Lecture 23: Bayesian global optimization

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The value of information

Key for creating information acquisition functions that align with the given problem

The value of information

- The value of information (VoI) depends on what you want to do.
- Can be quantified objectively if:
  - you have assigned probabilities over all possibilities.
  - you can quantify your profit/loss if any of the possibilities happen.

The value of information

systematically subjective

VoI of **x** = how much expected gain if I measure at **x**

= expected profit if I measure at **x**
- current best alternative

= expected income if I measure at **x**
- cost of measuring **x**
- current best alternative

Acquisition functions as proxies for the value of information

- Most of the times, we don't have the details to find the VoI.
- We use heuristic approximations to VoI such as:

  ↳ these are some information acquisition functions (IAF's)

  - the probability of improvement
  - the expected improvement
  - the knowledge gradient
  - the expected information gain
  - …