Data Preprocessing

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import pandas as pd
import io
data = pd.read_csv('coffee_dataset.csv')
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1339 entries, 0 to 1338
Data columns (total 44 columns):
 #   Column                 Non-Null Count  Dtype  
---  ------                 --------------  -----  
 0   Unnamed: 0             1339 non-null   int64  
 1   Species                1339 non-null   object 
 2   Owner                  1332 non-null   object 
 3   Country.of.Origin      1338 non-null   object 
 4   Farm.Name              980 non-null    object 
 5   Lot.Number             276 non-null    object 
 6   Mill                   1021 non-null   object 
 7   ICO.Number             1182 non-null   object 
 8   Company                1130 non-null   object 
 9   Altitude               1113 non-null   object 
 10  Region                 1280 non-null   object 
 11  Producer               1107 non-null   object 
 12  Number.of.Bags         1339 non-null   int64  
 13  Bag.Weight             1339 non-null   object 
 14  In.Country.Partner     1339 non-null   object 
 15  Harvest.Year           1292 non-null   object 
 16  Grading.Date           1339 non-null   object 
 17  Owner.1                1332 non-null   object 
 20  Aroma                  1339 non-null   float64
```

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```
 21  Flavor                 1339 non-null   float64
 22  Aftertaste             1339 non-null   float64
 23  Acidity                1339 non-null   float64
 24  Body                   1339 non-null   float64
 25  Balance                1339 non-null   float64
 26  Uniformity             1339 non-null   float64
 27  Clean.Cup              1339 non-null   float64
 28  Sweetness              1339 non-null   float64
 29  Cupper.Points          1339 non-null   float64
 30  Total.Cup.Points       1339 non-null   float64
 31  Moisture               1339 non-null   float64
 32  Category.One.Defects   1339 non-null   int64
 33  Quakers                1338 non-null   float64
 34  Color                  1121 non-null   object
 35  Category.Two.Defects   1339 non-null   int64
 36  Expiration             1339 non-null   object
 37  Certification.Body     1339 non-null   object
 38  Certification.Address  1339 non-null   object
 39  Certification.Contact  1339 non-null   object
 40  unit_of_measurement    1339 non-null   object
 41  altitude_low_meters    1109 non-null   float64
 42  altitude_high_meters   1109 non-null   float64
 43  altitude_mean_meters   1109 non-null   float64
dtypes: float64(16), int64(4), object(24)
memory usage: 460.4+ KB
```

```
data.head()
```

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	Unnamed: 0	Species	Owner	Country.of.Origin	Farm.Name	Lot.Number	Mill	ICO.Number	Company	Altitude	Regior
0	0	Arabica	metad plc	Ethiopia	metad plc	NaN	metad plc	2014/2015	metad agricultural developmet plc	1950-2200	guji-hambela
1	1	Arabica	metad plc	Ethiopia	metad plc	NaN	metad plc	2014/2015	metad agricultural developmet plc	1950-2200	guji-hambela
2	2	Arabica	grounds for health admin	Guatemala	san marcos barrancas "san cristobal	NaN	NaN	NaN	NaN	1600 - 1800 m	NaN

Data Encoding

```
from sklearn.preprocessing import LabelEncoder , OneHotEncoder
data['Species'].value_counts()
```

```
Arabica    1311
Robusta      28
Name: Species, dtype: int64
```

1. Label Encoder

```
le=LabelEncoder()
data['Number.of.Bags']=le.fit_transform(data['Number.of.Bags'])
```

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```
110    176
10     108
1       95
119     79
      ...
75       1
77       1
78       1
79       1
0        1
Name: Number.of.Bags, Length: 131, dtype: int64
```

```
le.classes_
```

```
array([   0,    1,    2,    3,    4,    5,    6,    7,    8,    9,   10,
         11,   12,   13,   14,   15,   16,   17,   18,   19,   20,   21,
         22,   23,   24,   25,   26,   27,   28,   29,   30,   31,   32,
         33,   35,   36,   37,   38,   39,   40,   42,   43,   44,   45,
         48,   49,   50,   51,   53,   54,   56,   58,   60,   62,   65,
         66,   69,   70,   74,   75,   77,   80,   82,   84,   85,   90,
         93,   94,  100,  114,  120,  121,  123,  125,  127,  129,  130,
        134,  135,  138,  140,  149,  150,  160,  165,  166,  167,  170,
        175,  180,  198,  200,  202,  209,  220,  223,  226,  230,  232,
        235,  240,  243,  245,  248,  250,  252,  253,  256,  270,  274,
        275,  280,  285,  288,  300,  302,  304,  305,  310,  320,  325,
        360,  377,  380,  400,  440,  450,  500,  550,  600, 1062])
```

2. Onehot Encoder

```
data['In.Country.Partner'].value_counts()
```

```
Specialty Coffee Association                                         313
AMECAFE                                                              205
                                                                     178
                                                                     155
                                                                      67
Instituto Hondureño del Café                                          60
```

To undo cell deletion use Ctrl+M Z or the Undo option in the Edit menu

```
Blossom Valley International                                                            58
Africa Fine Coffee Association                                                          49
Specialty Coffee Association of Costa Rica                                              42
NUCOFFEE                                                                                36
Uganda Coffee Development Authority                                                     32
Kenya Coffee Traders Association                                                        22
Ethiopia Commodity Exchange                                                             18
Specialty Coffee Institute of Asia                                                      16
METAD Agricultural Development plc                                                      15
Yunnan Coffee Exchange                                                                  12
Salvadoran Coffee Council                                                               11
Specialty Coffee Association of Indonesia                                               10
Centro Agroecológico del Café A.C.                                                       8
Asociación de Cafés Especiales de Nicaragua                                              8
Coffee Quality Institute                                                                 7
Asociación Mexicana De Cafés y Cafeterías De Especialidad A.C.                           6
Tanzanian Coffee Board                                                                   6
Torch Coffee Lab Yunnan                                                                  2
Specialty Coffee Ass                                                                     1
Blossom Valley International\n                                                           1
Central De Organizaciones Productoras De Café y Cacao Del Perú - Central Café & Cacao      1
Name: In.Country.Partner, dtype: int64
```

```
one_hot = OneHotEncoder()
transformed_data = one_hot.fit_transform(data['In.Country.Partner'].values.reshape(-1,1)).toarray()
one_hot.categories_
```

```
[array(['AMECAFE', 'Africa Fine Coffee Association', 'Almacafé',
        'Asociacion Nacional Del Café',
        'Asociación Mexicana De Cafés y Cafeterías De Especialidad A.C.',
        'Asociación de Cafés Especiales de Nicaragua',
        'Blossom Valley International', 'Blossom Valley International\n',
        'Brazil Specialty Coffee Association',
        'Central De Organizaciones Productoras De Café y Cacao Del Perú - Central Café & Cacao',
        'Centro Agroecológico del Café A.C.', 'Coffee Quality Institute',
        'Ethiopia Commodity Exchange', 'Instituto Hondureño del Café',
        'Kenya Coffee Traders Association',
                                                            ',
        'Specialty Coffee Association',
```

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```
       'Specialty Coffee Association of Costa Rica',
       'Specialty Coffee Association of Indonesia',
       'Specialty Coffee Institute of Asia', 'Tanzanian Coffee Board',
       'Torch Coffee Lab Yunnan', 'Uganda Coffee Development Authority',
       'Yunnan Coffee Exchange'], dtype=object)]
```

```

transformed_data = pd.DataFrame(transformed_data ,
                                columns = ['AMECAFE', 'Africa Fine Coffee Association', 'Almacafé',
        'Asociacion Nacional Del Café',
        'Asociación Mexicana De Cafés y Cafeterías De Especialidad A.C.',
        'Asociación de Cafés Especiales de Nicaragua',
        'Blossom Valley International', 'Blossom Valley International\n',
        'Brazil Specialty Coffee Association',
        'Central De Organizaciones Productoras De Café y Cacao Del Perú - Central Café & Cacao',
        'Centro Agroecológico del Café A.C.', 'Coffee Quality Institute',
        'Ethiopia Commodity Exchange', 'Instituto Hondureño del Café',
        'Kenya Coffee Traders Association',
        'METAD Agricultural Development plc', 'NUCOFFEE',
        'Salvadoran Coffee Council', 'Specialty Coffee Ass',
        'Specialty Coffee Association',
        'Specialty Coffee Association of Costa Rica',
        'Specialty Coffee Association of Indonesia',
        'Specialty Coffee Institute of Asia', 'Tanzanian Coffee Board',
        'Torch Coffee Lab Yunnan', 'Uganda Coffee Development Authority',
        'Yunnan Coffee Exchange'])
transformed_data.head()

```

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	AMECAFE	Africa Fine Coffee Association	Almacafé	Asociacion Nacional Del Café	Asociación Mexicana De Cafés y Cafeterías De Especialidad A.C.	Asociación de Cafés Especiales de Nicaragua	Blossom Valley International	Blossom Valley International\n	A
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

```
transformed_data.iloc[90, ]
```

```
AMECAFE                                                                         0.0
Africa Fine Coffee Association                                                  0.0
Almacafé                                                                        0.0
Asociacion Nacional Del Café                                                    0.0
Asociación Mexicana De Cafés y Cafeterías De Especialidad A.C.                  0.0
Asociación de Cafés Especiales de Nicaragua                                     0.0
Blossom Valley International                                                    0.0
Blossom Valley International\n                                                  0.0
Brazil Specialty Coffee Association                                             0.0
Central De Organizaciones Productoras De Café y Cacao Del Perú - Central Café & Cacao   0.0
Centro Agroecológico del Café A.C.                                              0.0
Coffee Quality Institute                                                        0.0
Ethiopia Commodity Exchange                                                     0.0
Instituto Hondureño del Café                                                    0.0
Kenya Coffee Traders Association                                                0.0
METAD Agricultural Development plc                                              0.0
NUCOFFEE                                                                        0.0
Salvadoran Coffee Council                                                       0.0
Specialty Coffee Ass                                                            0.0
Specialty Coffee Association                                                    1.0
Specialty Coffee Association of Costa Rica                                      0.0
Specialty Coffee Association of Indonesia                                       0.0
Specialty Coffee Institute of Asia                                              0.0
Tanzanian Coffee Board                                                          0.0
Torch Coffee Lab Yunnan                                                         0.0
Uganda Coffee Development Authority                                             0.0
                                                                                0.0
```

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```
data['Number.of.Bags'][90]
```

```
68
```

Normalization & Standardization

```

numeric_columns = [c for c in data.columns if data[c].dtype != np.dtype('O')]
numeric_columns
```

```
['Unnamed: 0',
 'Number.of.Bags',
 'Aroma',
 'Flavor',
 'Aftertaste',
 'Acidity',
 'Body',
 'Balance',
 'Uniformity',
 'Clean.Cup',
 'Sweetness',
 'Cupper.Points',
 'Total.Cup.Points',
 'Moisture',
 'Category.One.Defects',
 'Quakers',
 'Category.Two.Defects',
 'altitude_low_meters',
 'altitude_high_meters',
 'altitude_mean_meters']
```

```
len(numeric_columns) , len(data.columns)
```

To undo cell deletion use Ctrl+M Z or the Undo option in the Edit menu ×

```
numeric_columns.remove('Aroma')
numeric_columns.remove('Aroma')
numeric_columns.remove('Flavor')
```

```
temp_data = data[numeric_columns]
temp_data
```

```
      Unnamed:  Number.of.Bags  Aftertaste  Acidity  Body  Balance  Uniformity  Clean.Cup  Sweetness  Cupp
             0
   0         0             114        8.67     8.75  8.50     8.42       10.00      10.00      10.00
   1         1             114        8.50     8.58  8.42     8.42       10.00      10.00      10.00
   2         2               5        8.42     8.42  8.33     8.42       10.00      10.00      10.00
   3         3             119        8.42     8.42  8.50     8.25       10.00      10.00      10.00
   4         4             114        8.25     8.50  8.42     8.33       10.00      10.00      10.00
 ...       ...             ...         ...      ...   ...      ...         ...        ...        ...
1334      1334               1        7.33     7.58  5.08     7.83       10.00      10.00       7.75
1335      1335               1        7.75     7.75  5.17     5.25       10.00      10.00       8.42
1336      1336               1        7.17     7.42  7.50     7.17        9.33       9.33       7.42
1337      1337               1        6.75     7.17  7.25     7.00        9.33       9.33       7.08
1338      1338               1        6.50     6.83  6.92     6.83        9.33       9.33       6.67

1339 rows × 18 columns
```

Normalization

To undo cell deletion use Ctrl+M Z or the Undo option in the Edit menu ✕

```
ler
import warnings
```

```python
warnings.filterwarnings('ignore')
normalizer = MinMaxScaler()
temp_data.dropna(axis = 1 , inplace = True)
normalized_data = normalizer.fit_transform(temp_data)
pd.DataFrame(normalized_data , columns = temp_data.columns)
```

	Unnamed: 0	Number.of.Bags	Aftertaste	Acidity	Body	Balance	Uniformity	Clean.Cup	Sweetness
0	0.000000	0.876923	1.000000	1.000000	0.990676	0.962286	1.000	1.000	1.000
1	0.000747	0.876923	0.980392	0.980571	0.981352	0.962286	1.000	1.000	1.000
2	0.001495	0.038462	0.971165	0.962286	0.970862	0.962286	1.000	1.000	1.000
3	0.002242	0.915385	0.971165	0.962286	0.990676	0.942857	1.000	1.000	1.000
4	0.002990	0.876923	0.951557	0.971429	0.981352	0.952000	1.000	1.000	1.000
...	...	...	...	...	...	...	...	...	...
1334	0.997010	0.007692	0.845444	0.866286	0.592075	0.894857	1.000	1.000	0.775
1335	0.997758	0.007692	0.893887	0.885714	0.602564	0.600000	1.000	1.000	0.842
1336	0.998505	0.007692	0.826990	0.848000	0.874126	0.819429	0.933	0.933	0.742
1337	0.999253	0.007692	0.778547	0.819429	0.844988	0.800000	0.933	0.933	0.708
1338	1.000000	0.007692	0.749712	0.780571	0.806527	0.780571	0.933	0.933	0.667

1339 rows × 14 columns

Standardization

To undo cell deletion use Ctrl+M Z or the Undo option in the Edit menu ✕

```python
pd.DataFrame(standardized_data , columns = temp_data.columns)
```

	Unnamed: 0	Number.of.Bags	Aftertaste	Acidity	Body	Balance	Uniformity	Clean.Cup	Sweetnes
0	-1.730758	1.032078	3.138457	3.198164	2.655944	2.206476	0.29785	0.215923	0.23269
1	-1.728171	1.032078	2.717990	2.750424	2.439684	2.206476	0.29785	0.215923	0.23269
2	-1.725584	-1.359565	2.520123	2.329022	2.196392	2.206476	0.29785	0.215923	0.23269
3	-1.722997	1.141786	2.520123	2.329022	2.655944	1.790615	0.29785	0.215923	0.23269
4	-1.720409	1.032078	2.099656	2.539723	2.439684	1.986314	0.29785	0.215923	0.23269
...	...	...	...	...	...	...	...	...	.
1334	1.720409	-1.447331	-0.175812	0.116661	-6.589155	0.763194	0.29785	0.215923	-3.42066
1335	1.722997	-1.447331	0.862989	0.564400	-6.345863	-5.548106	0.29785	0.215923	-2.33277
1336	1.725584	-1.447331	-0.571545	-0.304742	-0.047302	-0.851325	-0.91070	-0.661430	-3.95649
1337	1.728171	-1.447331	-1.610346	-0.963182	-0.723113	-1.267185	-0.91070	-0.661430	-4.50855
1338	1.730758	-1.447331	-2.228680	-1.858662	-1.615184	-1.683046	-0.91070	-0.661430	-5.17427

1339 rows × 14 columns

Handling With Missing Values

```
data.isnull().sum()
```

```
Unnamed: 0                  0
Species                     0
```

To undo cell deletion use Ctrl+M Z or the Undo option in the Edit menu ✕

```
Lot.Number               1063
```

```
Mill                      318
ICO.Number                157
Company                   209
Altitude                  226
Region                     59
Producer                  232
Number.of.Bags              0
Bag.Weight                  0
In.Country.Partner          0
Harvest.Year               47
Grading.Date                0
Owner.1                     7
Variety                   226
Processing.Method         170
Aroma                       0
Flavor                      0
Aftertaste                  0
Acidity                     0
Body                        0
Balance                     0
Uniformity                  0
Clean.Cup                   0
Sweetness                   0
Cupper.Points               0
Total.Cup.Points            0
Moisture                    0
Category.One.Defects        0
Quakers                     1
Color                     218
Category.Two.Defects        0
Expiration                  0
Certification.Body          0
Certification.Address       0
Certification.Contact       0
unit_of_measurement         0
altitude_low_meters       230
altitude_high_meters      230
altitude_mean_meters      230
```

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```
data['altitude_low_meters'].isnull().sum()
```

```
230
```

Simple Imputer

```python
from sklearn.impute import SimpleImputer
imputer = SimpleImputer(missing_values=np.nan , strategy='mean')
agent_col = imputer.fit_transform(data['altitude_low_meters'].values.reshape(-1,1))
pd.DataFrame(agent_col).isnull().sum()
```

```
0    0
dtype: int64
```

```python
data['altitude_low_meters'].isnull().sum()
```

```
230
```

Discretization

```python
from sklearn.preprocessing import KBinsDiscretizer
temp_data.head()
```

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Unnamed: 0	Number.of.Bags	Aftertaste	Acidity	Body	Balance	Uniformity	Clean.Cup	Sweetness	Cupper.

Quantile Discretization Transform

```
trans = KBinsDiscretizer(n_bins =10 , encode = 'ordinal' , strategy='quantile')
new_data = trans.fit_transform(temp_data)
pd.DataFrame(new_data,columns = temp_data.columns )
```

	Unnamed: 0	Number.of.Bags	Aftertaste	Acidity	Body	Balance	Uniformity	Clean.Cup	Sweetness	Cupp
0	0.0	8.0	9.0	8.0	8.0	8.0	1.0	0.0	0.0	
1	0.0	8.0	9.0	8.0	8.0	8.0	1.0	0.0	0.0	
2	0.0	1.0	9.0	8.0	8.0	8.0	1.0	0.0	0.0	
3	0.0	8.0	9.0	8.0	8.0	8.0	1.0	0.0	0.0	
4	0.0	8.0	9.0	8.0	8.0	8.0	1.0	0.0	0.0	
...	...	...	...	...	...	...	...	...	...	
1334	9.0	0.0	4.0	5.0	0.0	7.0	1.0	0.0	0.0	
1335	9.0	0.0	8.0	7.0	0.0	0.0	1.0	0.0	0.0	
1336	9.0	0.0	2.0	3.0	4.0	1.0	1.0	0.0	0.0	
1337	9.0	0.0	0.0	1.0	1.0	0.0	1.0	0.0	0.0	
1338	9.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	

1339 rows × 14 columns

To undo cell deletion use Ctrl+M Z or the Undo option in the Edit menu ✕

Uniform Discretization Transform

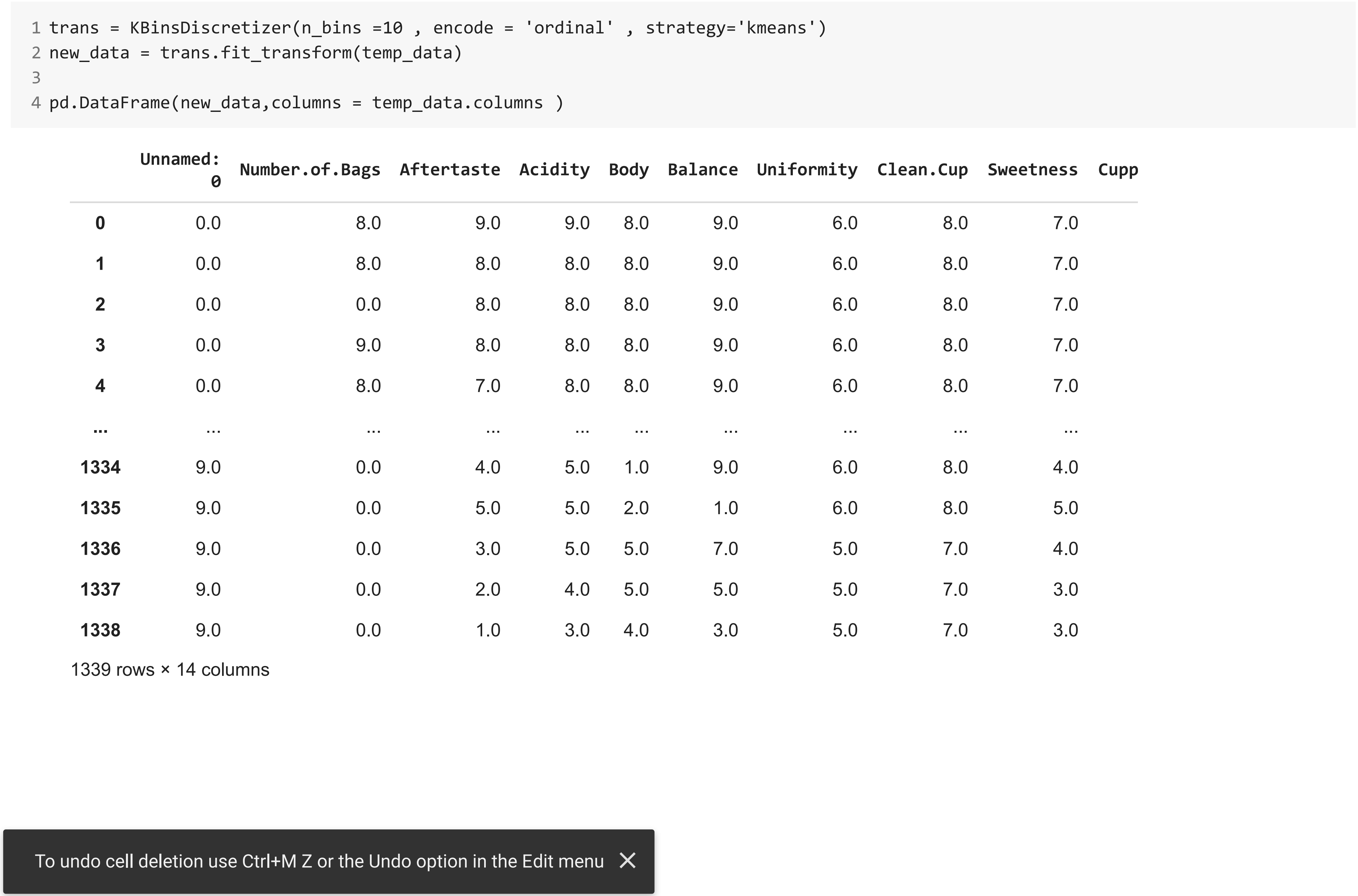
```python
trans = KBinsDiscretizer(n_bins =10 , encode = 'ordinal' , strategy='uniform')
new_data = trans.fit_transform(temp_data)

pd.DataFrame(new_data,columns = temp_data.columns )
```

	Unnamed: 0	Number.of.Bags	Aftertaste	Acidity	Body	Balance	Uniformity	Clean.Cup	Sweetness	Cupp
0	0.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
1	0.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
2	0.0	0.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
3	0.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
4	0.0	8.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
...	...	...	...	...	...	...	...	...	...	
1334	9.0	0.0	8.0	8.0	5.0	8.0	9.0	9.0	7.0	
1335	9.0	0.0	8.0	8.0	6.0	6.0	9.0	9.0	8.0	
1336	9.0	0.0	8.0	8.0	8.0	8.0	9.0	9.0	7.0	
1337	9.0	0.0	7.0	8.0	8.0	8.0	9.0	9.0	7.0	
1338	9.0	0.0	7.0	7.0	8.0	7.0	9.0	9.0	6.0	

1339 rows × 14 columns

To undo cell deletion use Ctrl+M Z or the Undo option in the Edit menu ✕



```python
trans = KBinsDiscretizer(n_bins =10 , encode = 'ordinal' , strategy='kmeans')
new_data = trans.fit_transform(temp_data)

pd.DataFrame(new_data,columns = temp_data.columns )
```

	Unnamed: 0	Number.of.Bags	Aftertaste	Acidity	Body	Balance	Uniformity	Clean.Cup	Sweetness	Cupp
0	0.0	8.0	9.0	9.0	8.0	9.0	6.0	8.0	7.0	
1	0.0	8.0	8.0	8.0	8.0	9.0	6.0	8.0	7.0	
2	0.0	0.0	8.0	8.0	8.0	9.0	6.0	8.0	7.0	
3	0.0	9.0	8.0	8.0	8.0	9.0	6.0	8.0	7.0	
4	0.0	8.0	7.0	8.0	8.0	9.0	6.0	8.0	7.0	
...	...	...	...	...	...	...	...	...	...	
1334	9.0	0.0	4.0	5.0	1.0	9.0	6.0	8.0	4.0	
1335	9.0	0.0	5.0	5.0	2.0	1.0	6.0	8.0	5.0	
1336	9.0	0.0	3.0	5.0	5.0	7.0	5.0	7.0	4.0	
1337	9.0	0.0	2.0	4.0	5.0	5.0	5.0	7.0	3.0	
1338	9.0	0.0	1.0	3.0	4.0	3.0	5.0	7.0	3.0	

1339 rows × 14 columns

To undo cell deletion use Ctrl+M Z or the Undo option in the Edit menu ✕

To undo cell deletion use Ctrl+M Z or the Undo option in the Edit menu ✕