Introduction to Machine Learning Information Theory KL for ML



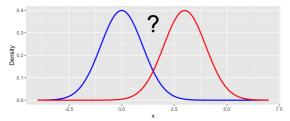


Learning goals

- Understand why measuring distribution similarity is important in ML
- Understand the advantages of forward and reverse KL

MEASURING DISTRIBUTION SIMILARITY IN ML

 Information theory provides tools (e.g., divergence measures) to quantify the similarity between probability distributions





- The most prominent divergence measure is the KL divergence
- In ML, measuring (and maximizing) the similarity between probability distributions is a ubiquitous concept, which will be shown in the following.

KL DIVERGENCE

Divergences can be used to measure the similarity of distributions.

For distributions p, q they are defined such that

- **2** D(p,q) = 0 iff p = q.
- ⇒ divergences can be (and often are) non-symmetrical.

If the same measure dominates the distributions p, q, we can use KL. For a target distribution p and parametrized distribution q_{ϕ} , we call

- $D_{KL}(p||q_{\phi})$ forward KL,
- $D_{KL}(q_{\phi}||p)$ reverse KL.

In the following, we highlight some properties of the KL that make it attractive from an ML perspective.

