Formulas that you are expected to understand

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In general, I do not ask students to memorise formulas for the exam. Rather, students are expected to demonstrate that they are able to understand the formulas. However, some formulas directly represent the core ideas of their underlying approaches. Therefore, if you understand the ideas, you should be able to remember the corresponding formulas. According to that, this document lists the formulas from Weeks 5 and 8-10 that you are expected to understand for the ML exam.

1 Regression

$$\mathbf{r} = \mathbf{t} - \mathbf{\Phi}\mathbf{w}$$

$$\mathcal{L}_{\text{MSE}}(\mathbf{w}) = \frac{1}{N}(\mathbf{t} - \mathbf{\Phi}\mathbf{w})^{\text{T}}(\mathbf{t} - \mathbf{\Phi}\mathbf{w})$$

$$\mathbf{\Phi}^{\text{T}}\mathbf{\Phi}\mathbf{w} - \mathbf{\Phi}^{\text{T}}\mathbf{t} = 0$$

2 Learning Theory

$$\mathbb{P}\left(|E_{\text{in}}(h) - E_{\text{out}}(h)| > \epsilon\right) \leq 2e^{-2\epsilon^2 N}$$

$$\mathbb{P}\left(|E_{\text{in}}(g) - E_{\text{out}}(g)| > \epsilon\right) \leq 2Me^{-2\epsilon^2 N}.$$

$$E_{\text{out}}(g) \leq E_{\text{in}}(g) + \sqrt{\frac{1}{2N}\ln\frac{2M}{\delta}}$$

$$E_{\text{out}}(g) \leq E_{\text{in}}(g) + \Omega(d_{\text{VC}})$$

$$E_{\text{out}}(g) = (\bar{g} - f)^2 + \text{var}[g] + \sigma^2$$