Siamese Neural Network as $\widehat{d_p}$

Training Dataset

$\{\mathbf{p}_p, q_p\}_{p=1}^{P}$

$\mathbf{p}_i$

$\mathbf{p}_j$

q_i q_j

Sister CNN #1
$\mathscr{G}_w$

$\mathscr{G}_w(\mathbf{p}_i)$

Same NN and Shared Weights

Sister CNN #2
$\mathscr{G}_w$

$\mathscr{G}_w(\mathbf{p}_j)$

Features Distance
$d_p(\mathbf{p}_i, \mathbf{p}_j) = d_f(\mathscr{G}_w(\mathbf{p}_i), \mathscr{G}_w(\mathbf{p}_j))$

$d_p(\mathbf{p}_i, \mathbf{p}_j)$

Loss Function
$\widehat{d_p} = \mathrm{argmin}_{d_p} \sum_{i,j} \left| d_p(\mathbf{p}_i, \mathbf{p}_j) - d_q(q_i, q_j) \right|^2$

Loss

$d_q(q_i, q_j) = 2\mathrm{arccos}(|\langle q_i, q_j \rangle|)$