

# Non Linear Models

Bayesian approach

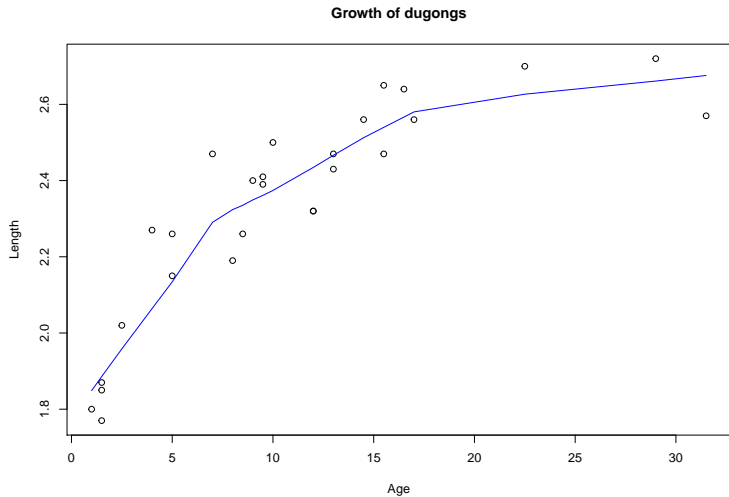
Fruday, April 7, 2015

# Non linear vs Linear approach

- the linear mean structure is:  $Y_i = x_i' \beta + \epsilon_i$ 
  - the generic form:  $Y_i = g(x_i, \beta) + \epsilon_i$  for a known function  $g$
- **Lets consider a non linear mean structure**
  - The idea is to model non transformed data

# Non transformed data

- The data are length and age measurements for 27 captured dugongs (sea cows).
  - **Carlin and Gelfand (1991)** model this data using a nonlinear growth



# Non-linear Dugong growth model

$$Y_i = \alpha - \beta * \gamma^{x^i} + \epsilon_i, i = 1, 2, \dots, n$$

- Where  $\alpha > 0$  ,  $\beta > 0$  ,  $0 \leq \gamma \leq 1$  and as usual  $\epsilon_i \sim N(0, \sigma^2)$
- $\alpha$  corresponds to the average length of a fully grown dugong
- $\alpha - \beta$  length of a dugong at birth and  $\gamma$  determines the growth rate

# Sampling approach: why?

- The nonlinearity of the model eliminates any hope for a closed form full conditional for  $\gamma$
- **Sampling** is the best approach - types of sampling?
  - We use **Gibbs** Sampling

get data and code?

<https://goo.gl/d5pbBo>

## OpenBugs Model ..

- We run three parallel Gibbs sampling chains of 20,000 iterations each following a 1000-iteration burn-in
- Obtain posterior density estimates and autocorrelation plots for  $\alpha > 0$  ,  $\beta > 0$  ,  $\gamma$  and  $\sigma$
- **Investigate the bivariate posterior of  $(\alpha, \gamma)$  using the Correlation tool on the inference menu**



## Some interesting intro

[https://youtu.be/30JEae7Qb\\_o?list=PLTn3e0V1DiQi80T3K7vrB\\_7cXYaLNb-Y-](https://youtu.be/30JEae7Qb_o?list=PLTn3e0V1DiQi80T3K7vrB_7cXYaLNb-Y-)