

Course introduction

WORKING WITH CATEGORICAL DATA IN PYTHON



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What does it mean to be "categorical"?

Categorical

- Finite number of groups (or categories)
- These categories are usually fixed or known (eye color, hair color, etc.)
- Known as qualitative data

Numerical

- Known as quantitative data
- Expressed using a numerical value
- Is usually a measurement (height, weight, IQ, etc.)

Ordinal vs. nominal variables

Ordinal

- Categorical variables that have a natural order

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Nominal

- Categorical variables that cannot be placed into a natural order

Blue Green Red Yellow Purple

Our first dataset

```
adult.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 32561 entries, 0 to 32560
Data columns (total 15 columns):
#   Column                Non-Null Count  Dtype
--  --
0   Age                   32561 non-null  int64
1   Workclass              32561 non-null  object
2   fnlgt                 32561 non-null  int64
3   Education              32561 non-null  object
4   Education Num          32561 non-null  int64
5   Marital Status        32561 non-null  object
...
```

¹ <https://www.kaggle.com/uciml/adult-census-income>

Using describe

```
adult["Marital Status"].describe()
```

```
count          32561
unique           7
top    Married-civ-spouse
freq          14976
Name: Marital Status, dtype: object
```

Using value counts

```
adult["Marital Status"].value_counts()
```

```
Married-civ-spouse      14976  
Never-married           10683  
Divorced                 4443  
Separated               1025  
Widowed                  993  
Married-spouse-absent   418  
Married-AF-spouse        23  
Name: Marital Status, dtype: int64
```

Using value counts with normalize

```
adult["Marital Status"].value_counts(normalize=True)
```

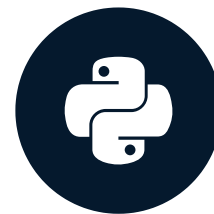
```
Married-civ-spouse      0.459937  
Never-married           0.328092  
Divorced                0.136452  
Separated              0.031479  
Widowed                0.030497  
Married-spouse-absent  0.012837  
Married-AF-spouse      0.000706  
Name: Marital Status, dtype: float64
```

Knowledge check

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Categorical data in pandas

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dtypes: object

```
adult = pd.read_csv("data/adult.csv")  
adult.dtypes
```

```
Age                int64  
Workclass          object  
fnlgt             int64  
Education          object  
Education Num     int64  
Marital Status    object  
Occupation        object  
Relationship      object  
...
```

dtypes: categorical

Default dtype:

```
adult["Marital Status"].dtype
```

```
dtype('O')
```

Set as categorical:

```
adult["Marital Status"] = adult["Marital Status"].astype("category")
```

```
adult["Marital Status"].dtype
```

```
CategoricalDtype(categories=[' Divorced', ' Married-AF-spouse',  
' Married-civ-spouse', ' Married-spouse-absent', ' Never-married',  
' Separated', ' Widowed'], ordered=False)
```

Creating a categorical Series

```
my_data = ["A", "A", "C", "B", "C", "A"]
```

```
my_series1 = pd.Series(my_data, dtype="category")  
print(my_series1)
```

```
0    A  
1    A  
2    C  
...  
dtype: category  
Categories (3, object): [A, B, C]
```

Creating a categorical Series

```
my_data = ["A", "A", "C", "B", "C", "A"]  
my_series2 = pd.Categorical(my_data, categories=["C", "B", "A"], ordered=True)  
my_series2
```

```
[A, A, C, B, C, A]  
Categories (3, object): [C < B < A]
```

Why do we use categorical: memory

Memory saver:

```
adult = pd.read_csv("data/adult.csv")  
adult["Marital Status"].nbytes
```

260488

```
adult["Marital Status"] = adult["Marital Status"].astype("category")  
adult["Marital Status"].nbytes
```

32617

Specify dtypes when reading data

1. Create a dictionary:

```
adult_dtypes = {"Marital Status": "category"}
```

2. Set the `dtype` parameter:

```
adult = pd.read_csv("data/adult.csv", dtype=adult_dtypes)
```

3. Check the `dtype`:

```
adult["Marital Status"].dtype
```

```
CategoricalDtype(categories=[' Divorced', ' Married-AF-spouse',  
                             ..., ' Widowed'], ordered=False)
```

pandas category practice

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Grouping data by category in pandas

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The basics of `.groupby()`: splitting data

```
adult = pd.read_csv("data/adult.csv")  
adult1 = adult[adult["Above/Below 50k"] == "<=50K"]  
adult2 = adult[adult["Above/Below 50k"] == ">50K"]
```

is replaced by

```
groupby_object = adult.groupby(by=["Above/Below 50k"])
```

The basics of `.groupby()`: apply a function

```
groupby_object = adult.groupby(by=["Above/Below 50k"])
```

Apply a function:

```
groupby_object.mean()
```

	Age	fnlgt	Education Num	Capital Gain ...
Above/Below 50k				
<=50K	36.783738	190340.86517	9.595065	148.752468 ...
>50K	44.249841	188005.00000	11.611657	4006.142456 ...

One liner:

```
adult.groupby(by=["Above/Below 50k"]).mean()
```

Specifying columns

Option 1: only runs `.sum()` on two columns.

```
adult.groupby(by=["Above/Below 50k"])['Age', 'Education Num'].sum()
```

	Age	Education Num
Above/Below 50k		
<=50K	909294	237190
>50K	346963	91047

Option 2: runs `.sum()` on all numeric columns and then subsets.

```
adult.groupby(by=["Above/Below 50k"]).sum()[['Age', 'Education Num']]
```

Option 1 is preferred - especially when using large datasets

Groupby multiple columns

```
adult.groupby(by=["Above/Below 50k", "Marital Status"]).size()
```

Above/Below 50k	Marital Status	
<=50K	Divorced	3980
	Married-AF-spouse	13
	Married-civ-spouse	8284
	Married-spouse-absent	384
	Never-married	10192
	Separated	959
	Widowed	908
>50K	Divorced	463
	Married-AF-spouse	10 <--- Only 10 records
	Married-civ-spouse	6692
...		

Practice using `.groupby()`

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