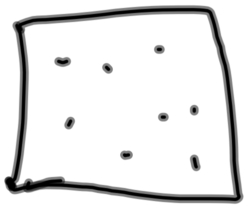
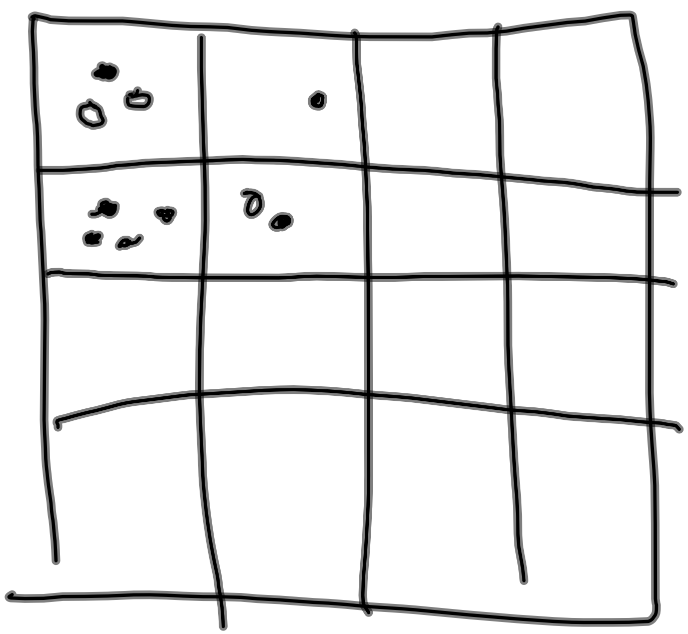
Latimer et al (2006)



gridcell

· = observations (p/a)

- no local α
- shared global parameters β



"case"$_i$ $\equiv$ cell$_i$

"global" $\equiv$ entire grid

α_i binomial parameter for cell$_i$

case specific

data:

$\underline{x}_i$ environmental covariates case$_i$

X

n_i number of trials for presence in cell i

m_i number of presences cell$_i$

If we know α_i then

$$p(m_i \mid n_i, \alpha_i) = \alpha_i^{m_i} (1-\alpha_i)^{n_i - m_i} \frac{n_i!}{m_i! \, (n_i - m_i)!}$$

$$E(m_i) = \alpha_i n_i$$

$$Var(m_i) = n_i \alpha_i (1-\alpha_i)$$

$$CV = \frac{\sqrt{n_i \cdot \alpha_i \cdot (1-\alpha_i)}}{\alpha_i \cdot n_i} = \frac{1}{\sqrt{n_i}} \sqrt{\frac{1-\alpha_i}{\alpha_i}}$$

logistic ~~Formula~~ regression

$$\alpha_i = \frac{e^{\underline{\beta}\,\underline{x}_i + \beta_0 + \varepsilon_i}}{1 + e^{\underline{\beta}\,\underline{x}_i + \beta_0 + \varepsilon_i}}$$

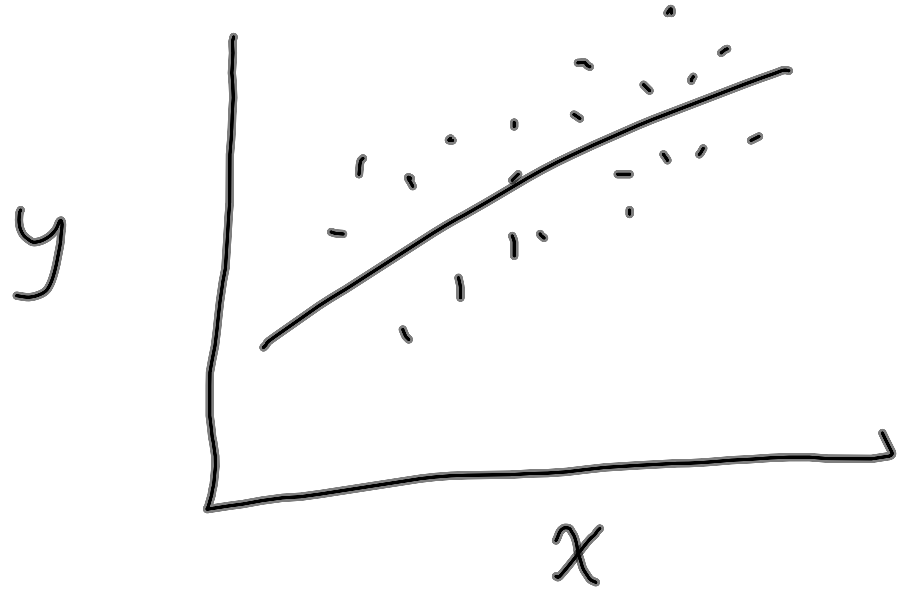
$$\underline{\beta}\,\underline{x}_i = \beta_1 x_{1_i} + \beta_2 x_{2_i} + \cdots \beta_Q x_{Q_i}$$

β are global

ε_i is case specific

Conventional linear regression

$$y = ax + a_0 + \varepsilon$$



α_{11} α_{11}	α_{12} α_{12}	α_{13} α_{13}	α_{14} α_{14}

α is calculated from β and x

α is from binomial inference using n m

$\updownarrow$ discrepancy reflects ε_i

Imagine we can grid ε

process:

$$\varepsilon_i = r\,\bar{\varepsilon}_{\hat{i}} + \delta_i\,\sigma_\varepsilon \sqrt{1-r^2}$$

δ_i: standard normal

$\left.\begin{array}{l} r \\ \sigma_\varepsilon \end{array}\right\}$ global parameters

Gibbs sampling:

A joint distribution can be simulated (sampled) from its conditionals.

$$p(\underline{\varepsilon}, \underline{\beta}, \beta_0, r, \sigma_\varepsilon \mid X, \underline{n}, \underline{m}) \propto$$

$$\pi(r)\,\pi(\sigma_\varepsilon)\,\pi(\underline{\beta}, \beta_0)\,\pi(\underline{\varepsilon} \mid r, \sigma)$$

$$\prod_{j=1}^{K} \left(\frac{e^{\underline{\beta}\,\underline{x}_j + \beta_0 + \varepsilon_j}}{1 + e^{\cdots}} \right)^{m_j} \left(1 - \frac{e^{\cdots}}{1 + e^{\cdots}} \right)^{n_j - m_j} \frac{n_j!}{m_j!\,(n_j - m_j)!}$$