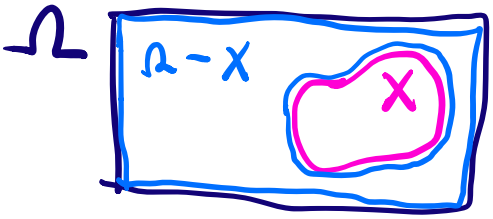
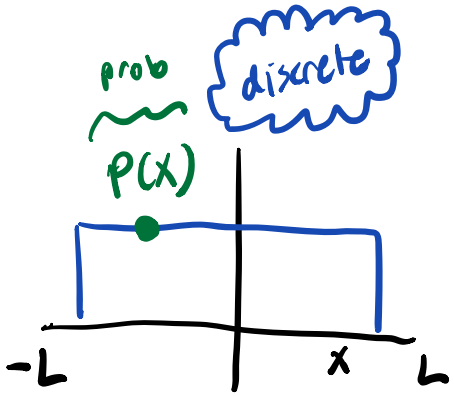
$\Omega \equiv$ data space

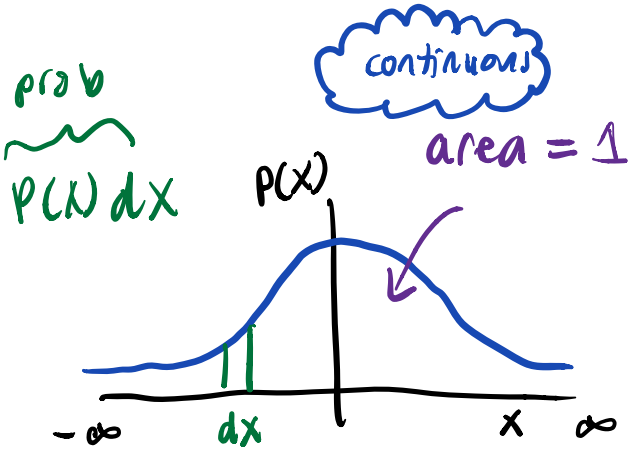
$X \equiv$ training set

$$E(\mathcal{L} \mid X, f) = \sum_h \sum_{y \in \Omega - X} P(y)\, \mathbb{1}\left[h(y) \neq f(y)\right] P(h \mid X, \mathcal{L})$$

any possible data, EXCEPT the training data







rolling a die:

What is the "average number that the die will show"?

$$E = \sum_{\text{outcome}} P(\text{outcome}) \cdot \text{outcome}$$

$$= \frac{1}{6}1 + \frac{1}{6}2 + \frac{1}{6}3 + \dots + \frac{1}{6}6$$

$$= \frac{1}{6}(1+2+\dots+6) = \frac{21}{6}$$

Playing the lottery:

does it make sense to buy a ticket?

assume $P(\text{win}) = \frac{1}{100}$

$P(\text{loss}) = 1 - P(\text{win}) = \frac{99}{100}$

costs \$1 to play

you get \$49 when you win

Expected winnings

$$= E = \frac{99}{100} \cdot (-1) + \frac{1}{100}(49)$$

$$= \frac{1}{100}(-99+49)$$

$$= -\frac{1}{2} < 0$$

Don't do it!