maximum likelihood

linear regression

logistic regression

principal components analysis

support ~~vec~~ vector machines

→ kernel density estimation ? not really solving an optimization problem

cross-validation ? "

bootstrap ? "

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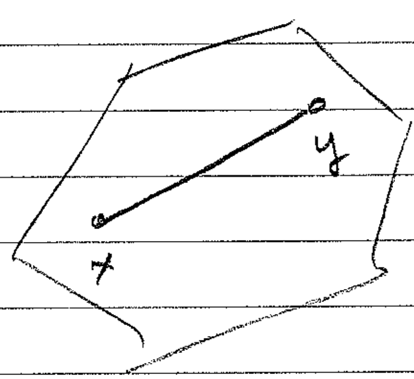
linear trend filtering

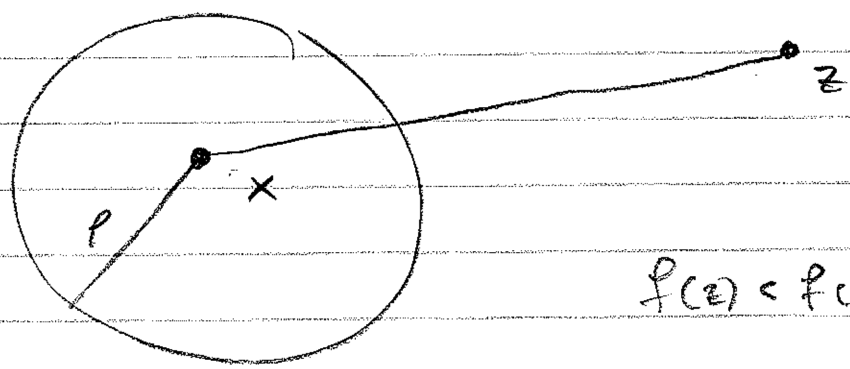
$$\beta_i - 2\beta_{i+1} + \beta_{i+2} = 0 \quad \text{for many } i$$

$$\iff \beta_{i+1} = \frac{\beta_i + \beta_{i+2}}{2}$$



$\mathrm{dom}(f) = \{ x : f(x) \text{ is defined and finite} \}$

$$h_j(x) = 0$$
$$\iff$$
$$h_j(x) \le 0$$
$$-h_j(x) \le 0$$



$f(z) < f(x)$

1. $\tilde{x} = tx + (1-t)z$ is feasible.

why? $\tilde{x} \in D$ ✓

$$\begin{aligned} g_i(\tilde{x}) &= g_i(tx + (1-t)z) \\ &\le t g_i(x) + (1-t) g_i(z) \\ &\le 0 \end{aligned}$$

$$\begin{aligned} h_j(\tilde{x}) &= a_j^T(tx + (1-t)z) + b_j \\ &= 0 + 0 \end{aligned}$$

2. choose $0 \le t < 1$ big enough so that

$$\tilde{x} = tx + (1-t)z \in \text{Ball}$$

$$\begin{aligned} f(\tilde{x}) &\le t f(x) + (1-t) f(z) \\ &< t f(x) + (1-t) f(x) \\ &= f(x) \end{aligned}$$