



Applied Remote Sensing Training (ARSET) Program

Visualizing Land Cover and Land Use Change with NASA Satellite Imagery

Homework Questions

Question 1

Which of the following statements about EarthData Search are true?

Answers: (bold correct)

- a. You must download the entire data record for a product
- b. You can apply spatial and temporal filters to refine your data search**
- c. You do not need to be logged in to download data

Feedback:

You can apply spatial, temporal, and other filters (i.e. cloud cover percentage) to refine your search results instead of downloading the entire data record. Though you can search for data without an account, you will need to be logged in to download data from EarthData search.

Question 2

Classification methods which use training data to inform the classification process are known as what kind of classification?

Answers: (bold correct)

- a. Supervised**
- b. Unsupervised
- c. Regression

d. Clustering

Feedback

Supervised classification methods employ labeled training data to inform the classification process whereas unsupervised classification methods rely only on the characteristics of the features to determine which observations belong to a certain class.

Question 3

What kind of NASA data would be appropriate for use in a land cover classification?

Answers: (bold correct)

- a. Streamflow
- b. Skin surface temperature
- c. The Global Seismographic Network (GSN)
- d. Multispectral imagery**

Feedback:

Land cover classification relies on the fact that different materials on the surface of the Earth reflect and absorb light differently. Multispectral imagery lets us measure that pattern of reflection and absorption at different wavelengths to determine the similarities and differences between land cover types.

Question 4

You are a natural resource manager in charge of large portions of inaccessible wilderness areas. There have been reports of a new disease which may affect some of the trees you have been tasked with managing. You would like to use LCLUC techniques to assess any forest loss but you are not able to collect training data due to the remoteness of the wilderness. Which of the following classification methods would you choose?

Answers: (bold correct)

- a. Supervised
- b. Unsupervised**
- c. Regression
- d. Logistic

Feedback:

Unsupervised classification methods rely only on the characteristics of the features to determine which observations belong to a certain class. Since unsupervised learning methods do not require training data they are appropriate for situations where there is no training data available, such as when the area of interest is remote or the exact nature of the changes is not known.

Question 5

Classification of remote sensing data is a useful tool with applications for the following problem areas:

Answers: (bold correct)

- a. forestry
- b. commercial fisheries and forestry
- c. urban planning, forestry and agriculture**
- d. commercial fisheries, urban planning, forestry and agriculture

Feedback:

Classification of remote sensing data gives us information about the directly observable features of the Earth's surface. Though water is an example of a possible land cover class it is not possible to directly observe information about commercial fisheries from remote sensing data.

Question 6

Below is a change matrix calculated using the crosstab function. Select the true statement given the information in this change matrix.

		2020		
		Barren	Grass	Water
1980	Barren	40	0	40
	Grass	20	10	0
	Water	0	0	50

Answers: (bold correct)

- a. There was no detected change in the Grass class
- b. There was an increase in the Water class**
- c. There was an increase in the Barren class
- d. There was no detected change in the Water class

Feedback:

The Water class shows an increase of 40 and no decreases, as evidenced by the 0 values in the cells corresponding to the Water-to-Barren and Water-to-Grass transitions. The Barren class decreased by 40 units (Barren-to-Water) while the Grass class decreased by 20 units (Grass-to-Barren).

Question 7

Which of the following functions is used in R to perform an unsupervised classification on remote sensing data?

Answers: (bold correct)

- a. randomForest
- b. ggplot
- c. kmeans**
- d. predict

Feedback:

The kmeans function performs unsupervised k-means clustering to classify a remote sensing image. The randomForest and predict functions are used to train and apply a random forest model respectively. Creating maps and graphs of results is handled by the ggplot function, but it is not otherwise related to classification tasks in particular.

Question 8

Select the steps which best describes the process to create a binary land cover change map (binary mask layer) with a random forest model.

Answers: (bold correct)

- a. Select a value for K > Choose cluster centers > Multiply the two resulting images
- b. Compute a change matrix > Extract the diagonal > Calculate change percentages
- c. Download the imagery > Apply a spatial filter > Assign the RGB band numbers

d. Train the model > Apply the model to two images > Compare using the logical NOT operator

Feedback:

Random forest is an example of a supervised machine learning classification model which means that it needs to be trained with labeled training data before it can be applied to an image. In order to detect the changes in land cover, we apply the model to two images taken at different dates and use the logical NOT operator (written `!=` in R) to isolate the pixels where the land cover in the first image is not the same as in the second image.

Question 9

Which pair of attributes are necessary for training data used in supervised land cover classification?

Answers: (bold correct)

- a. Reflectance values & Temperature
- b. Reflectance values & Class Labels**
- c. Class labels & Acquisition date
- d. Class labels & Temperature

Feedback:

Training data must contain information about the reflectance values for each band of the imagery as well as a class label which identifies the type of land cover those reflectance values represent.