Convex Optimization

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(w/ material from Stephen Boyd and Steven Diamond)

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Mathematical optimization

Outline

(mathy math)

optimization problem has form

$$\begin{array}{ll} \text{minimize} & f_0(x) \\ \text{subject to} & f_i(x) \leq 0, \quad i = 1, \ldots, m \end{array}$$

- $x \in \mathbf{R}^n$ is **decision variable** (to be found)
- f_0 is objective function; f_i are constraint functions
- problem data are hid inside $f_0, \ldots, f_m$
- variations: add equality constraints, maximize a utility function, satisfaction (feasibility), optimal trade off

Why convexity?

- trade off between supervision and modeling power
- nice theory
- theoretical guarantees, global optimum, interpretability: (of local minimizers)
- efficient algorithms
- common language
- (leaky) abstraction: once you've modeled as a convex problem, consider it solved
- with proper training, hearing "your problem is convex" offers deep, cosmic reassurance

In the morning

Outline

Getting up

one	two	three
apple	beta	omega

- Turn off alarm
- Get out of bed

code example

```
import numpy as np
y = np.random.rand(5)
print('hello', y)
```

Breakfast

we need a way to represent math x^{π^2}

- Eat eggs
- Drink coffee

In the evening

Outline

Dinner

- Eat spaghetti
- Drink wine

Going to sleep

- Get in bed
- Count sheep