

More about Validation Set

I used a validation set,
but my model still overfitted?

Validation Set

Training Set \mathcal{D}_{train}

Model \mathcal{H}_1 $h_1^* = \arg \min_{h \in \mathcal{H}_1} L(h, \mathcal{D}_{train})$

Model \mathcal{H}_2 $h_2^* = \arg \min_{h \in \mathcal{H}_2} L(h, \mathcal{D}_{train})$

Model \mathcal{H}_3 $h_3^* = \arg \min_{h \in \mathcal{H}_3} L(h, \mathcal{D}_{train})$

Validation Set \mathcal{D}_{val}

$$L(h_1^*, \mathcal{D}_{val}) = 0.9$$

$$L(h_2^*, \mathcal{D}_{val}) = 0.7$$

$$L(h_3^*, \mathcal{D}_{val}) = 0.5$$

Testing Set \mathcal{D}_{test}

Approximation of \mathcal{D}_{all}

Training Set \mathcal{D}_{train}

$$\text{Model } \mathcal{H}_1 \quad h_1^* = \arg \min_{h \in \mathcal{H}_1} L(h, \mathcal{D}_{train})$$

$$\text{Model } \mathcal{H}_2 \quad h_2^* = \arg \min_{h \in \mathcal{H}_2} L(h, \mathcal{D}_{train})$$

$$\text{Model } \mathcal{H}_3 \quad h_3^* = \arg \min_{h \in \mathcal{H}_3} L(h, \mathcal{D}_{train})$$

Validation Set \mathcal{D}_{val}

$$L(h_1^*, \mathcal{D}_{val}) = 0.9$$

$$L(h_2^*, \mathcal{D}_{val}) = 0.7$$

$$L(h_3^*, \mathcal{D}_{val}) = 0.5$$

$$\mathcal{H}_{val} = \{h_1^*, h_2^*, h_3^*\} \quad h^* = \arg \min_{h \in \mathcal{H}_{val}} L(h, \mathcal{D}_{val})$$

Using validation set to select model =

considered as “*training*” by \mathcal{D}_{val}

Your model is $\mathcal{H}_{val} = \{h_1^*, h_2^*, h_3^*\}$

Using validation set to select model =

considered as “*training*” by \mathcal{D}_{val}

Your model is $\mathcal{H}_{val} = \{h_1^*, h_2^*, h_3^*\}$

$$L(h^{train}, \mathcal{D}_{all}) - L(h^{all}, \mathcal{D}_{all}) \leq \delta$$

$$P(\mathcal{D}_{train} \text{ is bad}) \leq |\mathcal{H}| \cdot 2 \exp(-2N\varepsilon^2)$$

$$L(h^{val}, \mathcal{D}_{all}) - L(h^{all}, \mathcal{D}_{all}) \leq \delta$$

$$P(\mathcal{D}_{val} \text{ is bad}) \leq |\mathcal{H}_{val}| \cdot 2 \exp(-2N_{val}\varepsilon^2)$$



It is small.

Hopefully 😊