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1 Zadanie pierwsze

Logistic model:

$$P(y=1|x,\theta)=\sigma(x\theta)=\frac{1}{1+e^{-x\theta}}=\frac{1}{1+exp(-\sum_{i=1}^{5}x_i\theta_i+\theta_0)}$$

Bayes model:

$$P(y=1|x)=\frac{P(x|y=1)P(y=1)}{P(x)}=\frac{P(x|y=1)P(y=1)}{P(y=1)P(x|y=1)+P(y=0)P(x|y=0)}=$$

After dividing by numerator

$$=\frac{1}{1+\frac{P(x|y=0)P(y=0)}{P(x|y=1)P(y=1)}}=\frac{1}{1+exp(ln(\frac{P(x|y=0)P(y=0)}{P(x|y=1)P(y=1)}))}=\frac{1}{1+exp(ln(\frac{P(x|y=0)}{P(x|y=1)})+ln(\frac{P(y=0)}{P(y=1)}))}$$

Naive assumption:

$$P(x|y=0)=\prod_{i=1}^{5}P(x_i|y=0)$$

$$P(x|y=1)=\prod_{i=1}^{5}P(x_i|y=1)$$

Rewriting previous expression we get:

$$P(y=1|x)=\frac{1}{1+exp(ln\frac{P(y=0)}{P(y=1)}+\sum ln\frac{x_i|y=0)}{P(x_i|y=1)})}$$

Therefore, logistic regression is equivalent to naive Bayes when:

$$\theta_0=ln\frac{P(y=0)}{P(y=1)}$$

$$-\sum_{i=1}^{5}x_i\theta_i=\sum ln\frac{P(x_i|y=0)}{P(x_i|y=1)}$$