① The whitening loss The whitening loss

Embedding $z = f(x; \theta)$

Goal, $\begin{cases} \min_\theta E\left[\text{dist}(z_i, z_j)\right] \\ \text{s.t.} \quad \text{cov}(z_i, z_i) = \text{cov}(z_j, z_j) = I \end{cases}$

$$\text{dist}(z_i, z_j) = \left\| \frac{z_j}{\|z_j\|_2} - \frac{z_i}{\|z_i\|_2} \right\|^2.$$

$$= 2 - 2 \frac{\langle z_i, z_j \rangle}{\|z_i\|_2 \|z_j\|_2}$$

Original Image No. N

Batch $B = \{x_1, x_2 \cdots x_K\}$

$K = Nd \rightarrow$ No of positives.

$V = \{v_1, v_2 \ldots v_K.\}$

<u>Proposed W-MSE :</u>

whitening (v)

$$L_{W\text{-}MSE}(V) = \frac{2}{Nd(d-1)} \sum \text{dist}(z_i, z_j); \ (i, j) \in \text{Positive}$$

$$\text{whitening}(v) = W_V(\underline{v} - \mu_v)$$

$$\boxed{\Sigma_V = \frac{1}{K-1} \sum_K (v_K - \mu_V)(v_K - \mu_V)^T}$$

$$\mu_v = \frac{1}{K} \sum_K v_K$$

$W_V^T W_V = \Sigma_V^{-1}$ // Inverse of covariance Matrix.