Bayes Error

- Based on Bayes optimal decision rule the classifier for the six different combination of (X_1, X_2) for the different classes $(Y = 0, 1, 2)$ is calculated as follows:

$$max(P(X|Y) * P(Y))$$

The following table gives the classification values with the probabilities, with the classes :

Table 1: Classification

X1	X2	Y=0	Y=1	Y=2	Class
0	0	0.08	**0.18**	0.03	1
0	1	**0.16**	0.03	0.09	0
0	2	0	0.03	**0.06**	2
1	0	0.04	0.03	**0.12**	2
1	1	**0.08**	0.03	0	0
1	2	**0.04**	0	0	0

- The Bayes error is calculated as follows:

$$\begin{aligned} P(error) &= 1 - P(correct) \\ P(correct) &= 0.18 + 0.16 + 0.06 + 0.12 + 0.08 + 0.04 = 0.64 \\ P(error) &= 0.36 \end{aligned}$$

- It is not possible to have zero training error because of the overlap between the probability distributions of the given classifiers (0,1 and 2).