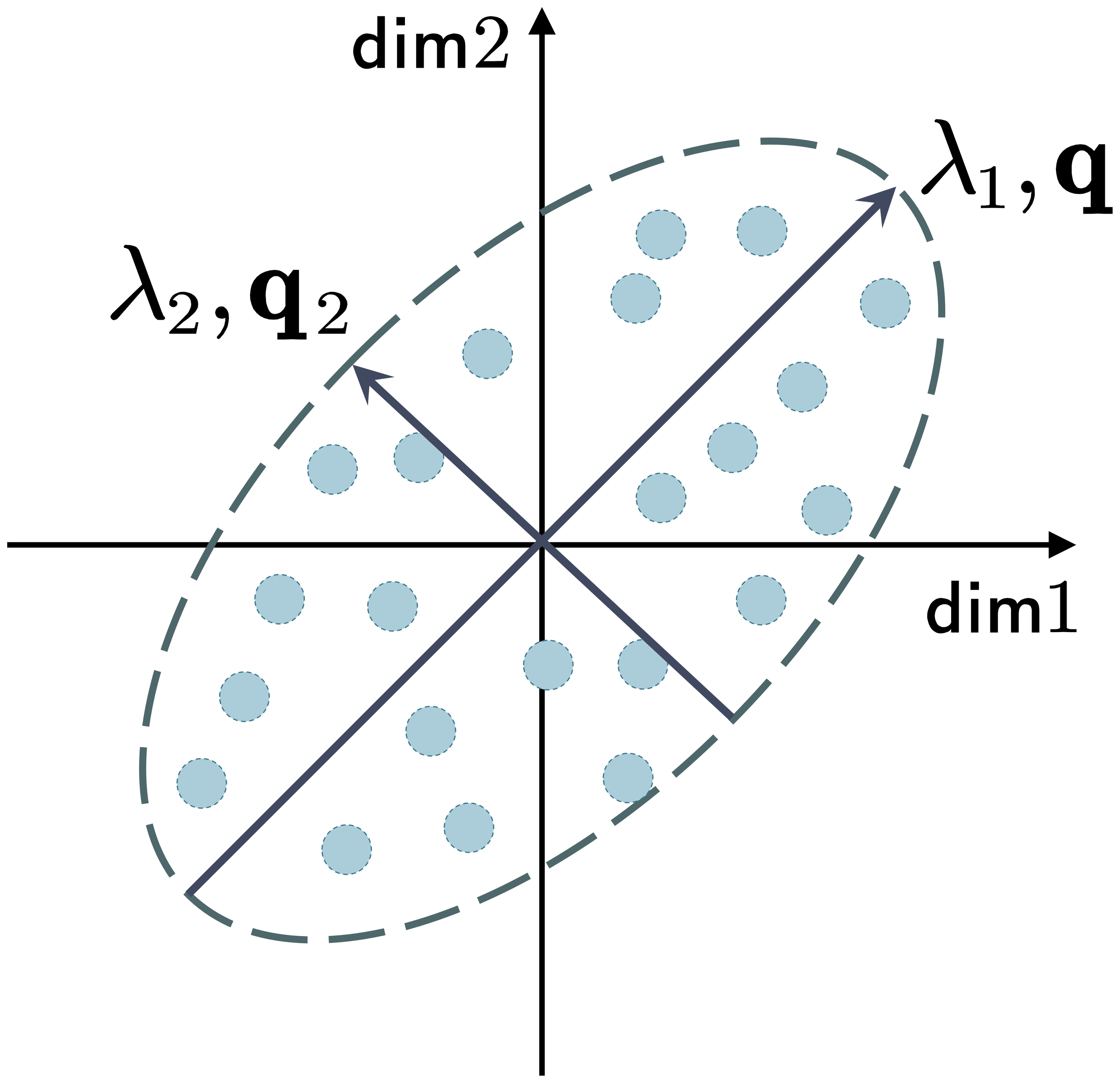
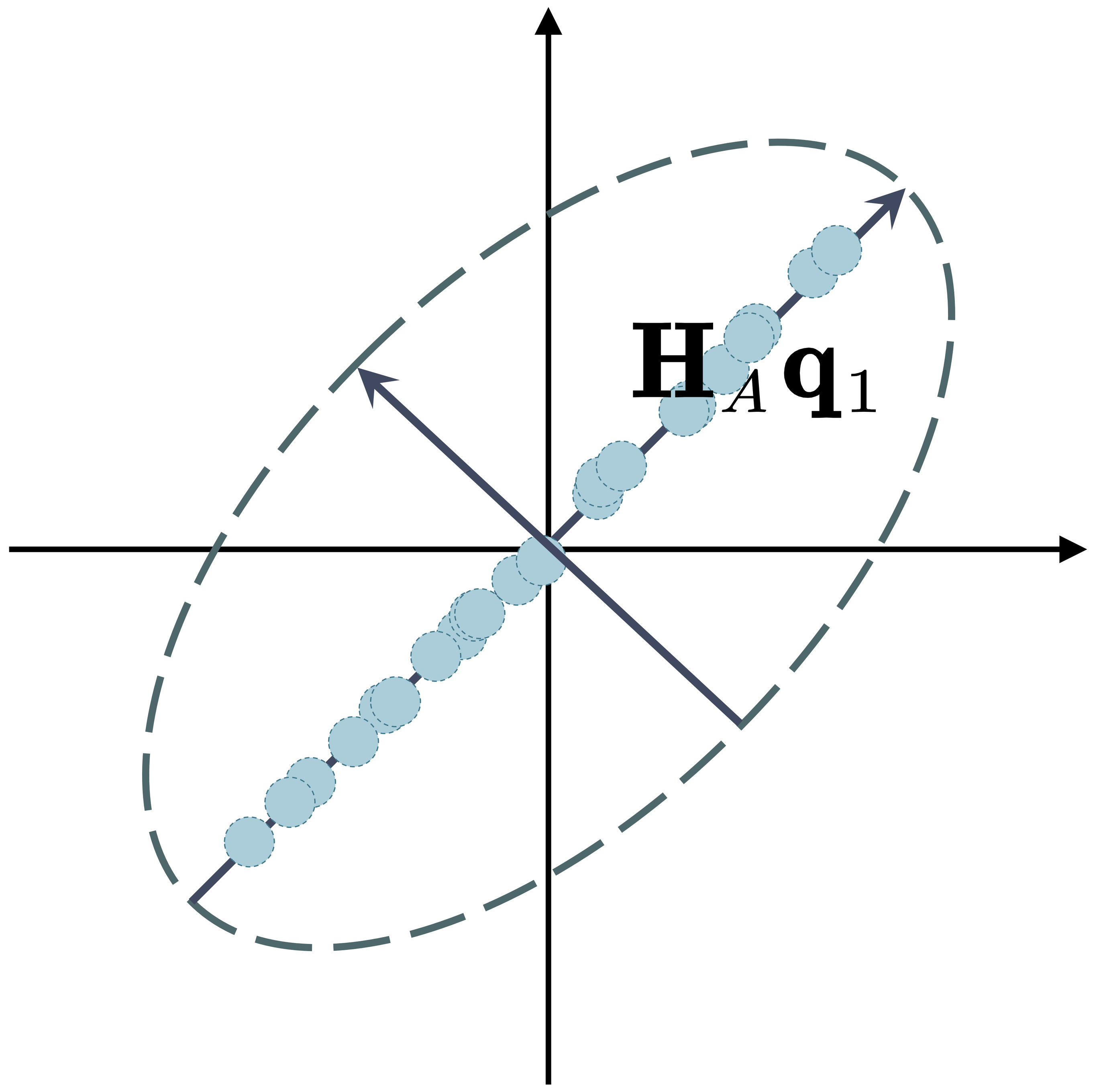
$\mathbf{H}_A \in \mathbb{R}^{N\times 2}$ *from Veiw A, that is, d is set to 2*

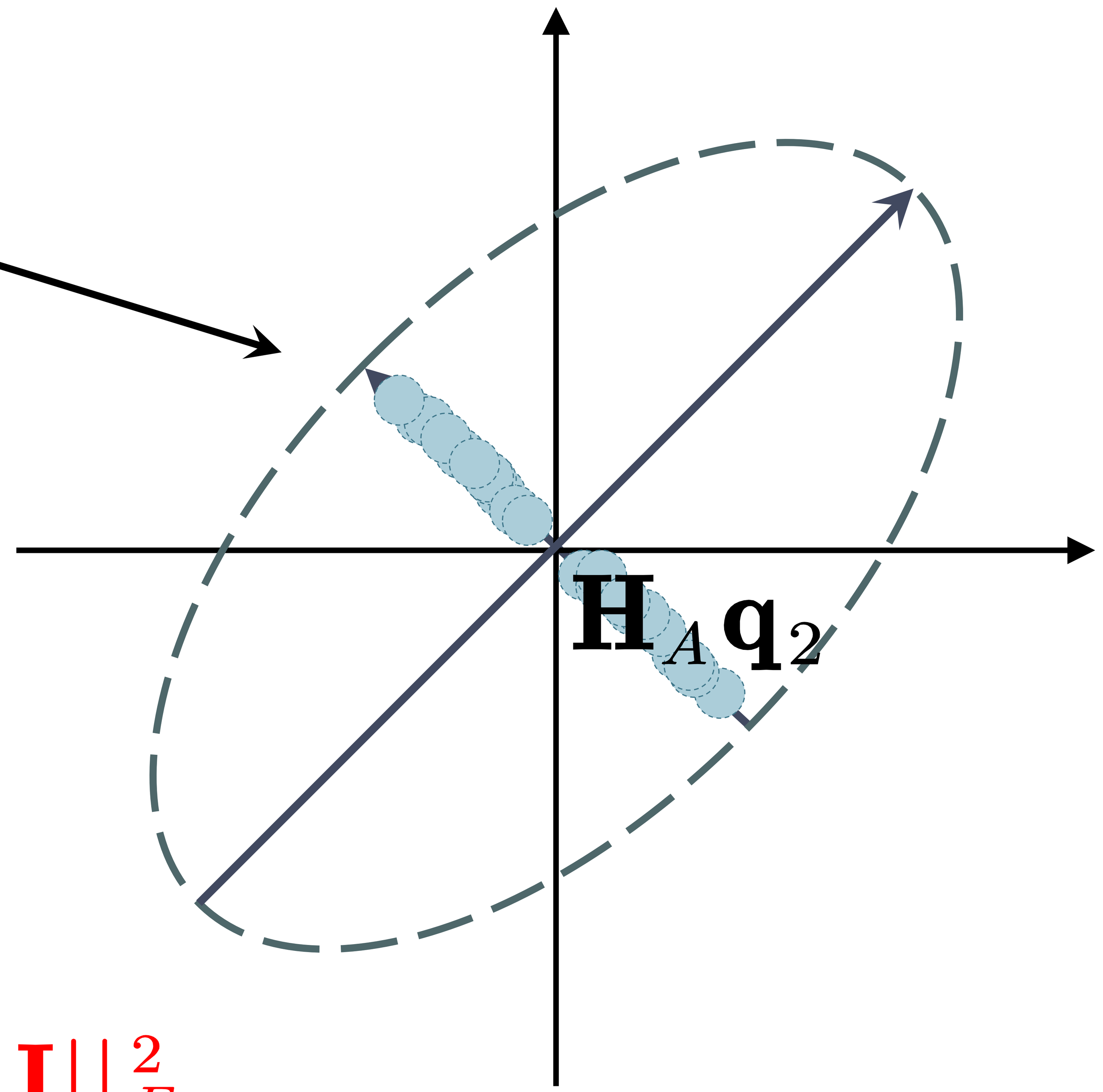


Projection 1

In Proposition 2, we choose **projection vectors** as eigenvectors $\mathbf{q}_1$ and $\mathbf{q}_2$ in each training step.



Projection 2



- Two principal directions: $\mathbf{q}_1$ and $\mathbf{q}_2$
- $\mathbf{q}_1$ and $\mathbf{q}_2$ are two eigenvectors of covariance matrix $\mathbf{\Sigma}_A = \frac{1}{N}\mathbf{H}_A^\top \mathbf{H}_A$ corresponding to eigenvalues $\boldsymbol{\lambda}_1$ and $\boldsymbol{\lambda}_2$

Decorrelation loss for view A is $\mathcal{L}_{DEC}^A = ||\frac{1}{N}\mathbf{H}_A^\top \mathbf{H}_A - \mathbf{I}||_F^2$

Only considering 2nd central moment (variance), isotropic constraint is

$$\mathcal{L}_{IC}^A = var(\{var(\mathbf{H}_A\mathbf{q}_j)|j=1,\dots,d\}) = var(\{var(\mathbf{H}_A\mathbf{q}_1),\ var(\mathbf{H}_A\mathbf{q}_2)\})$$

$$\Big\downarrow \ \textit{Property 1 in Line } 1308: \lambda_i = var(\mathbf{H}_A\mathbf{q}_i)$$

$$= var(\{\lambda_1,\ \lambda_2\})$$

Proposition 2 proves that $\mathcal{L}_{DEC}^A$ is equivalent to $\mathcal{L}_{IC}^A$ (So does view B), thus demonstrating that decorrelation loss can be regarded as a special case of our isotropic constraints under the conditions of **1) only considering 2-nd central moment** and **2) choosing eigenvectors of covariance matrix as projection vectors**.

$\mathcal{L}_{DEC}^A = tr(\mathbf{\Sigma}_A^2) - d$ $\qquad$ $\mathcal{L}_{IC}^A = \frac{1}{d} tr(\mathbf{\Sigma}_A^2) - 1$