AIFS ML Lecture 1: Machine Learning Basics

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Overview

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Module Outline

- Machine Learning Basics
- Linear Models for Regression and Classifications
- Non-linear Models
- Kernel Methods
- Graphical Models
- Latent Variable Models
- Approximate Inference and Sampling
- Dimensionality Reduction

Textbooks:

- Pattern Recognition and Machine Learning Christopher M. Bishop
- Deep Learning, Ian Goodfellow et. al.(Ch5)

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- Intelligence is a measure of some agent's (here a computer program) ability to achieve its goals in a wide range of environments (Legg and Hutter, 2007).

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- Intelligence is a measure of some agent's (here a computer program) ability to achieve its goals in a wide range of environments (Legg and Hutter, 2007).
- For example, we can say that a computer program that is able to play both Chess and Go (AlphaZero) is more intelligent that a program that can only play Go (AlphaGo).

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- The key idea here is that in order to posses the intelligence of being able to discern between ECG's, first Alice had to extract patterns from data.
- Therefore the ability to extract patterns from data is a crucial prerequisite for intelligence.

What is Machine Learning?

- Machine Learning is the ability of a computer program to acquire knowledge by recognising hidden patterns in data.
- Key consideration: A pattern can be extracted only if there exists one.
- In this module we'll look at learning algorithms that can extract patterns out of data.

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- More formally:
  A computer program is said to learn from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E

  - Tom Mitchell, 1997

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- **Objective Function:** A function that scores the current state of the model based on its ability to accurately explain the data in relation to task T.
- **Optimizer:** The optimizer tunes the adaptable parameters of the model such that it improves the model's ability to explain the data, i.e. improves the score. When the objective function is a loss function the optimizer minimizes the score, when it is a performance measure the optimizer maximizes the score.

Simplified Learning Loop
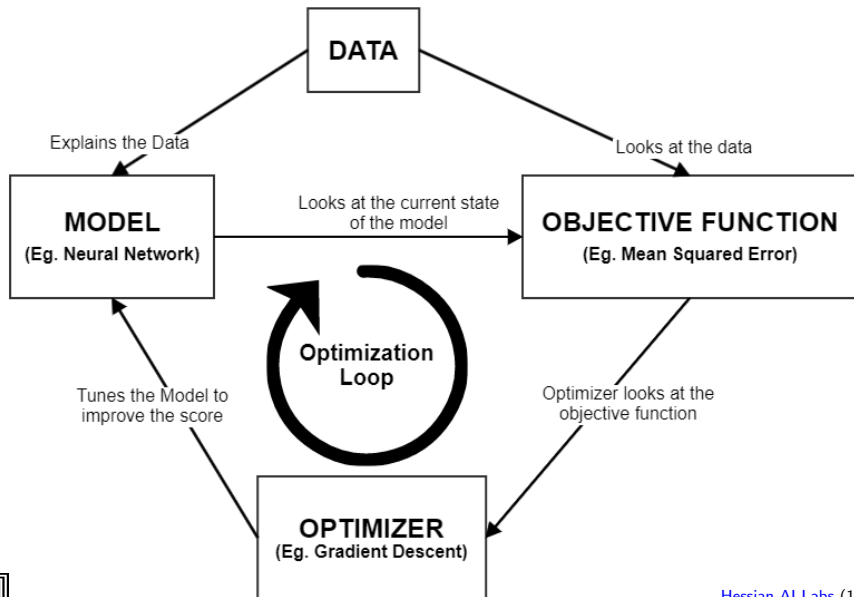
Homework

- Finish Lab1 and Lab2 by Sunday April 19th.
- Read pages 1-3 (till before section 1.1) from PRML Bishop Chapter 1

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References

- Universal Intelligence: A Definition of Machine Intelligence (Legg and Hutter, 2007): https://arxiv.org/abs/0712.3329
- Mitchell, T. M. (1997). Machine learning. 1997. Burr Ridge, IL: McGraw Hill, 45(37), 870-877.