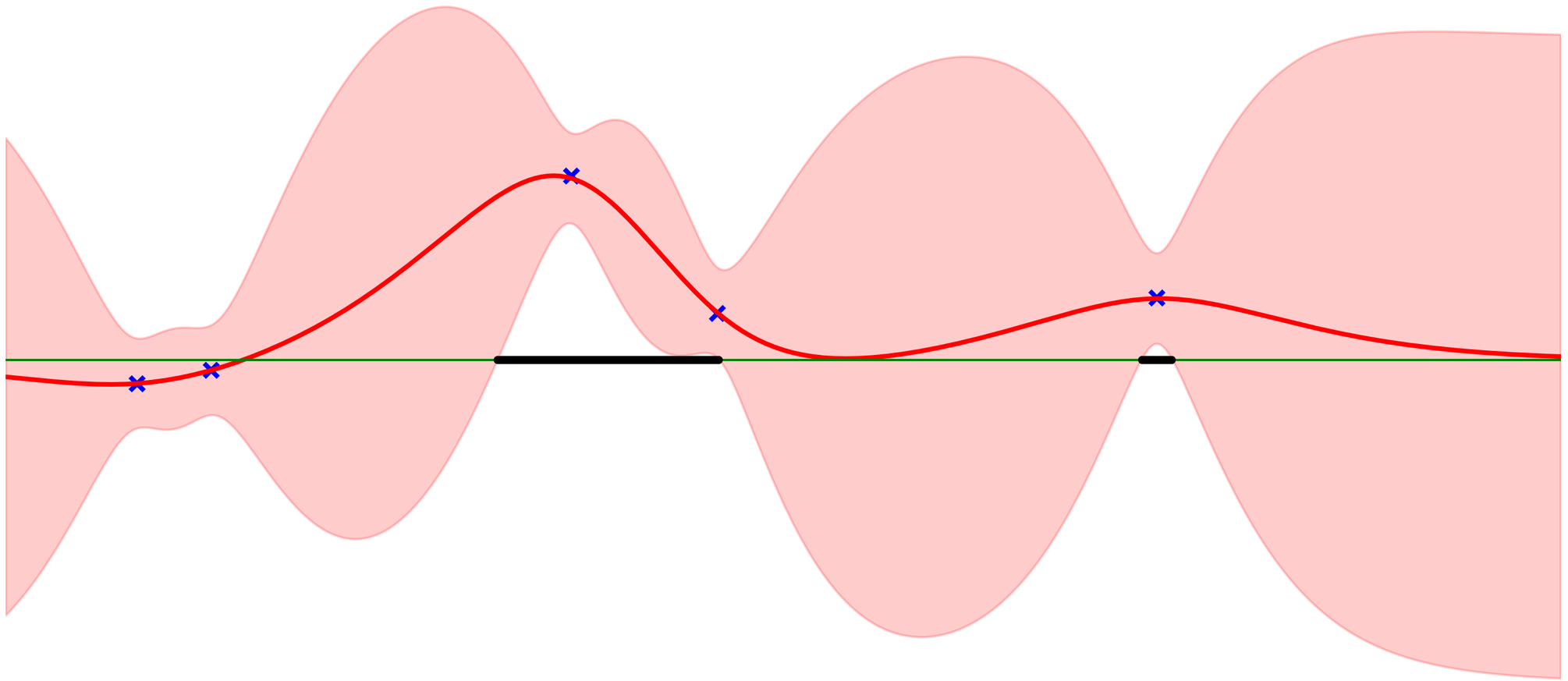


Zi Wang (MIT CSAIL)

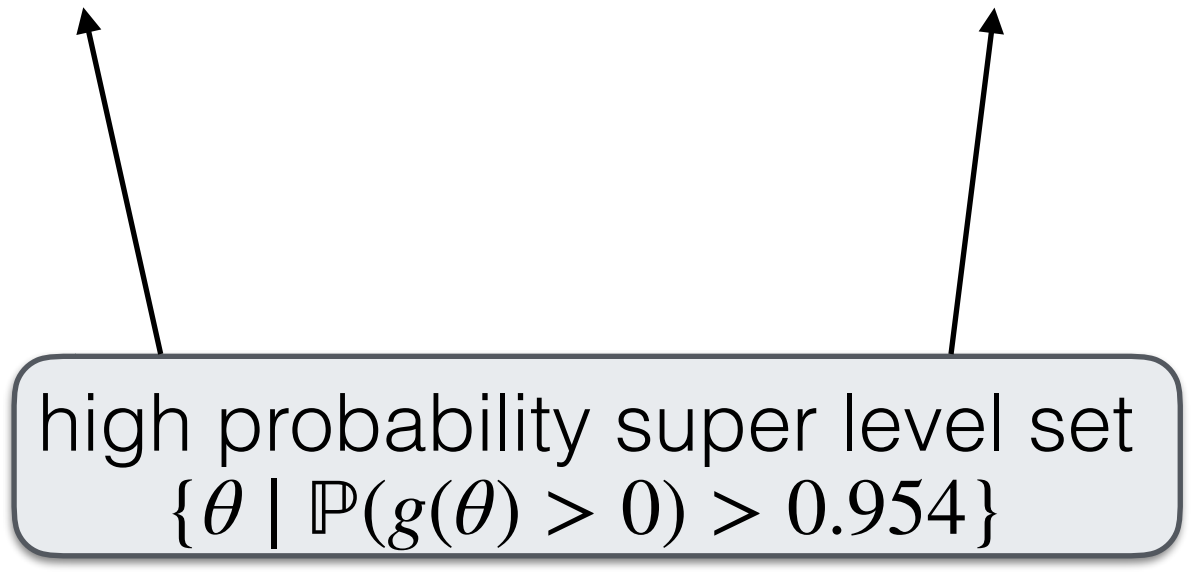
Robot Learning

9

Modeling constraints with Gaussian processes

Constraint: $g(\theta) > 0$

mean function $\mu(\theta)$
confidence interval $\mu(\theta) \pm 2\sigma(\theta)$
observation $(\theta_i, g(\theta_i))$


high probability super level set
$\{\theta \mid \mathbb{P}(g(\theta) > 0) > 0.954\}$

#observations = 5

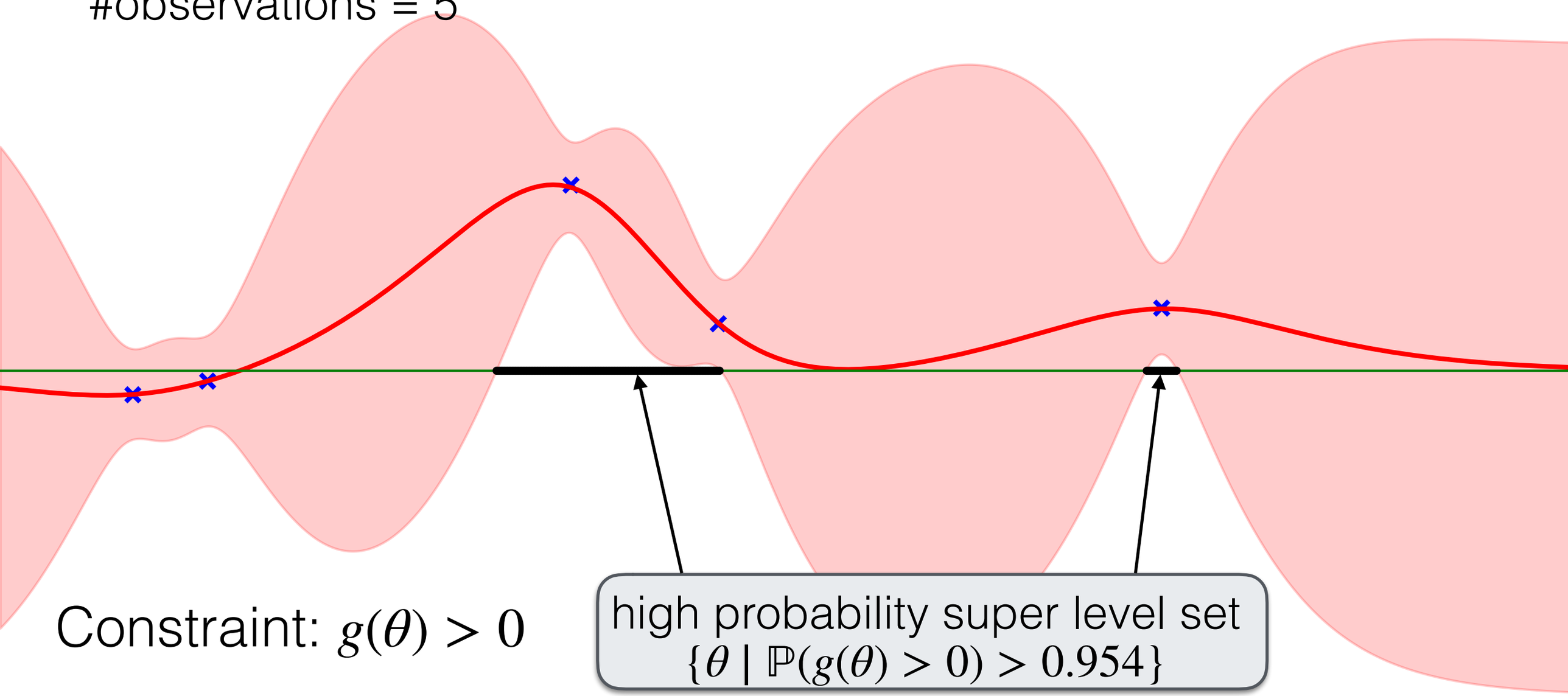
Modeling constraints with Gaussian processes

mean function $\mu(\theta)$

confidence interval $\mu(\theta) \pm 2\sigma(\theta)$

observation $(\theta_i, g(\theta_i))$

#observations = 5



Active learning of constraints *[Straddle algorithm, Bryan et al, NIPS 2016]*

mean function $\mu(\theta)$

confidence interval $\mu(\theta) \pm 2\sigma(\theta)$

x observation $(\theta_i, g(\theta_i))$

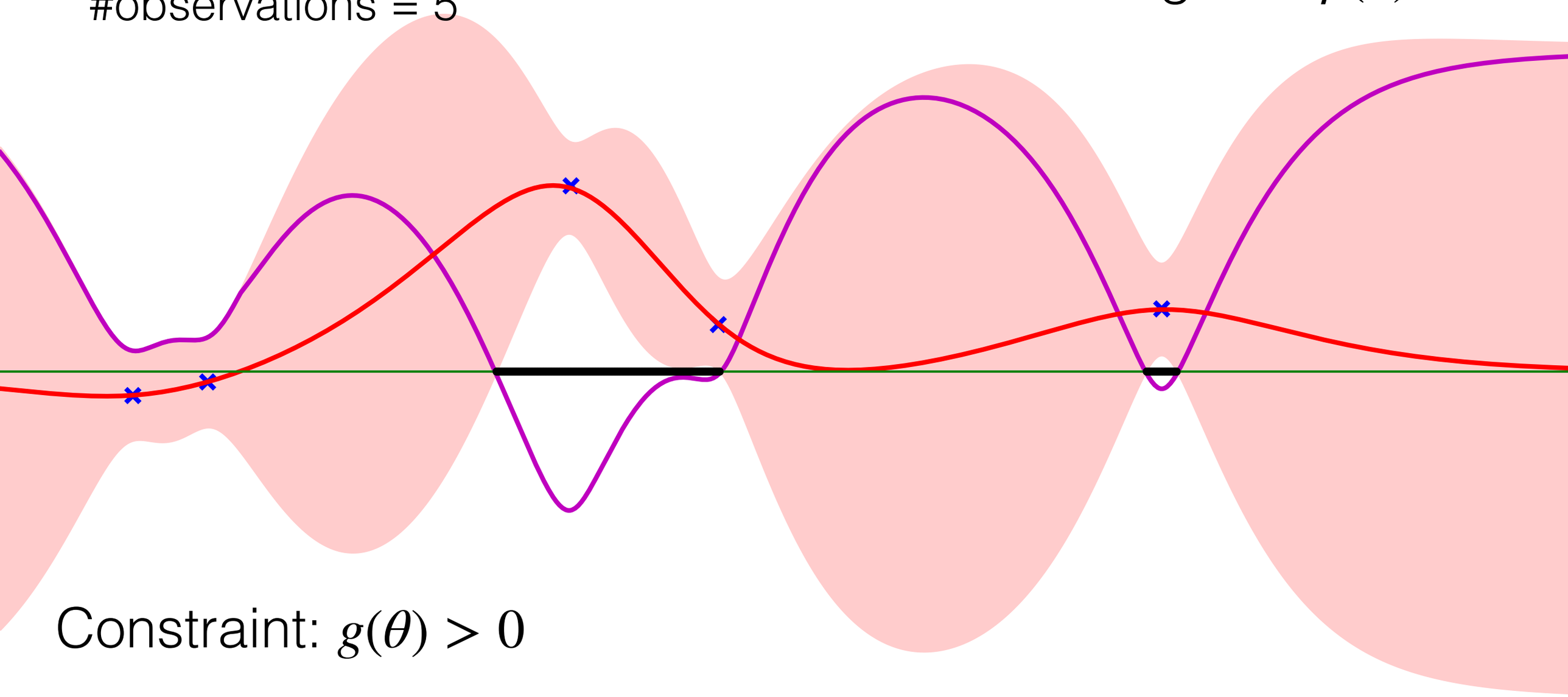
#observations = 5

acquisition function

$$\phi(\theta) = 2\sigma(\theta) - |\mu(\theta)|$$

next: test action with parameter

$$\theta^* = \text{argmax } \phi(\theta)$$



Constraint: $g(\theta) > 0$