Prophet

Facebook

$$y_t = \underbrace{g(t)}_{\text{trend}} + \underbrace{s(t)}_{\text{seas}} + \underbrace{h(t)}_{\text{holidays}} + \varepsilon_t \sim \mathcal{N}(0, \sigma^2)$$

1) $g(t)$

a) logistic

$$g(t) = \frac{\overbrace{C(t)}^{\text{capacity}}}{1 + \exp\left(-\left(\underbrace{k}_{} + a(t)^T \underbrace{\delta}_{\text{laplace}(0,\tau)}\right)\left(t - \left(\underbrace{m}_{} + a(t)^T \gamma\right)\right)\right)}$$

changepoints

b) linear

$$g(t) = \underbrace{\left(k + a(t)^T \delta\right)}_{} t + \underbrace{\left(m + a(t)^T \gamma\right)}_{}$$

2) seasonality

$$s(t) = \sum_{n=1}^{N} a_n \cos\left(\frac{2\pi n t}{P}\right) + b_n \sin\left(\frac{2\pi n t}{P}\right)$$

Yearly, $N = 10$, $P = 365.25$

Weekly: $N = 3$, $P = 7$

Daily

3) Holidays $h(t) = Z(t)\,\kappa \sim \mathcal{N}(0, \nu^2)$

$$z(t) = [\mathbb{I}\{t \in D_1\}, \dots, \mathbb{I}\{t \in D_K\}]$$

D_k – мн-во дней праздника k

w – все параметры модели $p(w)$ – prior

$p(data|w)$ – likelihood

$$p(w|data) = \underbrace{\frac{p(w, data)}{p(data)}}_{\text{posterior}} = \frac{p(data|w)p(w)}{\int p(data|w^*)p(w^*)dw^*}$$

1) ML $p(data|w) \to \max\limits_{w}$

2) MAP – maximum a posteriori

$p(data|w) \cdot p(w) \to \max\limits_{w}$

3) Явно вычислить $p(w|data)$

(сопряжённые распределения)

4) Variational inference } sampling

5) MCMC