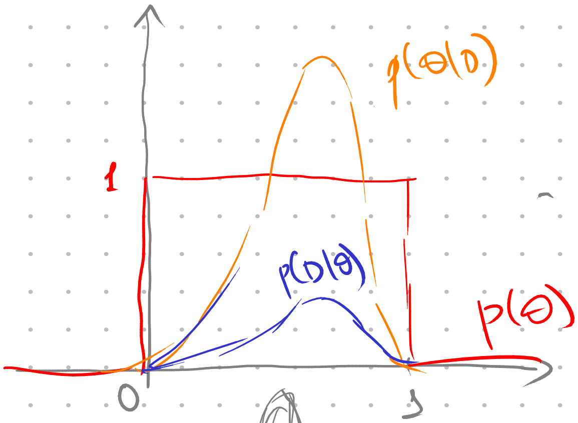
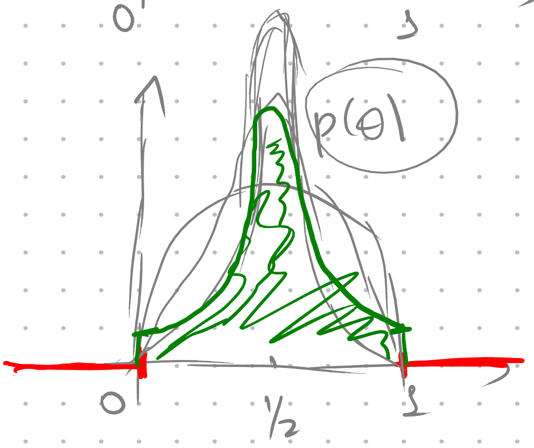


$$p(D|\theta) \xrightarrow[\theta]{} \max \qquad \theta_{ML}$$

$$p(\theta|D) \propto p(\theta)p(D|\theta) \xrightarrow[\theta]{} \max \qquad \theta_{MAP}$$

$$p(x|D) = \int p(x|\theta)\,p(\theta|D)\,d\theta$$



$$\cancel{p(\theta) = \delta(\theta - \tfrac{1}{2})}$$

$$p(\theta) = \begin{cases} \mathcal{N}(\theta \mid \frac{1}{2}, \sigma^2), & \theta \in [0,1] \\ 0, & \theta \notin [0,1] \end{cases}$$

$$p(\theta|D) \propto p(\theta)p(D|\theta) \propto \boxed{\theta^{n}(1-\theta)^{m}}\; e^{-\frac{1}{2\sigma^2}(\theta - \frac{1}{2})^2}$$

$$p(\theta) \propto \theta^{\cdots}(1-\theta)^{\cdots}, \quad \theta \in [0,1] \quad \xrightarrow{\alpha,\beta\to\infty} \delta(\theta - \tfrac{1}{2})$$

$$p(\theta) = \frac{1}{B(\alpha,\beta)}\theta^{\alpha-1}(1-\theta)^{\beta-1}, \quad \theta \in [0,1]$$

$$= \mathrm{Beta}(\theta|\alpha,\beta)$$

$$p(\theta|D) \propto p(\theta)p(D|\theta) \propto \theta^{n+\alpha-1}(1-\theta)^{m+\beta-1}$$

$$p(\theta|D) = \mathrm{Beta}(\theta|n+\alpha, m+\beta)$$

$$\underset{\mathrm{Beta}}{p(\theta)} \times p(D|\theta) \longrightarrow \underset{\mathrm{Beta}}{p(\theta|D)}$$

$$\underset{\mathrm{Beta}}{p(\theta|D)} \times p(\overset{(n',m')}{D'}|\theta) \longrightarrow p(\theta|D,D')$$

$$= \mathrm{Beta}(\theta|n+n'+\alpha, m+m'+\beta)$$

Conjugate prior

$p(\bar\theta \mid \bar\alpha)$ – conjugate prior for $p(D \mid \bar\theta)$, if

$\forall \bar\alpha, D \quad p(\bar\theta \mid D) \propto p(\bar\theta \mid \bar\alpha)\, p(D \mid \bar\theta)$

$\quad = p(\bar\theta \mid \bar\alpha')$

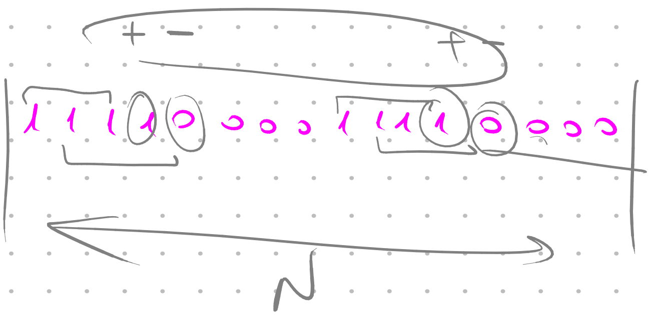
Exponential family

$p(w \mid t) = \theta_{wt}$

$p(\bar\theta_{*t})$

sparsity

1 1 1 (...)



1 1 1 | .

1 1 1 0 1 1 1 0

streak = 1

N=3

	n	# succes	
1 1 1	2	2	1
1 1 0	2	1	1/2
1 0 1	1	0	0
1 0 0	1	0	0
0 1 1	1	1	1
0 1 0	1	0	0
0 0 1	0		
0 0 0	0		

$\text{Avg} = \frac{5}{12} < \frac{1}{2}$