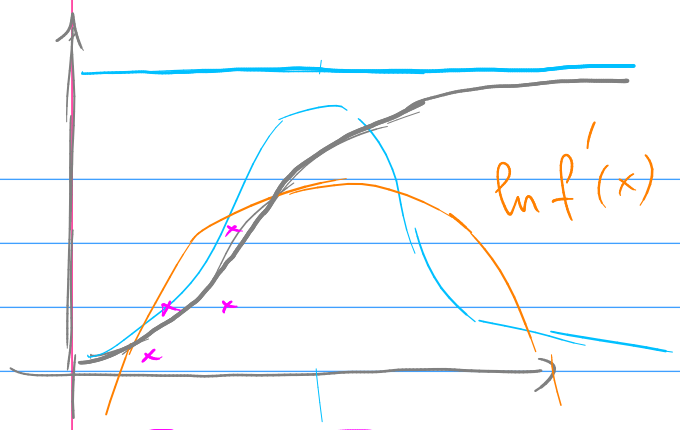


$$F(x) = \int_{-\infty}^{x} N(\dots)$$

$$\ln f'(x) \approx w_0 + w_1 x + w_2 x^2$$

SIR – susceptible – infected – recovered

$X = \{x_1, x_2, \dots, x_N\}$

$S^{(t)} + I^{(t)} + R^{(t)} = N$

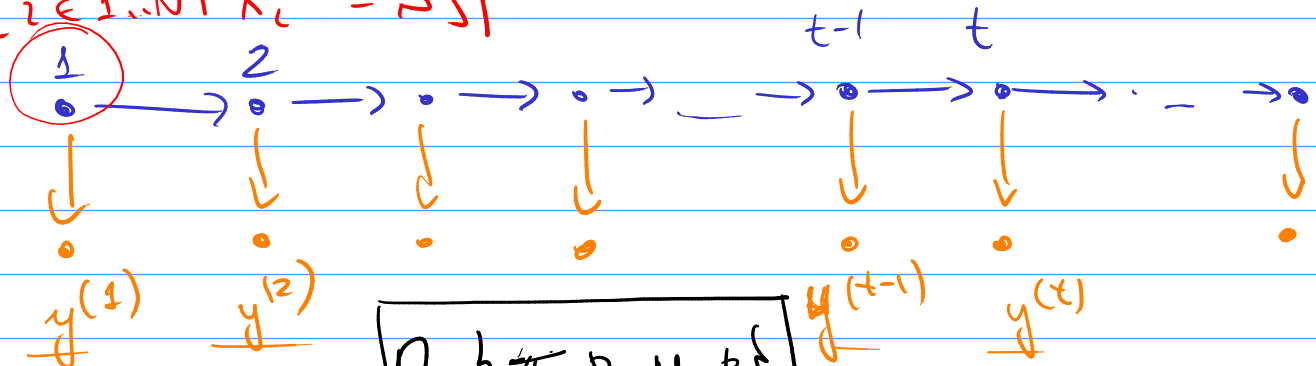
$x_i^{(t)} \in \{S, I, R\}$

$X^{(t)} = \{S^{(t)}, I^{(t)}, R^{(t)}\}$

$S^{(t)} = |\{ i \in 1..N \mid x_i^{(t)} = S \}|$

$I^{(t)}$

$R^{(t)}$



Модель и её параметры: $\boxed{\theta = \{\pi, \beta, \mu, \beta\}}$

1) $p(x_i^{(1)} = I) = \pi$, $p(x_i^{(1)} = S) = 1 - \pi$

2) $p(x_i^{(t)} \in y^{(t)} \mid x_i^{(t)} = I) = \beta$ $I^{(t)}$ – количество сбр. β

$p(y^{(t)} \mid I^{(t)}, \beta) = \text{Binomial}(y^{(t)} \mid I^{(t)}, \beta)$

3) $S \to I \to R$

$$p(x_i^{(t)} \mid x_i^{(t-1)}) = \begin{array}{c} \\ S \\ I \\ R \end{array} \begin{array}{c} \begin{array}{ccc} S & I & R \end{array} \\ \begin{pmatrix} (1-\beta)^{I^{(t-1)}} & 1-(1-\beta)^{I^{(t-1)}} & 0 \\ 0 & 1-\mu & \mu \\ 0 & 0 & 1 \end{pmatrix} \end{array} \quad (t-1)$$

$$p(x_i^{(t)} = R \mid x_i^{(t-1)} = I) = \mu$$

$\beta = p$(заразиться от одного зараж. человека)

$$p(x_i^{(t)} = S \mid x_i^{(t-1)} = S) = (1-\beta)^{I^{(t-1)}}$$

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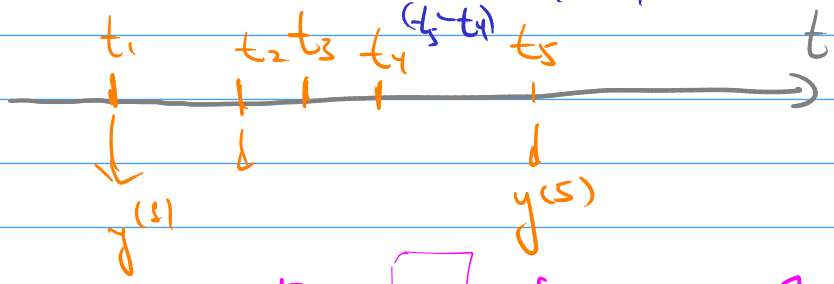
1) SIR $\longrightarrow$ SEIR, SETRS

exposed

$S^{(t)}, I^{(t)}, R^{(t)} \longrightarrow S^{(s)}, I^{(s)}, R^{(s)}$

2) Непрерывное время



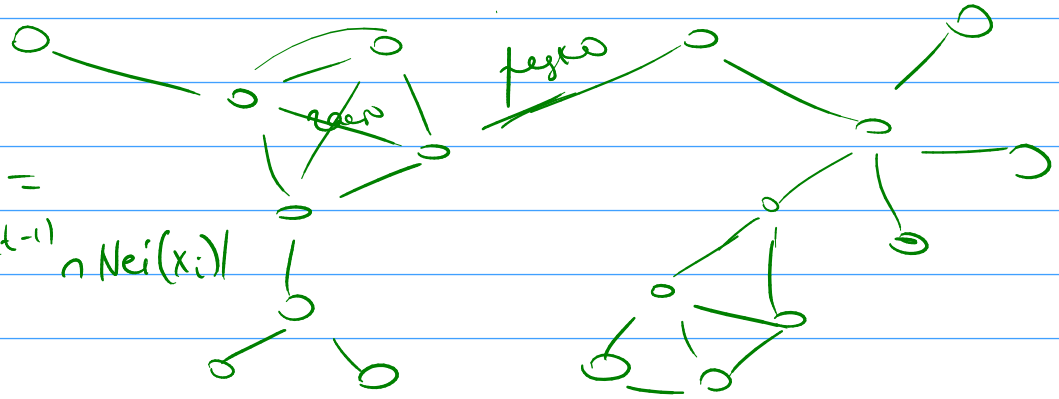
3) Модель заражения

$R_0 = \beta \cdot \mathbb{E}[\#\text{контактов}]$ болезнь

- N чел-к в одной квартире
- граф взаимодействий

$[\ldots]$

$y^{(1)}, y^{(2)}, \ldots, y^{(T)}$



$$p(x_i^{(t)} = S \mid x_i^{(t-1)} = S) = (1-\beta)^{|I^{(t-1)} \cap Nei(x_i)|}$$

$X = \{x_i^{(t)} \mid i, t\}$

$y = \{y^{(t)} \mid t\}$

$$p(X, y \mid \theta) = p(X^{(1)} \mid \pi)\, p(X^{(2)} \mid X^{(1)}, \beta, \mu)\, p(X^{(3)} \mid X^{(2)}, \beta, \mu) \cdots$$

$$\cdots p(X^{(T)} \mid X^{(T-1)}, \beta, \mu)\, p(y^{(1)} \mid X^{(1)}, \rho) \cdots p(y^{(T)} \mid X^{(T)}, \rho) =$$

$$= \left(\prod_{i=1}^{N} \pi^{[x_i^{(1)} = I]} (1-\pi)^{[x_i^{(1)} = S]} \right) \cdot$$

$$\cdot \prod_{t=1}^{T-1} \prod_{i=1}^{N} p(x_i^{(t+1)} \mid \beta, \mu, I^{(t)}) \cdot$$

$$\cdot \prod_{t=1}^{T} \binom{I^{(t)}}{y^{(t)}} \cdot p^{y^{(t)}} \cdot (1-p)^{I^{(t)} - y^{(t)}}$$

$$\times p(\mu, \beta, \beta_3, \pi)$$

$$p(y \mid \theta) = \int p(x, y \mid \theta) dx \xrightarrow[\theta]{} \max$$

$$p(\theta \mid y) \propto p(y \mid \theta) p(\theta) = \int p(\theta) p(x, y \mid \theta) dx \xrightarrow[\theta]{} \max$$

$\bar{x}_j = (S,S,I \; I,I,R \; R \ldots R)$

$\theta_0 \xrightarrow{\text{Gibbs}} X_0$

$\theta_0 \xleftarrow{\text{MAP/ML}} X_0$

$j = 1$

$\vdots$

$\bar{x}_j \sim p(\bar{x}_j \mid X_{-j}, y, \theta)$

$j = N$

$\theta_1 \xrightarrow{\text{Gibbs}} X_1$

$\theta_1 \xleftarrow{\text{MAP/ML}} X_1$

$\theta_2 \xrightarrow{\text{Gibbs}} X_2$

$\theta_2 \xleftarrow{\text{MAP/ML}}$

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