Bookmarks

- Week 1 - Course Overview, Software Setup, and Machine Learning Basics
- Week 2 - Linear Regression and Distributed Machine Learning Principles
- Week 3 - Logistic Regression and Click-through Rate Prediction
- **Week 4 - Principal Component Analysis and Neuroimaging**

Lecture 4: Principal Component Analysis and Neuroimaging
Quiz due Aug 08, 2016 at 23:00 UTC

Bookmark

Neurons

(1/1 point)

A mouse brain has approximately how many times as many neurons as the brain of a larval zebrafish?

- 80
- 800 ✔
- 8000

EXPLANATION

A larval zebrafish has approximately 100,000 neurons while a mouse has approximately 80,000,000 neurons.

fMRI

Lab4 - Neuroimaging Analysis via PCA
Lab due Aug 08, 2016 at 23:00 UTC

Lab4 Quiz
Quiz due Aug 08, 2016 at 23:00 UTC

(1/1 point)
fMRI scanners provide too low of a resolution to tell, in detail, what is occurring at the neuron level.

- (●) True ✔
- ( ) False

EXPLANATION

fMRI provides a coarse-grained view of neural activity.

Light-sheet Microscopy

(1/1 point)
Light-sheet microscopy can only be used in transparent animals.

- (●) True ✔
- ( ) False

EXPLANATION

Light-sheet microscopy can only be used in transparent animals like the larval zebrafish.

Experiment Data

(1/1 point)

According to the lecture, recording the neuron activity of the entire brain of a larval zebrafish during a typical experiment requires:

- 1 MB of data
- 1 GB of data
- 1 TB of data ✔
- 1 PB of data

EXPLANATION

Recording the neural activity for the larval zebrafish's 100,000 neurons requires approximately 1 TB of data.

Clustering

(1/1 point)
Clustering is a supervised learning technique.

- ○ True
- ◉ False ✔

EXPLANATION

Clustering does not use labels. It attempts to place similar (according to some measure of similarity) observations into groups based on their features.

PCA Distance Metric

(1/1 point)
When working with two dimensional data, if we project data points onto the top principal component (which is a line in 2D space), the distance between the projected points and the original points minimizes which distance?

- ○ vertical distance

- ◉ euclidean distance ✔
- ○ manhattan distance
- ○ horizontal distance

EXPLANATION

PCA minimizes the euclidean distance between points and their projections.

Covariance Matrix Symmetry

(1/1 point)
The covariance matrix is asymmetric.

- ○ True
- ◉ False ✔

EXPLANATION

The covariance matrix is symmetric. The covariance between vectors u and v is equal to the covariance between v and u, i.e. cov(u, v) == cov(v, u).

Covariance Matrix Diagonal Entries

(1/1 point)

The values along the diagonal of the covariance matrix are variances.

- (●) True ✔
- ( ) False

EXPLANATION

Along the diagonal of the covariance matrix, the values are the covariance of a feature with itself, which is the variance of the feature, i.e. cov(x, x) == var(x).

Principal Components Properties

(1/1 point)

For a set of principal component vectors, the dot product between any two distinct vectors equals:

- One
- Zero ✔
- d -- the number of features

EXPLANATION

Principal component vectors are orthnormal, which means that they are pair-wise perpendicular. The dot product of perpendicular vectors is zero.

Principal Components

(1/1 point)
Principal components equal the eigenvalues of some matrix.

- True
- False ✔

EXPLANATION

Principal components are eigenvectors of the sample covariance matrix.

Number of Principal Components

(1/1 point)

Given a d-dimensional dataset with n observations, the total number of principal components is:

- n
- d ✔
- some other number

EXPLANATION

The total number of principal components equals the number of dimensions of the data.