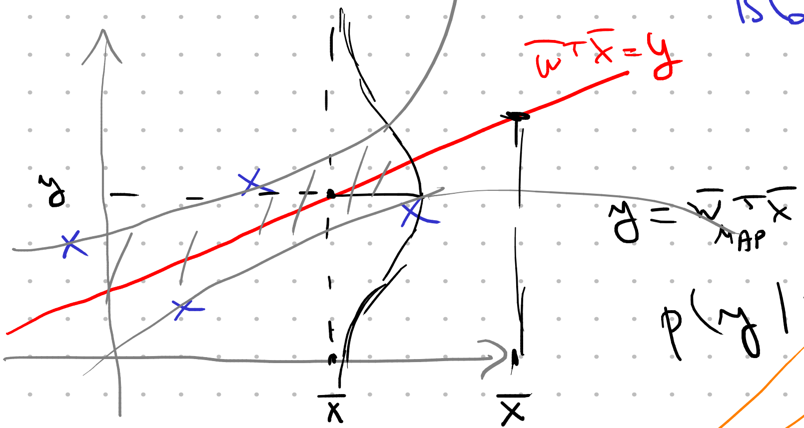
$$\overbrace{p(\theta|D)}^{\text{posterior}} = \frac{\overbrace{p(\theta)}^{\text{prior}}\ \overbrace{p(D|\theta)}^{\text{likelihood}}}{p(D)}$$

$\theta^{\alpha-1}(1-\theta)^{\beta-1}$ $\qquad$ $\theta^{n}(1-\theta)^{m}$

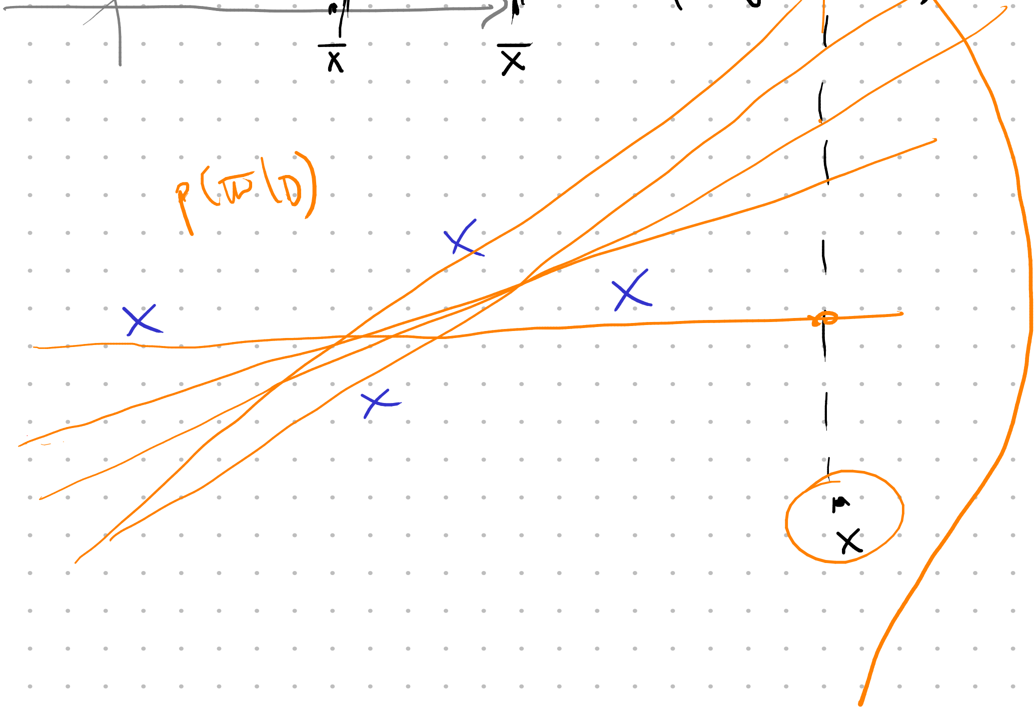
$$\propto \theta^{\alpha+n-1}(1-\theta)^{\beta+m-1}$$

$$p(\text{heads}|D) = \int p(\text{heads}, \theta|D)\,d\theta =$$

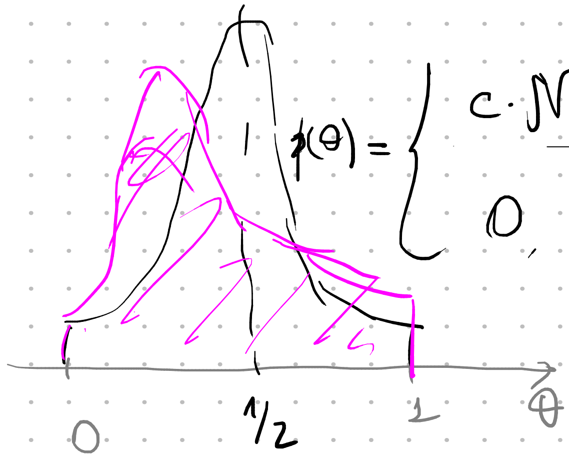
$$= \int \underbrace{p(\text{heads}|\theta)}_{\theta}\ \underbrace{p(\theta|D)}_{\frac{1}{B(\alpha+n,\,\beta+m)}\theta^{\alpha+n-1}(1-\theta)^{\beta+m-1}}\,d\theta$$



$$p(y|\bar{x}, D) = \ldots = \mathcal{N}(y|\bar{w}_{MAP}^T\bar{x}, \sigma^2)$$



improper priors

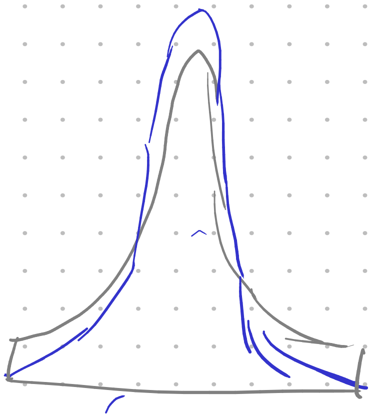


$$p(\theta) = \begin{cases} c\cdot \mathcal{N}(\theta \mid \tfrac{1}{2}, \sigma^2), & \theta\in[0,1] \\ 0, & \theta\notin[0,1] \end{cases}$$

$\theta\in[0,1]$

$$p(\theta|D) \propto \theta^n (1-\theta)^m \cdot e^{-\frac{1}{2\sigma^2}(\theta-\frac{1}{2})^2}, \quad \theta\in[0,1]$$

$$p(\text{heads}|D) = \int_0^1 \theta\cdot p(\theta|D)\,d\theta$$



$$\boxed{\int_{\bar{\theta}\in[0,1]^{1000}} f(\bar{\theta})\,d\bar{\theta}}$$

$$\overbrace{\underline{p(\theta)}\,\underline{p(D|\theta)}}^{=\text{const}}$$

$\theta\in\mathbb{R}$

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

$$= E_{p(\theta|D)}\left[p(x|\theta)\right] \simeq \frac{1}{R}\sum p(x|\theta^{(r)})$$

$\simeq q(\theta)$

$$\theta^{(r)} \sim p(\theta|D)$$