Coursework 2: Representation and Distance Metrics Learning

Timothee Gathmann *(**tlg15**, 01061046)*
and his trusty undergrad assistanr Luka Lagator *()*

I. Problem formulation

The features $X \in \mathbb{R}^{DXN}$ are readily available, and consist of a set of samples $x_i \in \mathbb{R}^D, i = 1, 2, ..., N$ corresponding to N pictures of pedestrians. Each sample is assigned a ground-truth label $l(x_i) \in \mathbb{N}$ identifying the individual on the picture. The features are divided in a training subset T, a query subset Q and a gallery subset G. Our goal is to minimise the retrieval error when performing retrieval experiments with the K-Nearest Neighbour algorithm [1] at different ranks ($R = 1, 2, ..., 10$), with different distance metrics. For a distance metric $d(x_i, x_j)$, a nearest neighbour x_j of $x_i \in Q$ is defined as

$$n_k(x_i) = \min_{x_j \in G} d(x_i, x_j), k = 1 \tag{1}$$

For other positive values of k, the k nearest neighbours are returned instead. We can formulate our problem as a Distance Metric Learning problem. The retrieval error at rank R is defined by

$$e = \frac{1}{N_Q R} \sum_{i}^{N_Q} negatives(n_R(x_i), l(x_i)) \tag{2}$$

Where $negative$ is the function that returns the number of neighbours x_j to x_i for which $l(x_i) \neq l(x_j)$

References

[1] T. Cover and P. Hart, "Nearest neighbor pattern classification," *IEEE Transactions on Information Theory*, vol. 13, no. 1, pp. 21–27, 1967.