

EECS545 Lecture 17 Quiz Solutions

March 17, 2024

1. Select all that are true.

- (a) The goal of PCA is to interpret the underlying structure of the data in terms of the principal components that are best at predicting the output variable.
- (b) The number of source for the ICA can be larger than the input dimension.
- (c) The number of basis vectors for sparse coding can be larger than the input dimension.
- (d) tSNE is useful for pre-processing the data for downstream tasks (e.g., classification, regression, etc.)

Solution: (c)

2. Select all that are true about ICA.)

- (a) ICA can be used to reduce the dimensionality of data.
- (b) ICA can be used to discover independent components from data.
- (c) ICA finds directions (e.g., basis vectors) of maximal variance in the data.
- (d) ICA finds directions (e.g., basis vectors) that are maximally independent from data following a Gaussian distribution.
- (e) ICA finds directions (e.g., basis vectors) that are maximally independent from data following a non-Gaussian distribution.

Solution: (a) (b) (e)

3. What is the main benefit of applying PCA whitening before performing ICA on a dataset?

- (a) It reduces the dimensionality of the data by discarding low-variance components.
- (b) It makes the data more Gaussian by transforming it to a standard normal distribution.
- (c) It decorrelates the data by making its covariance matrix diagonal.
- (d) It rotates the data by aligning it with its principal directions.

Solution: (c)

PCA whitening decorrelates the data by making its covariance matrix diagonal. This simplifies the ICA problem by reducing it to finding a rotation matrix that maximizes non-Gaussianity.

4. Select all that are true about the sparse coding objective function.
- (a) Increasing β will result in a basis that better approximate the input data
 - (b) Using an L2 loss for the sparsity penalty is viable for sparse coding as long as β is increased
 - (c) The sparse coding objective is convex when maximizing b or s independently (while fixing the other), but not both.

Solution: (c)

Note for (b), L2 does not work well as a sparsity penalty (unlike L1, L0 and log penalty).

5. Select all that are true about tSNE vs. ISOMAP
- (a) ISOMAP preserves global distances while tSNE does not
 - (b) ISOMAP preserves local distance by preserving geodesic distance, while tSNE preserves (noisy) euclidean distance.
 - (c) tSNE and ISOMAP are both relatively computationally intensive.
 - (d) tSNE is less sensitive to noise than ISOMAP.

Solution: (b), (c), (d)