CSC411 Fall 2017
Assignment 2 Report

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1 Q1: Class-conditional gaussians

Given:

$$p(y = k) = a_k \tag{1}$$

$$p(\mathbf{x}|y = k, \mu, \sigma) = (\prod_{i=1}^{d} 2\pi\sigma_i^2)^{-1/2} \exp\{-\sum_{i=1}^{d} \frac{1}{2\sigma_i^2}(x_i - \mu_{ki})^2\} \tag{2}$$

1.1 Bayes' rule derivation

$$
\begin{aligned}
p(y = k|\mathbf{x}, \mu, \sigma) &= \frac{p(\mathbf{x}|y = k, \mu, \sigma)p(y = k)}{p(\mathbf{x}|\mu, \sigma)} \\
&= \frac{p(\mathbf{x}|y = k, \mu, \sigma)p(y = k)}{\sum_{j=1}^{K} p(\mathbf{x}|y = j, \mu, \sigma)} \\
&= \frac{(\prod_{i=1}^{d} 2\pi\sigma_i^2)^{-1/2} \exp\{-\sum_{i=1}^{d} \frac{1}{2\sigma_i^2}(x_i - \mu_{ki})^2\}a_k}{\sum_{j=1}^{K}(\prod_{i=1}^{d} 2\pi\sigma_i^2)^{-1/2} \exp\{-\sum_{i=1}^{d} \frac{1}{2\sigma_i^2}(x_i - \mu_{ji})^2\}}
\end{aligned}
$$