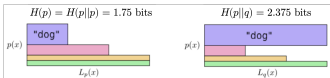


# Introduction to Machine Learning

## Information Theory

## Source Coding and Cross-Entropy

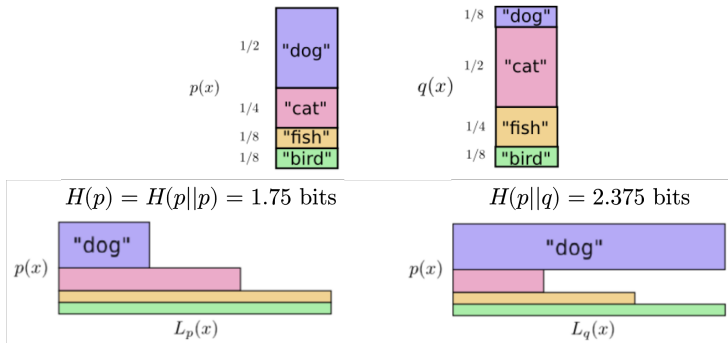
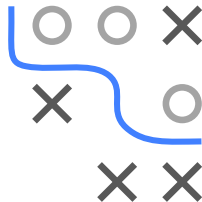


### Learning goals

- Know connection between source coding and (cross-)entropy
- Know that the entropy of the source distribution is the lower bound for the average code length

# SOURCE CODING AND CROSS-ENTROPY

- For a random source / distribution  $p$ , the minimal number of bits to optimally encode messages from is the entropy  $H(p)$ .
- If the optimal code for a different distribution  $q(x)$  is instead used to encode messages from  $p(x)$ , expected code length will grow.



**Figure:**  $L_p(x)$ ,  $L_q(x)$  are the optimal code lengths for  $p(x)$  and  $q(x)$