Submission for Apoorv Walia and Marcos Lagos

3.3
$$P(y=1/x) = \frac{\gamma \prod_{j=1}^{d} \frac{1}{\sqrt{2\pi\sigma_j}} e^{\frac{-(x_j-\mu_j^1)^2}{\sigma_j^2}}}{(1-\gamma)\prod_{j=1}^{d} \frac{1}{\sqrt{2\pi\sigma_j}} e^{\frac{-(x_j-\mu_j^0)^2}{\sigma_j^2}} + \gamma \prod_{j=1}^{d} \frac{1}{\sqrt{2\pi\sigma_j}} e^{\frac{-(x_j-\mu_j^1)^2}{\sigma_j^2}}}$$

Since we have uniform priors, we can get rid of γ in the expression

$$= \frac{\sqrt{2\pi}^{-d}\ \sigma_j^{-d}\ e^{-\sum_{j=1}^{d}(x_j-\mu_j^1)^2/\sigma_j^2}}{\sqrt{2\pi}^{-d}\ \sigma_j^{-d}\ e^{-\sum_{j=1}^{d}(x_j-\mu_j^0)^2/\sigma_j^2} + \sqrt{2\pi}^{-d}\ \sigma_j^{-d}\ e^{-\sum_{j=1}^{d}(x_j-\mu_j^1)^2/\sigma_j^2}}$$

$$= \frac{1}{1+e^{\sum_{j=1}^{d}(x_j-\mu_j^1)^2/\sigma_j^2 - \sum_{j=1}^{d}(x_j-\mu_j^0)^2/\sigma_j^2}}$$

$$= \frac{1}{1+e^{\sum_{j=1}^{d}\frac{(\mu_j^{0^2}-\mu_j^{1^2})+2(\mu_j^0-\mu_j^1)x_j}{\sigma_j^2}}}$$

$$= \frac{1}{1+e^{\sum_{j=1}^{d}(\mu_j^{0^2}-\mu_j^{1^2})/\sigma_j^2 + \sum_{j=1}^{d}2(\mu_j^0-\mu_j^1)x_j/\sigma_j^2}}$$

For logistic regression

$$P(y=1/x) = \frac{1}{1-e^{-\theta^T x}}$$

$$= \frac{1}{1+e^{-\theta_0-\sum_{j=1}^{d}\theta_j x_j}}$$

If we set $\theta_0 = \sum_{j=1}^{d}(\mu_j^{0^2}-\mu_j^{1^2})/\sigma_j^2$

and $\theta_j = 2(\mu_j^0-\mu_j^1)/\sigma_j^2$

Then with above parameterization $P(y=1/x)$ for gaussian naive bayes with uniform priors is equivalent to $P(y=1/x)$ for logistic regression