```
imds = imageDatastore('/Users/Harsh/Documents/GSU_Spring/ComputerVision/
Harsh_Assignment_3/Q6/images',['IncludeS' ...
    'ubfolders'],true,'LabelSource','foldernames');
```

```
tbl = countEachLabel(imds)
```

tbl = 5×2 table

	Label	Count
1	fork	10
2	glass	10
3	kettle	10
4	knife	10
5	spoon	10

```
figure
montage(imds.Files(1:16:end))
```

```
% prepare data
[trainingSet, validationSet] = splitEachLabel(imds, 0.6, 'randomize');
```

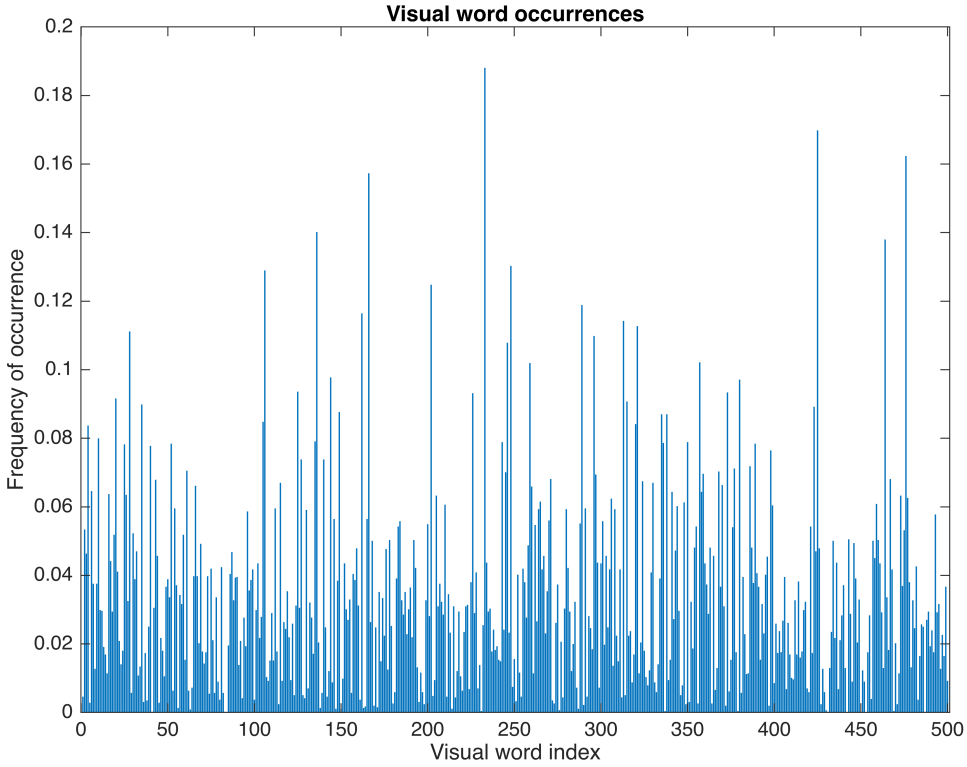
```
bag = bagOfFeatures(trainingSet);
```

```
Creating Bag-Of-Features.
-------------------------
* Image category 1: fork
* Image category 2: glass
* Image category 3: kettle
* Image category 4: knife
* Image category 5: spoon
* Selecting feature point locations using the Grid method.
* Extracting SURF features from the selected feature point locations.
** The GridStep is [8 8] and the BlockWidth is [32 64 96 128].

* Extracting features from 30 images...done. Extracted 2304000 features.

* Keeping 80 percent of the strongest features from each category.

* Creating a 500 word visual vocabulary.
* Number of levels: 1
* Branching factor: 500
* Number of clustering steps: 1

* [Step 1/1] Clustering vocabulary level 1.
* Number of features          : 1843200
* Number of clusters          : 500
* Initializing cluster centers...100.00%.
* Clustering...completed 47/100 iterations (~18.30 seconds/iteration)...converged in 47 iterations.

* Finished creating Bag-Of-Features
```

```
img = readimage(imds, 1);
featureVector = encode(bag, img);
```

```
Encoding images using Bag-Of-Features.
--------------------------------------
* Encoding an image...done.
```

```
% Plot the histogram of visual word occurrences
figure
bar(featureVector)
title('Visual word occurrences')
xlabel('Visual word index')
ylabel('Frequency of occurrence')
```




```
% categoryClassifier = trainImageCategoryClassifier(trainingSet, bag);
categoryClassifier = trainImageCategoryClassifier(trainingSet, bag);
```

```
Training an image category classifier for 5 categories.
--------------------------------------------------------
* Category 1: fork
* Category 2: glass
* Category 3: kettle
* Category 4: knife
* Category 5: spoon

* Encoding features for 30 images...done.

* Finished training the category classifier. Use evaluate to test the classifier on a test set.
```

```
confMatrix = evaluate(categoryClassifier, trainingSet);
```

```
Evaluating image category classifier for 5 categories.
-------------------------------------------------------

* Category 1: fork
* Category 2: glass
* Category 3: kettle
* Category 4: knife
* Category 5: spoon

* Evaluating 30 images...done.

* Finished evaluating all the test sets.
```

```
* The confusion matrix for this test set is:

                          PREDICTED
KNOWN     | fork   glass   kettle   knife   spoon
------------------------------------------------
fork      | 1.00   0.00    0.00     0.00    0.00
glass     | 0.00   1.00    0.00     0.00    0.00
kettle    | 0.00   0.00    1.00     0.00    0.00
knife     | 0.00   0.00    0.00     1.00    0.00
spoon     | 0.33   0.00    0.00     0.00    0.67

* Average Accuracy is 0.93.
```

```
confMatrix = evaluate(categoryClassifier, validationSet);
```

```
Evaluating image category classifier for 5 categories.
-------------------------------------------------------

* Category 1: fork
* Category 2: glass
* Category 3: kettle
* Category 4: knife
* Category 5: spoon

* Evaluating 20 images...done.

* Finished evaluating all the test sets.

* The confusion matrix for this test set is:

                          PREDICTED
KNOWN     | fork   glass   kettle   knife   spoon
------------------------------------------------
fork      | 1.00   0.00    0.00     0.00    0.00
glass     | 0.00   1.00    0.00     0.00    0.00
kettle    | 0.00   0.00    1.00     0.00    0.00
knife     | 0.00   0.00    0.00     1.00    0.00
spoon     | 0.50   0.00    0.00     0.00    0.50

* Average Accuracy is 0.90.
```

```
% Compute average accuracy
mean(diag(confMatrix))
```

```
ans = 0.9000
```

```
img = imread(fullfile('/Users/Harsh/Documents/GSU_Spring/ComputerVision/
Harsh_Assignment_3/Q6/images/','spoon','8.jpeg'));
figure
imshow(img)
```

```
[labelIdx, scores] = predict(categoryClassifier, img);
```

```
Encoding images using Bag-Of-Features.
----------------------------------------
* Encoding an image...done.
```

```
% Display the string label
categoryClassifier.Labels(labelIdx)
```

```
ans = 1×1 cell array
    {'spoon'}
```