

ELLIPTICAL SLICE SAMPLING

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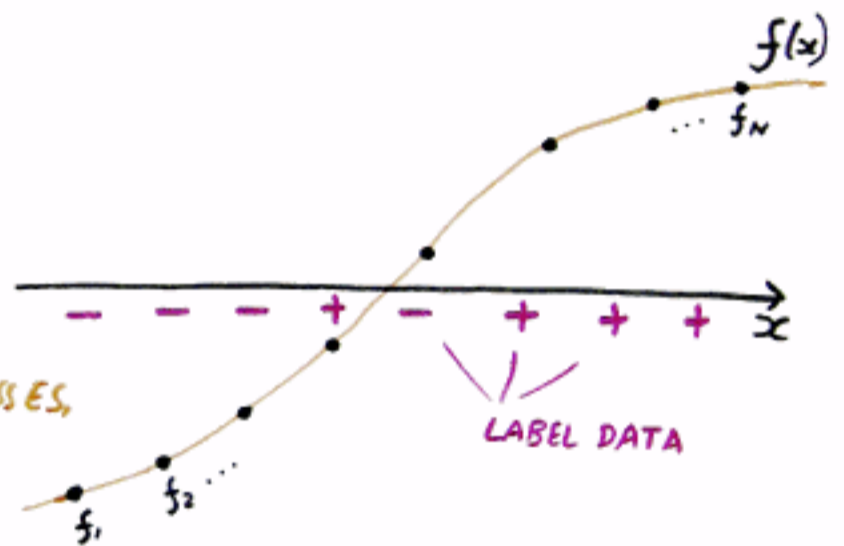
SETUP: GAUSSIAN PROCESS MODELS

$$f \sim N(0, \Sigma)$$

$$p(\text{data} | f) \equiv L(f)$$

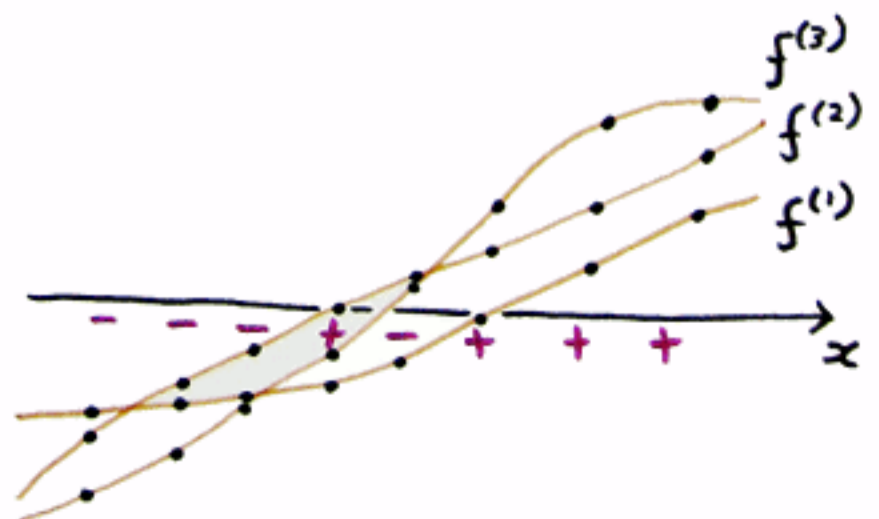
E.G. CLASSIFICATION:

(ALSO ORDINAL REGRESSION, POINT PROCESSES,
DENSITY ESTIMATION, MATRIX FACTORIZATION,
DIFFERENTIAL EQUATION MODELS, ...)

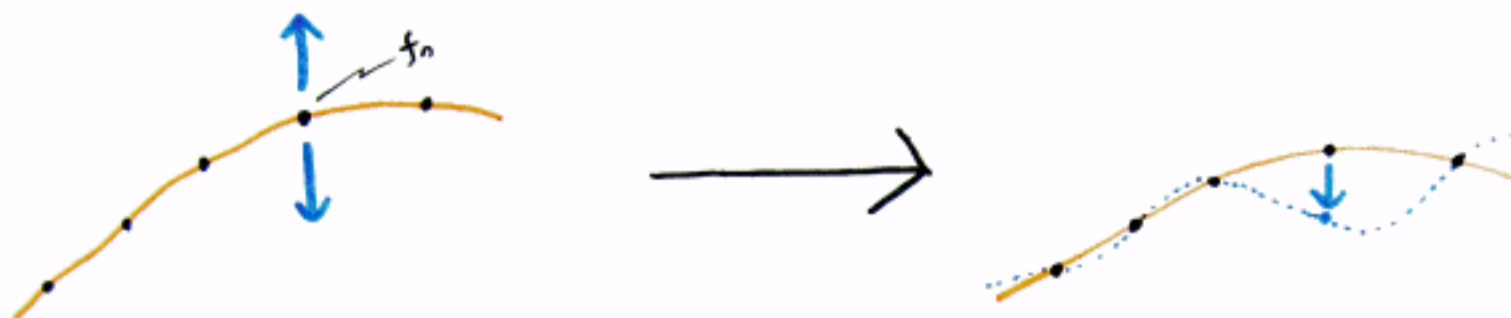


TASK

SAMPLE $p(f | \text{data})$

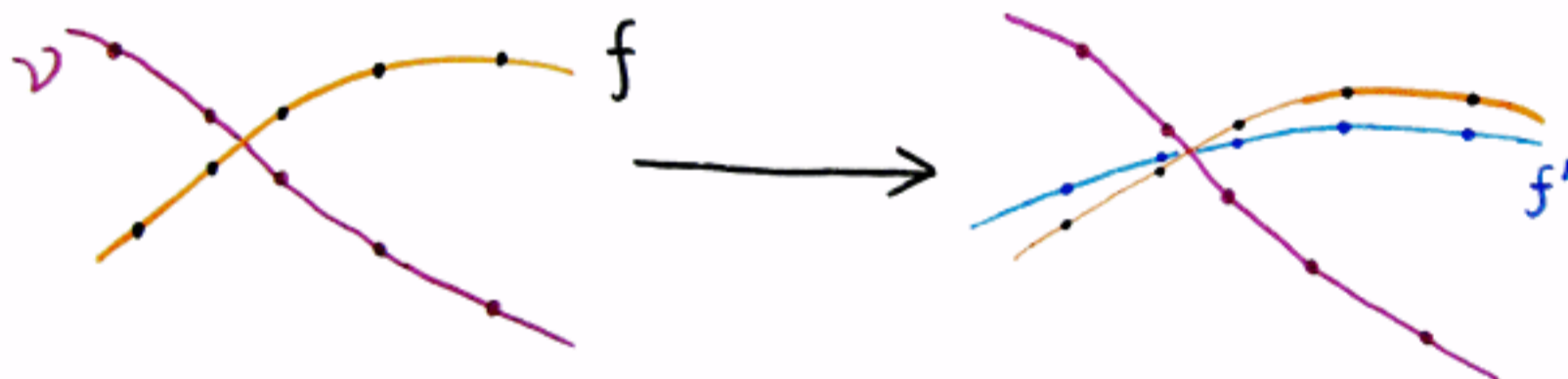


MARKOV CHAIN UPDATES



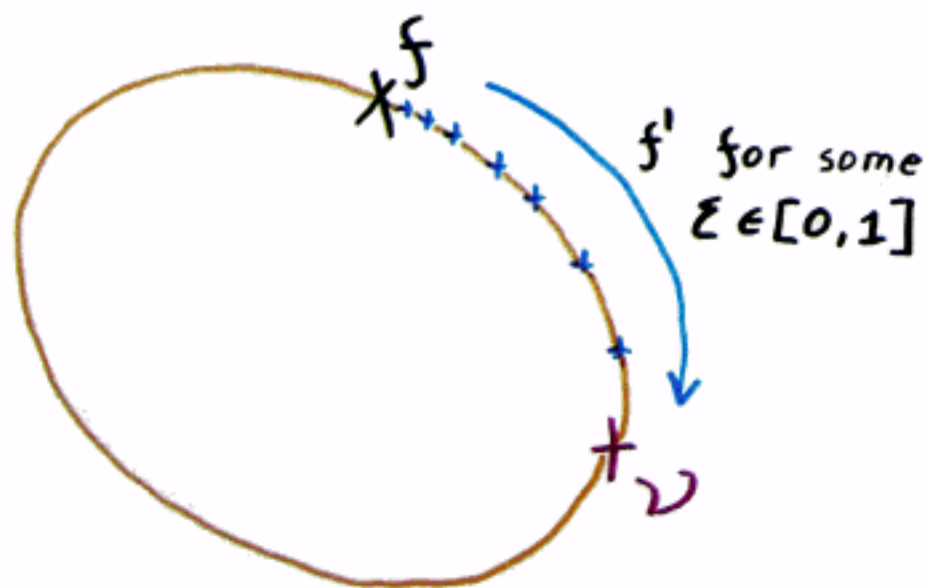
GIBBS, COMPONENT M-H

NEAL (1999)



$$f' = \sqrt{1-\epsilon^2} f + \epsilon v$$

$$P(\text{ACCEPT}) = \min\left(1, \frac{L(f')}{L(f)}\right)$$



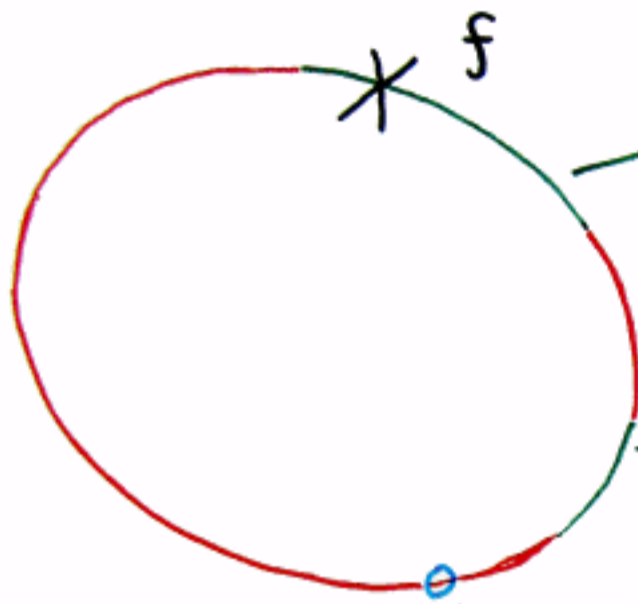
WHOLE ELLIPSE:

$$f' = \pm \sqrt{1-\epsilon^2} f + \epsilon v$$

$$\epsilon \in [-1, +1]$$

ELLIPTICAL SLICE SAMPLING

$$f' = f \sin \theta + v \cos \theta$$

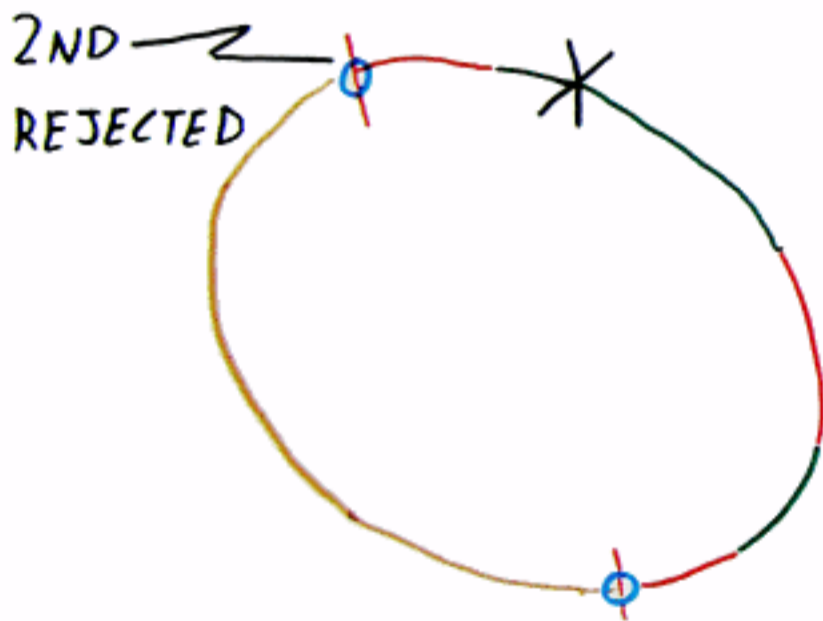


ACCEPTABLE POINTS:

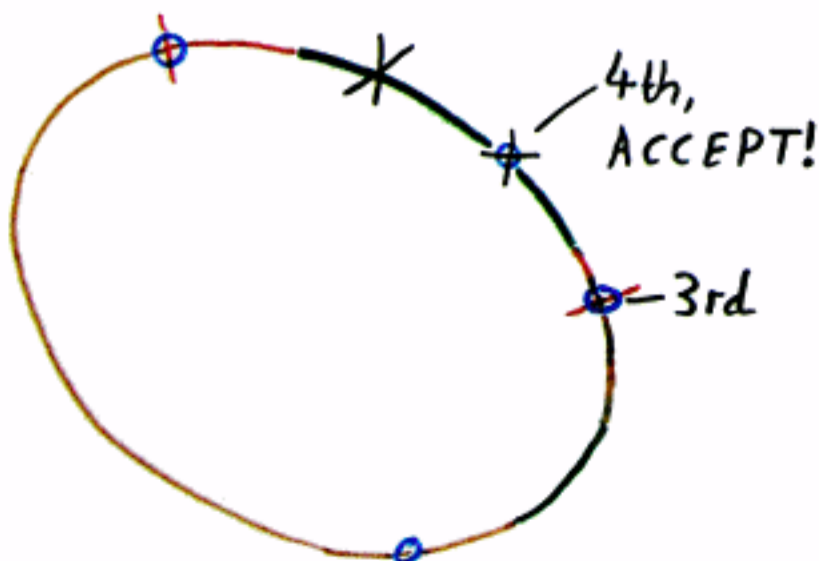
$$L(f') \geq L(f) \times \text{rand}()$$

PROPOSE $\theta \sim \text{UNIFORM}[0, 2\pi]$

(1st REJECTED)



NOW ONLY PROPOSE
BETWEEN CLOSEST
REJECTIONS TO f

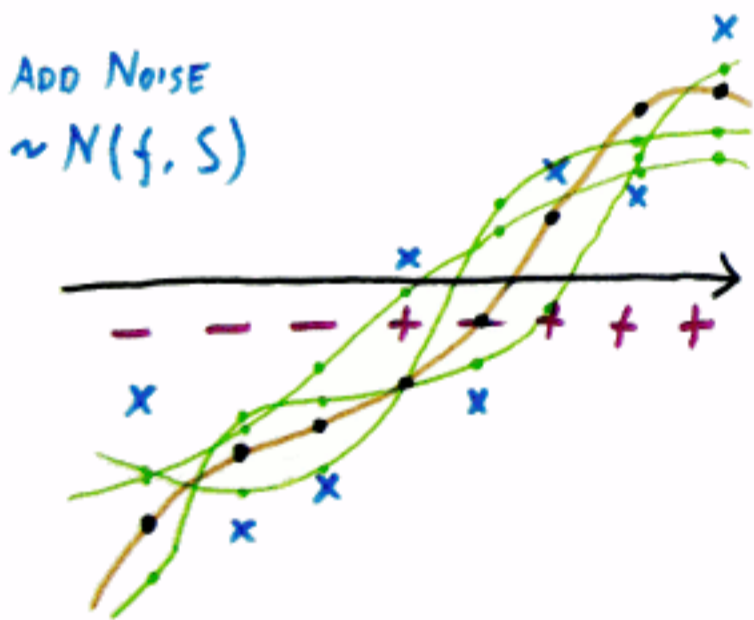
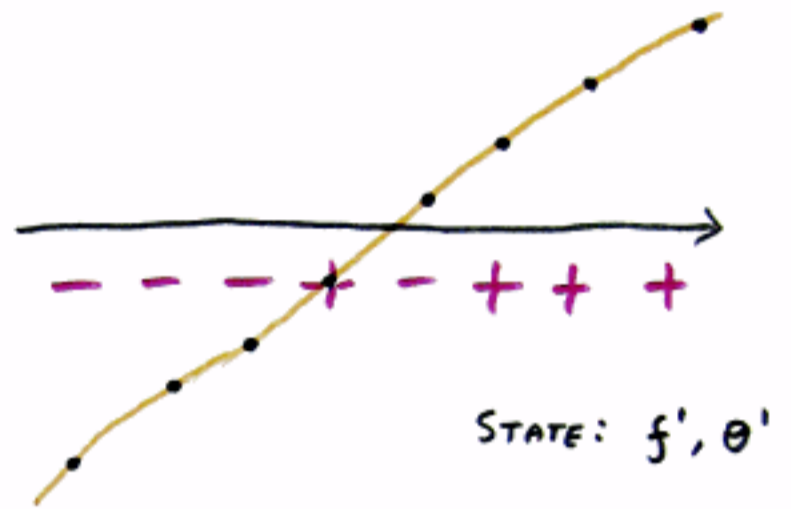
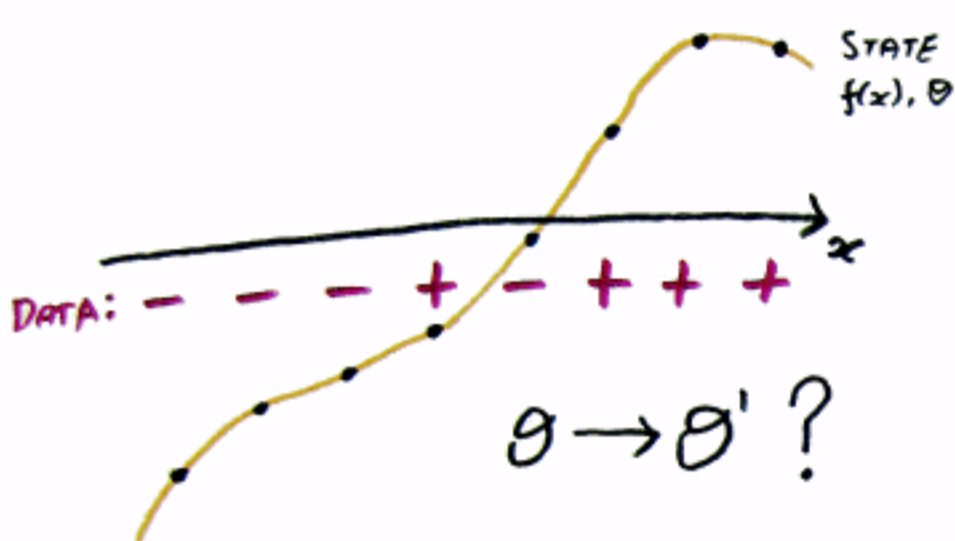


SIMPLE CODE

ZERO FREE PARAMETERS

UPDATING PARAMETERS

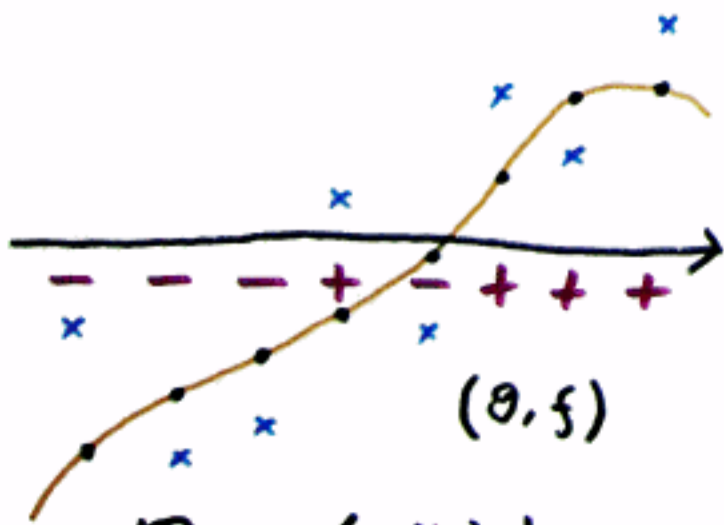
$f \sim N(0, \Sigma_\theta)$, INFER θ



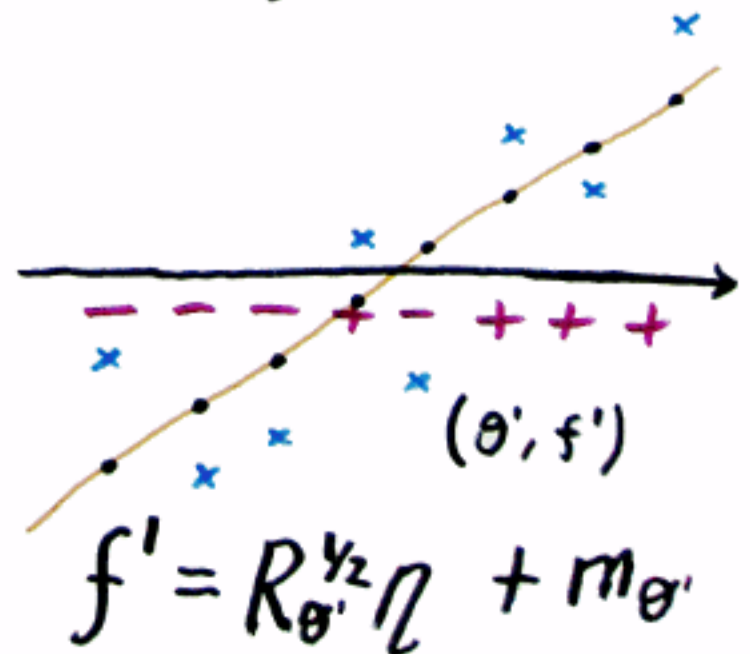
SURROGATE POSTERIOR $N(m_{\theta'}, R_{\theta'})$

IMAGINE:

$\eta \sim N(0, I)$
 $f = R_{\theta'}^{1/2} \eta + m_{\theta'}$



$\theta \rightarrow \theta'$



$Z = (R_{\theta'}^{1/2})^{-1} (f - m_{\theta'})$

$f' = R_{\theta'}^{1/2} \eta + m_{\theta'}$