Ex No. 2	Pre-processing Techniques in Machine Learning
Date:	

Aim

To implement pre-processing techniques in machine learning.

Definition

Data Pre-processing

Data preprocessing can refer to manipulation or dropping of data before it is used in order to ensure or enhance performance, and is an important step in the data mining process. The phrase "garbage in, garbage out" is particularly applicable to data mining and machine learning projects.

It involves below steps:

- Getting the dataset
- Importing libraries
- Importing datasets
- Finding Missing Data
- Encoding Categorical Data
- Splitting dataset into training and test set
- Feature scaling

Procedure

Open PyCharm Community Edition.

Go to File menu → New Project → Specify the project name → Press "Create" button.

Right Click on Project name → New → Python File → Specify the file name → Press Enter.

Type the following codes. Right click on file name or coding window → Select "Run" to view the result.

1. **Data Rescaling:**

Data Normalization:

```
# Normalize the data attributes for the Iris dataset.

from sklearn.datasets import load_iris

from sklearn import preprocessing

# load the iris dataset

iris = load_iris()

print(iris.data.shape)

# separate the data from the target attributes

X = iris.data

y = iris.target

# normalize the data attributes

normalized_X = preprocessing.normalize(X)

print(normalized_X)
```

Output:

```
(150, 4)

[[0.80377277 0.55160877 0.22064351 0.0315205 ]

 [0.82813287 0.50702013 0.23660939 0.03380134]

 [0.80533308 0.54831188 0.2227517  0.03426949]

 [0.80003025 0.53915082 0.26087943 0.03478392]
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[0.69025916 0.35097923 0.5966647 0.21058754]]

Data Standardization:

```
# Standardize the data attributes for the Iris dataset.
from sklearn.datasets import load_iris
from sklearn import preprocessing
# load the Iris dataset
iris = load_iris()
print(iris.data.shape)
# separate the data and target attributes
X = iris.data
y = iris.target
# standardize the data attributes
standardized_X = preprocessing.scale(X)
print(standardized_X)
```

Output:

```
(150, 4)
[[-9.00681170e-01  1.01900435e+00 -1.34022653e+00 -1.31544430e+00]
```

[-1.14301691e+00 -1.31979479e-01 -1.34022653e+00 -1.31544430e+00]

[-1.38535265e+00 3.28414053e-01 -1.39706395e+00 -1.31544430e+00]

[-1.50652052e+00 9.82172869e-02 -1.28338910e+00 -1.31544430e+00]

[-1.02184904e+00 1.24920112e+00 -1.34022653e+00 -1.31544430e+00]

[-5.37177559e-01 1.93979142e+00 -1.16971425e+00 -1.05217993e+00]

[-1.50652052e+00 7.88807586e-01 -1.34022653e+00 -1.18381211e+00]

[-1.02184904e+00 7.88807586e-01 -1.28338910e+00 -1.31544430e+00]

[-1.74885626e+00 -3.62176246e-01 -1.34022653e+00 -1.31544430e+00]

[-1.14301691e+00 9.82172869e-02 -1.28338910e+00 -1.44707648e+00]

[-5.37177559e-01 1.47939788e+00 -1.28338910e+00 -1.31544430e+00]

[-1.26418478e+00 7.88807586e-01 -1.22655167e+00 -1.31544430e+00]

[-1.26418478e+00 -1.31979479e-01 -1.34022653e+00 -1.44707648e+00]

[-1.87002413e+00 -1.31979479e-01 -1.51073881e+00 -1.44707648e+00]

[-5.25060772e-02 2.16998818e+00 -1.45390138e+00 -1.31544430e+00]

[-1.73673948e-01 3.09077525e+00 -1.28338910e+00 -1.05217993e+00]

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[-9.00681170e-01 1.01900435e+00 -1.34022653e+00 -1.18381211e+00]

[-1.73673948e-01 1.70959465e+00 -1.16971425e+00 -1.18381211e+00]

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[-9.00681170e-01 1.47939788e+00 -1.28338910e+00 -1.05217993e+00]

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[-1.26418478e+00 9.82172869e-02 -1.22655167e+00 -1.31544430e+00]

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[-4.16009689e-01 1.01900435e+00 -1.39706395e+00 -1.31544430e+00]

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[-1.26418478e+00 -1.31979479e-01 -1.34022653e+00 -1.18381211e+00]

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[-1.73673948e-01 -1.31979479e-01 2.51221427e-01 8.77547895e-04]

[-1.73673948e-01 -3.62176246e-01 2.51221427e-01 1.32509732e-01]

[4.32165405e-01 -3.62176246e-01 3.08058854e-01 1.32509732e-01]

[-9.00681170e-01 -1.28296331e+00 -4.30827696e-01 -1.30754636e-01]

[-1.73673948e-01 -5.92373012e-01 1.94384000e-01 1.32509732e-01]

[5.53333275e-01 5.58610819e-01 1.27429511e+00 1.71209594e+00]

[-5.25060772e-02 -8.22569778e-01 7.62758269e-01 9.22302838e-01]

[1.52267624e+00 -1.31979479e-01 1.21745768e+00 1.18556721e+00]

[5.53333275e-01 -3.62176246e-01 1.04694540e+00 7.90670654e-01]

[7.95669016e-01 -1.31979479e-01 1.16062026e+00 1.31719939e+00]

[2.12851559e+00 -1.31979479e-01 1.61531967e+00 1.18556721e+00]

[-1.14301691e+00 -1.28296331e+00 4.21733708e-01 6.59038469e-01]

[1.76501198e+00 -3.62176246e-01 1.44480739e+00 7.90670654e-01]

[1.03800476e+00 -1.28296331e+00 1.16062026e+00 7.90670654e-01]

[1.64384411e+00 1.24920112e+00 1.33113254e+00 1.71209594e+00]

[7.95669016e-01 3.28414053e-01 7.62758269e-01 1.05393502e+00]

[6.74501145e-01 -8.22569778e-01 8.76433123e-01 9.22302838e-01]

[1.15917263e+00 -1.31979479e-01 9.90107977e-01 1.18556721e+00]

[-1.73673948e-01 -1.28296331e+00 7.05920842e-01 1.05393502e+00]

[-5.25060772e-02 -5.92373012e-01 7.62758269e-01 1.58046376e+00]

[6.74501145e-01 3.28414053e-01 8.76433123e-01 1.44883158e+00]

[7.95669016e-01 -1.31979479e-01 9.90107977e-01 7.90670654e-01]

[2.24968346e+00 1.70959465e+00 1.67215710e+00 1.31719939e+00]

[2.24968346e+00 -1.05276654e+00 1.78583195e+00 1.44883158e+00]

[1.89829664e-01 -1.97355361e+00 7.05920842e-01 3.95774101e-01]

[1.28034050e+00 3.28414053e-01 1.10378283e+00 1.44883158e+00]

[-2.94841818e-01 -5.92373012e-01 6.49083415e-01 1.05393502e+00]

[2.24968346e+00 -5.92373012e-01 1.67215710e+00 1.05393502e+00]

[5.53333275e-01 -8.22569778e-01 6.49083415e-01 7.90670654e-01]

[1.03800476e+00 5.58610819e-01 1.10378283e+00 1.18556721e+00]

[1.64384411e+00 3.28414053e-01 1.27429511e+00 7.90670654e-01]

[4.32165405e-01 -5.92373012e-01 5.92245988e-01 7.90670654e-01]

[3.10997534e-01 -1.31979479e-01 6.49083415e-01 7.90670654e-01]

[6.74501145e-01 -5.92373012e-01 1.04694540e+00 1.18556721e+00]

[1.64384411e+00 -1.31979479e-01 1.16062026e+00 5.27406285e-01]

[1.88617985e+00 -5.92373012e-01 1.33113254e+00 9.22302838e-01]

[2.49201920e+00 1.70959465e+00 1.50164482e+00 1.05393502e+00]

[6.74501145e-01 -5.92373012e-01 1.04694540e+00 1.31719939e+00]

[5.53333275e-01 -5.92373012e-01 7.62758269e-01 3.95774101e-01]

[3.10997534e-01 -1.05276654e+00 1.04694540e+00 2.64141916e-01]

[2.24968346e+00 -1.31979479e-01 1.33113254e+00 1.44883158e+00]

```
 [ 5.53333275e-01  7.88807586e-01  1.04694540e+00  1.58046376e+00]
 [ 6.74501145e-01  9.82172869e-02  9.90107977e-01  7.90670654e-01]
 [ 1.89829664e-01 -1.31979479e-01  5.92245988e-01  7.90670654e-01]
 [ 1.28034050e+00  9.82172869e-02  9.33270550e-01  1.18556721e+00]
 [ 1.03800476e+00  9.82172869e-02  1.04694540e+00  1.58046376e+00]
 [ 1.28034050e+00  9.82172869e-02  7.62758269e-01  1.44883158e+00]
 [-5.25060772e-02 -8.22569778e-01  7.62758269e-01  9.22302838e-01]
 [ 1.15917263e+00  3.28414053e-01  1.21745768e+00  1.44883158e+00]
 [ 1.03800476e+00  5.58610819e-01  1.10378283e+00  1.71209594e+00]
 [ 1.03800476e+00 -1.31979479e-01  8.19595696e-01  1.44883158e+00]
 [ 5.53333275e-01 -1.28296331e+00  7.05920842e-01  9.22302838e-01]
 [ 7.95669016e-01 -1.31979479e-01  8.19595696e-01  1.05393502e+00]
 [ 4.32165405e-01  7.88807586e-01  9.33270550e-01  1.44883158e+00]
 [ 6.86617933e-02 -1.31979479e-01  7.62758269e-01  7.90670654e-01]]
```

2. Standardize IRIS DataSet:

```
from sklearn import datasets
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
iris = datasets.load_iris()
X = iris.data
y = iris.target
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.33)
std_slc = StandardScaler()
std_slc.fit(X_train)
X_train_std = std_slc.transform(X_train)
X_test_std = std_slc.transform(X_test)
print(X_train[0:5])
```

```
print(X_train_std[0:5])

print(X_test[0:5])

print(X_test_std[0:5])
```

Output:

```
[[5.1 3.5 1.4 0.3]
 [5.7 3.  4.2 1.2]
 [6.3 2.9 5.6 1.8]
 [6.1 2.8 4.7 1.2]
 [5.6 2.8 4.9 2. ]]
[[-0.84747571  1.09946882 -1.27248426 -1.12920679]
 [-0.12002875 -0.13036208  0.2977916   0.05114874]
 [ 0.60741821 -0.37632826  1.08292953  0.83805243]
 [ 0.36493589 -0.62229444  0.578198    0.05114874]
 [-0.24126991 -0.62229444  0.69036056  1.10035366]]
[[6.3 3.3 6.  2.5]
 [6.6 3.  4.4 1.4]
 [6.3 2.8 5.1 1.5]
 [4.6 3.2 1.4 0.2]
 [6.7 3.  5.  1.7]]
[[ 0.60741821  0.60753646  1.30725465  1.75610673]
 [ 0.97114169 -0.13036208  0.40995416  0.31344997]
 [ 0.60741821 -0.62229444  0.80252312  0.44460058]
 [-1.45368151  0.36157028 -1.27248426 -1.26035741]
 [ 1.09238285 -0.13036208  0.74644184  0.70690181]]
```

Result

Thus, data pre-processing techniques in machine learning have been successfully implemented.