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IE 7374: Machine Learning

Prove that by fixating the value of $\hat{\gamma}$ in SVM, we will have one unique solution.

Answer to Question

SVM solves the problem below

$$max \frac{\hat{\gamma}(w,b)}{||w||_2} \quad s.t.\ y_i(w^T x_i + b) >= \hat{\gamma}$$

Where $i = 1, \ldots, n, y_i \in \{-1, 1\}$, suppose we fix $\hat{\gamma} = 1$, vanilla SVM can be obtained.

$$max \frac{1}{||w||_2} \quad s.t.\ y_i(w^T x_i + b) >= 1$$

Suppose there is another solution $(\alpha w, \alpha b)$, we substitute them to (w, b) in vanilla SVM,

$$max \frac{1}{|\alpha|||w||_2} \quad s.t.\ y_i(w^T x_i + b) >= \frac{1}{|\alpha|}$$

This new statement is not the same as the previous one, which means that they are not used for solving the same problem. So, there is no other solutions if we fix the value of $\hat{\gamma}$ in SVM.