SMAI-M20-QUIZ 1

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Review Question - 6 (one, none or more correct)

We know that solution to the problem of Maximize $\mathbf{w}^T\mathbf{A}\mathbf{w}$ subject to $||\mathbf{w}|| = 1$ is the eigen vector corresponding to the largest eigen value.
Note that we assume that a typical eigen value computation assumes to be returning (i) eigen values arranged in non-increasing order (ii) eigen vectors have unit L2 norm.
What is the solution to the problem of Maximize $\mathbf{w}^T\mathbf{A}\mathbf{w}$ subject to $||\mathbf{w}||_2^2 = 2$

1. Eigen vector correspond to the second eigen value.
2. Eigen vector correspond to the first eigen value.
3. 2*$\mathbf{u}$ where $\mathbf{u}$ is the eigen vector correspond to the first eigen value.
4. $\sqrt{2} * \mathbf{u}$ where $\mathbf{u}$ is the eigen vector correspond to the first eigen value.
5. None of the above.

Ans: D

Quiz Question - 7 (one, none or more correct)

We are working with N samples each of d dimension. Consider $N < d$

1. Solution to the problem of linear regression as a closed form can not be computed because the matrices are no longer compatble for multiplication.
2. Solution to the problem of linear regression as a closed form can not be computed because the matrix can not be inverted.
3. Solution to the problem of ridge regularized linear regression as a closed form can not be computed because the matrix can not be inverted.
4. None of the above

Ans: B (Covariance matrix becomes non full-rank, hence singular). But on adding lambda I, it can become full rank

Quiz Question - 8 (one, none or more correct)

We are working with N samples each of d dimension. Consider $N \leq d$

1. PCA can not be computed
2. While computing Eigen values, we will see d zero eigen values.
3. While computing Eigen values, we will see at least $d - N$ zero eigen values.
4. While computing Eigen values, we will see at max $d - N$ zero eigen values.
5. We can not use eigen value/vector computation. We need to use SVD.
6. None of the above.

C Rank of covariance matrix will be N so that many non-zero eigen values. Rest of d-N eigenvalues are 0

Quiz Question - 9 (one, none or more correct)

We know the weighted Euclidean distance

$$\tau = [\mathbf{x} - \mathbf{y}]^T [\mathbf{A}][\mathbf{x} - \mathbf{y}]$$

Where $\mathbf{x}$ is a vector in d dimension $\mathbf{A}$ is a square matrix

1. If $\mathbf{A}$ is a non-identity diagonal matrix. Then "dist" is a scaled version of Euclidean distance or "$\tau = \alpha$ Euclidean distance"
2. If $k < d$ and $A = \sum_{i=1}^{k} \mathbf{u}_i \mathbf{u}_i^T$, with $\mathbf{u}_i$s as orthonormal. Then A is rank deficient and Euclidean τ can not be computed.
3. If $k < d$ and $A = \sum_{i=1}^{k} \mathbf{u}_i \mathbf{u}_i^T$, with $\mathbf{u}_i$s as orthonormal. Then τ is equivalent to dimensioality reduction $\mathbf{x}' = \mathbf{W}\mathbf{x}$ with $\mathbf{W}$ as $k \times d$ matrix with $\mathbf{u}_i^T$ as the i th row.
4. When $\mathbf{A}$ is non-diagonal matrix, τ can not be a metric.
5. None of the above.

Ans: AC

Quiz Question - 10 (one, none or more correct)

Consider the covariance matrix Σ

1. Σ is symmetric
2. Σ is PSD
3. Σ is Diagonal if the distribution is Normal.
4. Σ can not be Diagonal if the distribution is Normal.
5. None of the above

Ans: AB