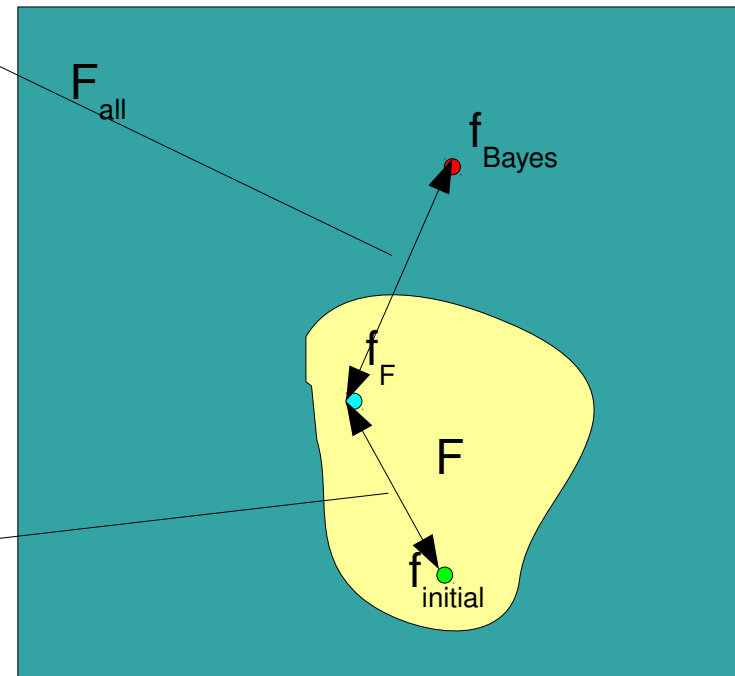how far our solution is
from the best classifier in F

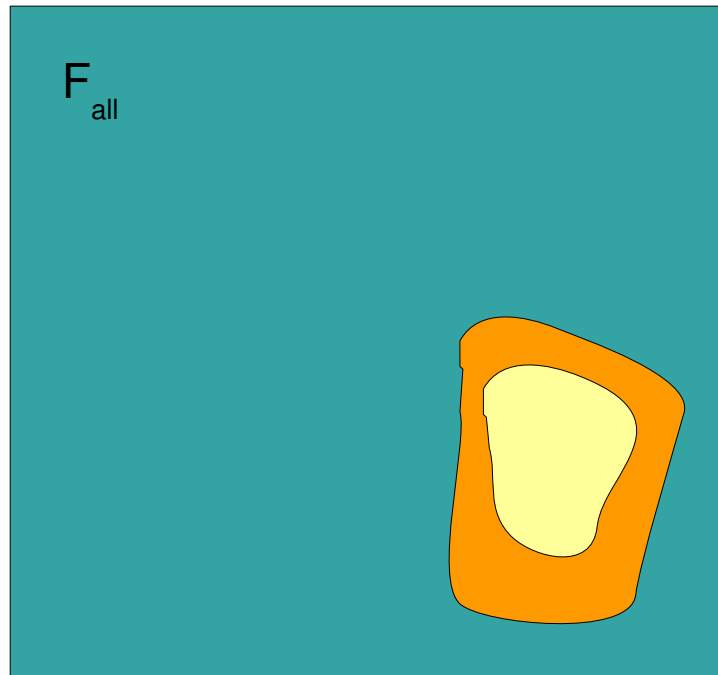- How a given algorithm converges to its best solution

Approximation error:
how far the best
solution in F is
from the best classifier at all

Estimation error:
how far our solution is
from the best classifier in F

F_{all}

f_{Bayes}

f_F

F

$f_{initial}$

- Biases of different algorithms:
  - Either for supervised or unsupervised algorithms

- Algebra

- Calculus

- Statistical inference

- Probability

- Others:

  - Topology

  - Measure Theory

  - Biology

- Supervised

  - Perceptron

  - Multilayer Perceptron

  - K-Nearest Neighbors

  - Distance-Weighted Nearest Neighbors

  - Naive Bayes

  - Support Vector Machines

- Unsupervised

  - K-means

  - DBScan

  - SOM

  - Radial Basis Function-based algorithms

- Supervised

  - Perceptron

  - Multilayer Perceptron

  - **K-Nearest Neighbors**

  - Distance-Weighted Nearest Neighbors

  - Naive Bayes

  - Support Vector Machines

- Unsupervised

  - **K-means**

  - DBScan

  - SOM

  - Radial Basis Function-based algorithms

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- Luxburg and Scholkopf, Statistical Learning Theory: Models, Concepts, and Results. Handbook of the History of Logic. Volume 10: Inductive Logic. Volume Editors: Dov M. Gabbay, Stephan Hartmann and John Woods, Elsevier, 2009

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- Book coming soon :)