# Practice Problems 2 - Estimation

1) Given the samples $X_i = \{x_i^t, r_i^t\}$, we define the discriminant function as $\underbrace{g_i(x) = r_i^1}$

→ Our estimate for any $x$ is the label of the first instance in the first (unordered) dataset $X_i$

- What can you say about its bias and variance as compared with $g_i(x) = 2$ $\quad g_i(x) = \sum_{i=1}^{N} r_i^t / N$

- With $g_i(x) = 2$ vs $g_i(x) = r_i^1$

For a classification problem with $i = 1, .., k$ classes, with $g_i(x) = 2$ we have the exact same disc. function, so, in practice we can't classify anything because the bias is too high and theoretically the variance is 0

With $g_i(x) = r_i^1$ we have a different values for all the discrimination functions, it allow to classify correctly (for sure) the first instance of the class, but still it doesn't give useful info about the class, so the bias is still too high and the variance is greather than 0 but still is too low

- With $g_i(x) = \sum_{i=1}^{N} \frac{r_i^t}{N}$ vs $g_i(x) = r_i^1$

With $g_i(x) = \sum_t r_i^t / N$, the discriminant function is the sum of the samples in class $C_i$ divided by the total samples, thats the maximum likelihood estimation, with this the bias decreases a lot and the variance rises, but is a good clasificator

What if the sample is ordered, so that $g_i(x) = \min_t r_i^t$?

In this case the bias and variance will not change, or if it change, it will change very very little, because it still a non-representative value of the class

2 In google Colab! :D