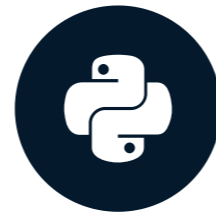


Does time of day affect arrest rate?

ANALYZING POLICE ACTIVITY WITH PANDAS



Kevin Markham
Founder, Data School

Analyzing datetime data

```
apple
```

```
   price  volume  date_and_time
0  174.35  20567800 2018-01-08 16:00:00
1  174.33  21584000 2018-01-09 16:00:00
2  155.15  54390500 2018-02-08 16:00:00
3  156.41  70672600 2018-02-09 16:00:00
4  176.94  23774100 2018-03-08 16:00:00
5  179.98  32185200 2018-03-09 16:00:00
```

Accessing datetime attributes (1)

```
apple.dtypes
```

```
price          float64  
volume         int64  
date_and_time  datetime64[ns]
```

```
apple.date_and_time.dt.month
```

```
0    1  
1    1  
2    2  
3    2  
...
```

Accessing datetime attributes (2)

```
apple.set_index('date_and_time', inplace=True)
apple.index
```

```
DatetimeIndex(['2018-01-08 16:00:00', '2018-01-09 16:00:00',
               '2018-02-08 16:00:00', '2018-02-09 16:00:00',
               '2018-03-08 16:00:00', '2018-03-09 16:00:00'],
              dtype='datetime64[ns]', name='date_and_time', freq=None)
```

```
apple.index.month
```

```
Int64Index([1, 1, 2, 2, 3, 3], dtype='int64', name='date_and_time')
```

- `dt` accessor is not used with a `DatetimeIndex`

Calculating the monthly mean price

```
apple.price.mean()
```

```
169.52666666666667
```

```
apple.groupby(apple.index.month).price.mean()
```

```
date_and_time
1    174.34
2    155.78
3    178.46
Name: price, dtype: float64
```

```
monthly_price = apple.groupby(apple.index.month).price.mean()
```

Plotting the monthly mean price

```
import matplotlib.pyplot as plt
```

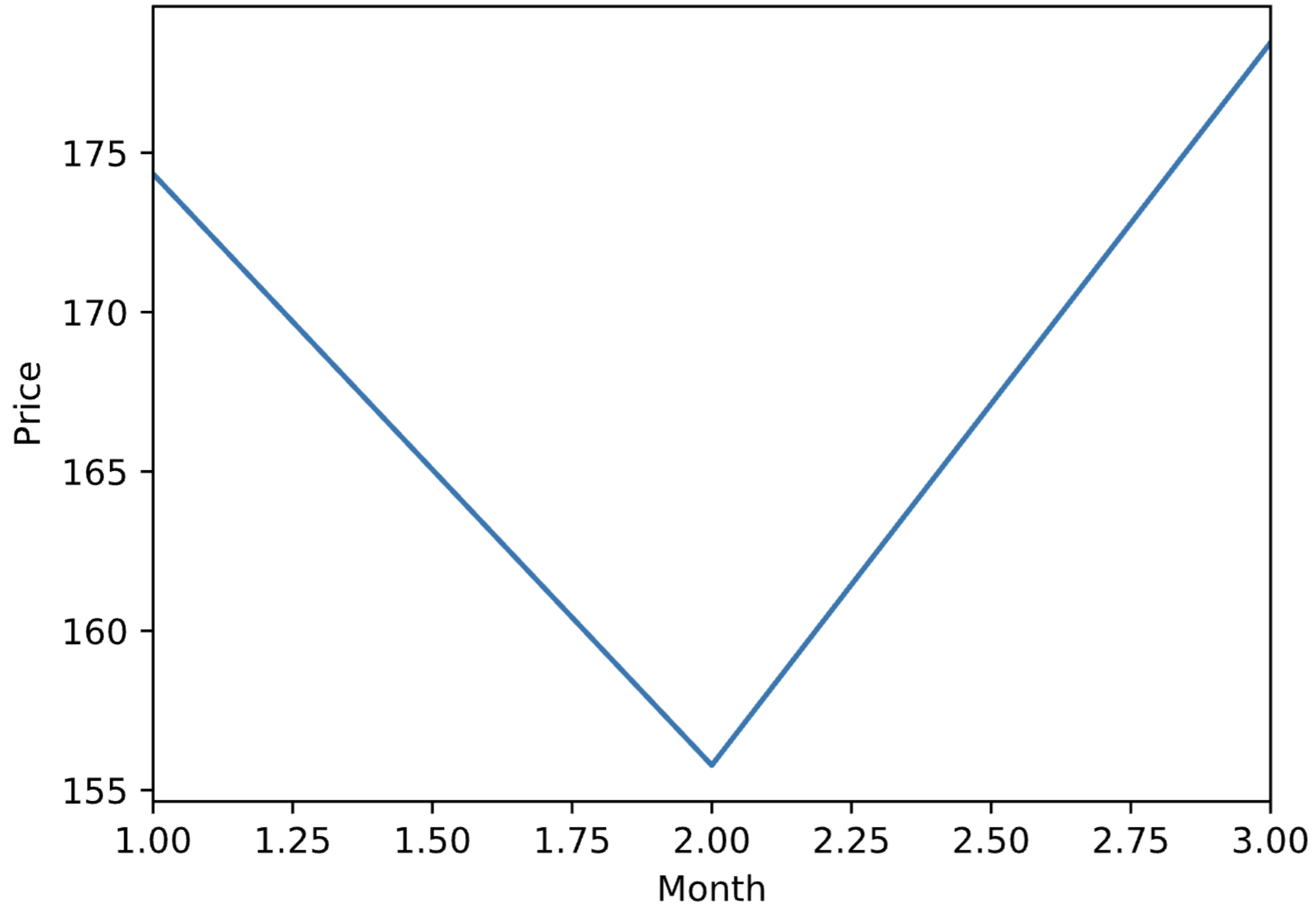
```
monthly_price.plot()
```

- Line plot: Series index on x-axis, Series values on y-axis

```
plt.xlabel('Month')  
plt.ylabel('Price')  
plt.title('Monthly mean stock price for Apple')
```

```
plt.show()
```

Monthly mean stock price for Apple

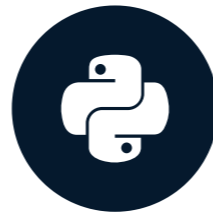


Let's practice!

ANALYZING POLICE ACTIVITY WITH PANDAS

Are drug-related stops on the rise?

ANALYZING POLICE ACTIVITY WITH PANDAS



Kevin Markham
Founder, Data School

Resampling the price

```
apple.groupby(apple.index.month).price.mean()
```

```
date_and_time
1      174.34
2      155.78
3      178.46
```

```
apple.price.resample('M').mean()
```

```
date_and_time
2018-01-31      174.34
2018-02-28      155.78
2018-03-31      178.46
```

Resampling the volume

```
apple
```

```
date_and_time      price      volume
2018-01-08 16:00:00  174.35  20567800
2018-01-09 16:00:00  174.33  21584000
2018-02-08 16:00:00  155.15  54390500
...           ...           ...
```

```
apple.volume.resample('M').mean()
```

```
date_and_time
2018-01-31      21075900
2018-02-28      62531550
2018-03-31      27979650
```

Concatenating price and volume

```
monthly_price = apple.price.resample('M').mean()  
monthly_volume = apple.volume.resample('M').mean()
```

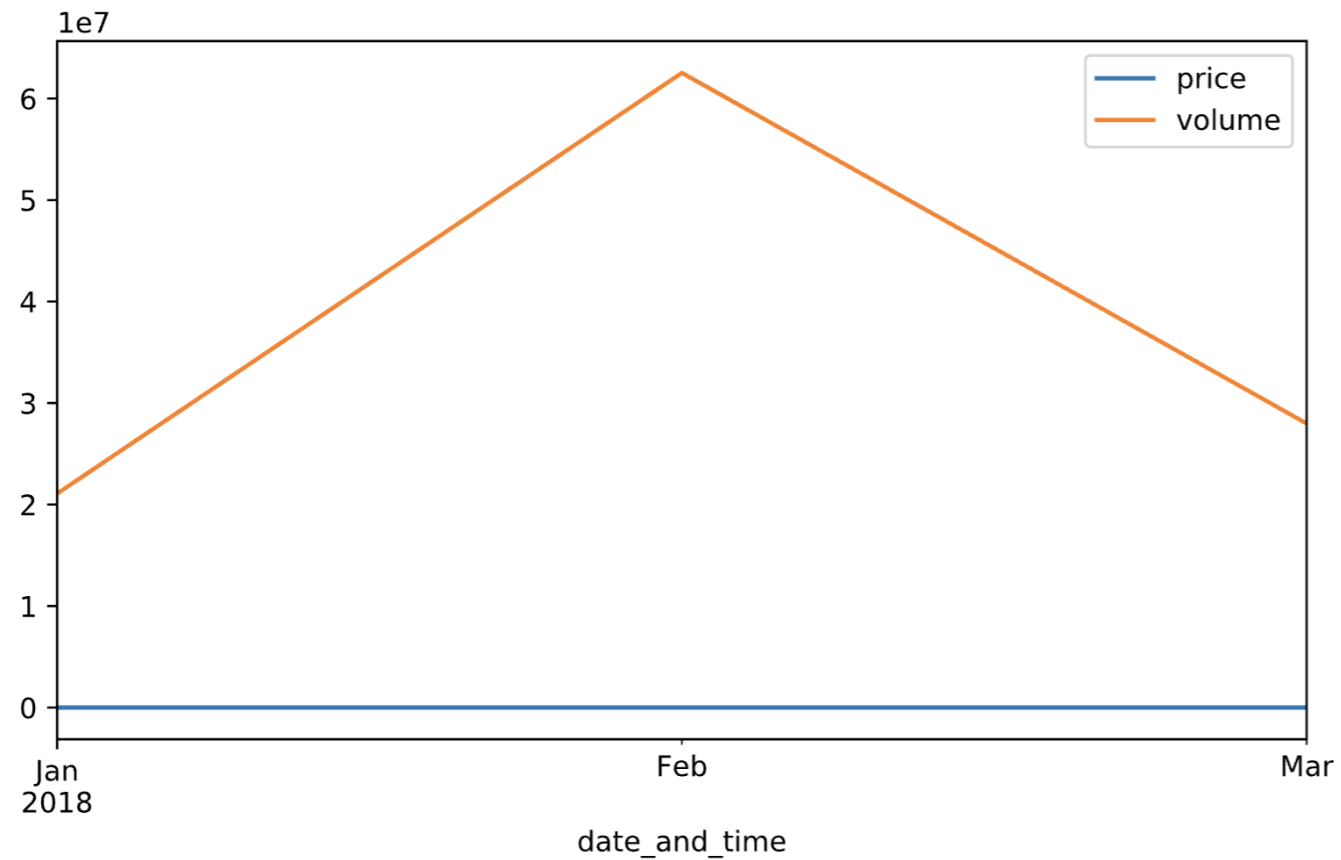
```
pd.concat([monthly_price, monthly_volume], axis='columns')
```

date_and_time	price	volume
2018-01-31	174.34	21075900
2018-02-28	155.78	62531550
2018-03-31	178.46	27979650

```
monthly = pd.concat([monthly_price, monthly_volume],  
                    axis='columns')
```

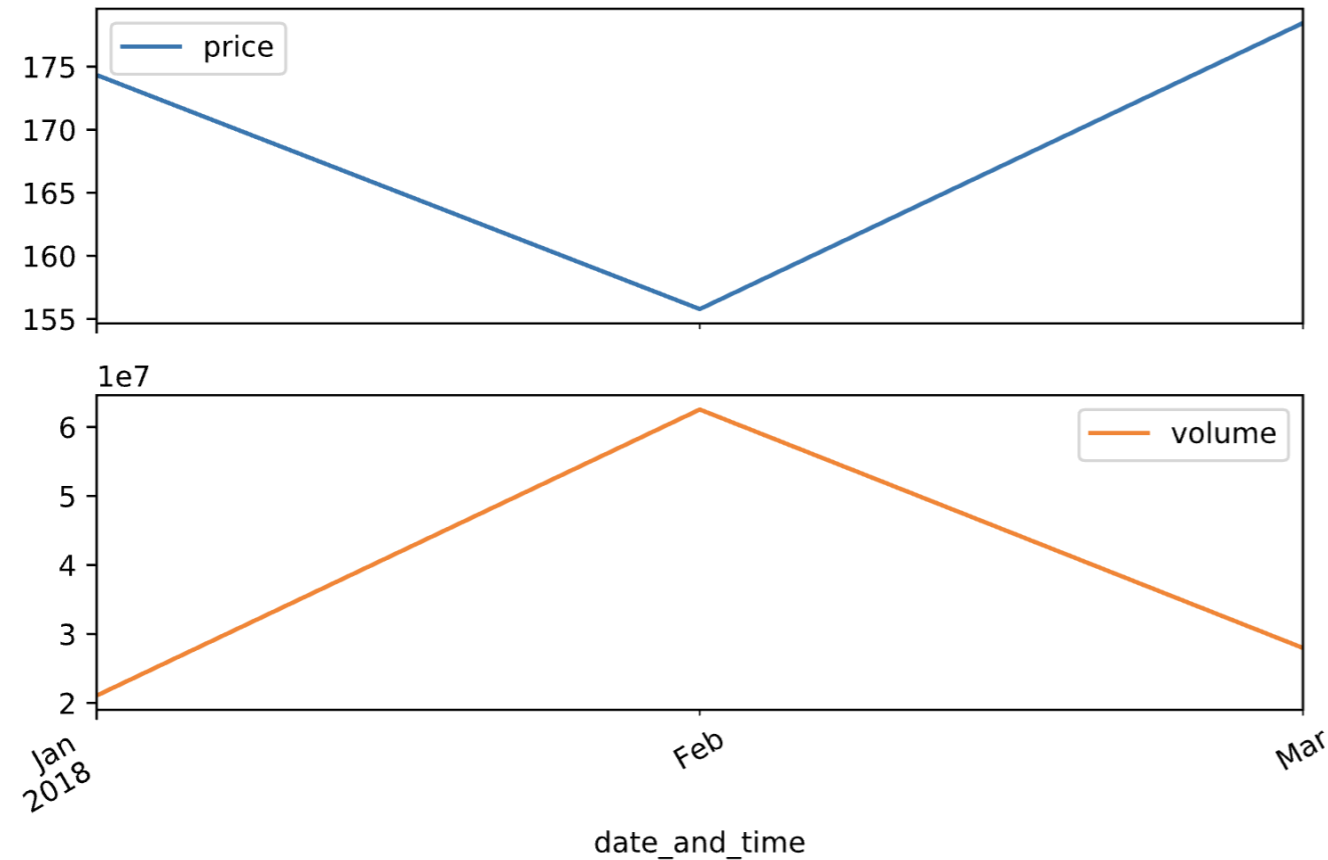
Plotting price and volume (1)

```
monthly.plot()  
plt.show()
```



Plotting price and volume (2)

```
monthly.plot(subplots=True)  
plt.show()
```

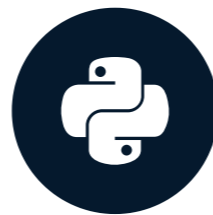


Let's practice!

ANALYZING POLICE ACTIVITY WITH PANDAS

What violations are caught in each district?

ANALYZING POLICE ACTIVITY WITH PANDAS



Kevin Markham
Founder, Data School

Computing a frequency table

```
pd.crosstab(ri.driver_race,  
            ri.driver_gender)
```

```
driver_gender    F    M  
driver_race  
Asian           551  1838  
Black          2681  9604  
Hispanic       1953  7774  
Other           53   212  
White         18536 43334
```

- Frequency table: Tally of how many times each combination of values occurs

```
ri[(ri.driver_race == 'Asian') &  
   (ri.driver_gender == 'F')  
].shape
```

```
(551, 14)
```

- `driver_race` is along the index, `driver_gender` is along the columns

```
table = pd.crosstab(  
    ri.driver_race,  
    ri.driver_gender)
```

Selecting a DataFrame slice

- `.loc[]` accessor: Select from a DataFrame by label

```
table
```

```
driver_gender    F    M
driver_race
Asian            551  1838
Black           2681  9604
Hispanic        1953  7774
Other            53   212
White          18536 43334
```

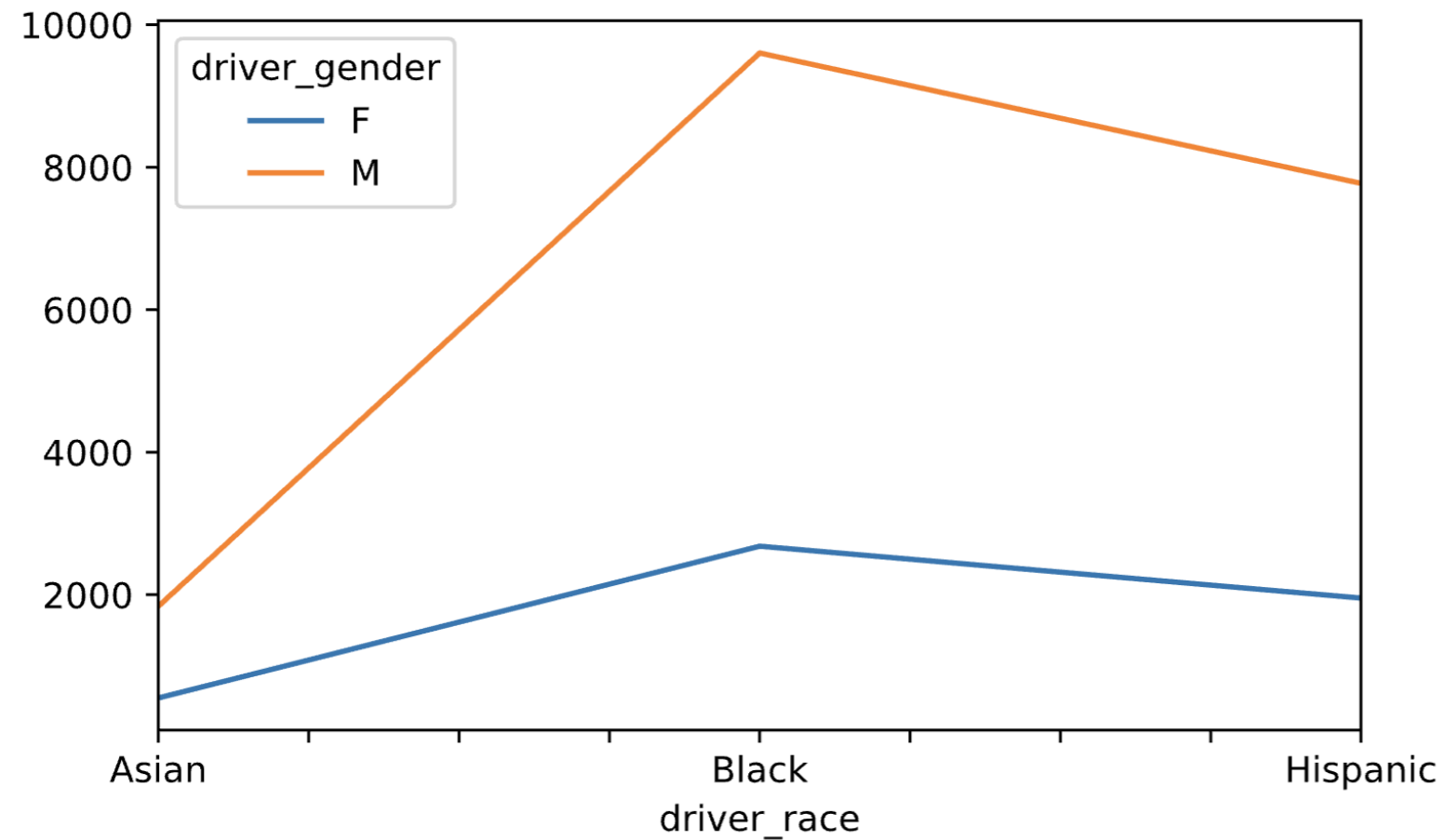
```
table.loc['Asian':'Hispanic']
```

```
driver_gender    F    M
driver_race
Asian            551  1838
Black           2681  9604
Hispanic        1953  7774
```

```
table =
    table.loc['Asian':'Hispanic']
```

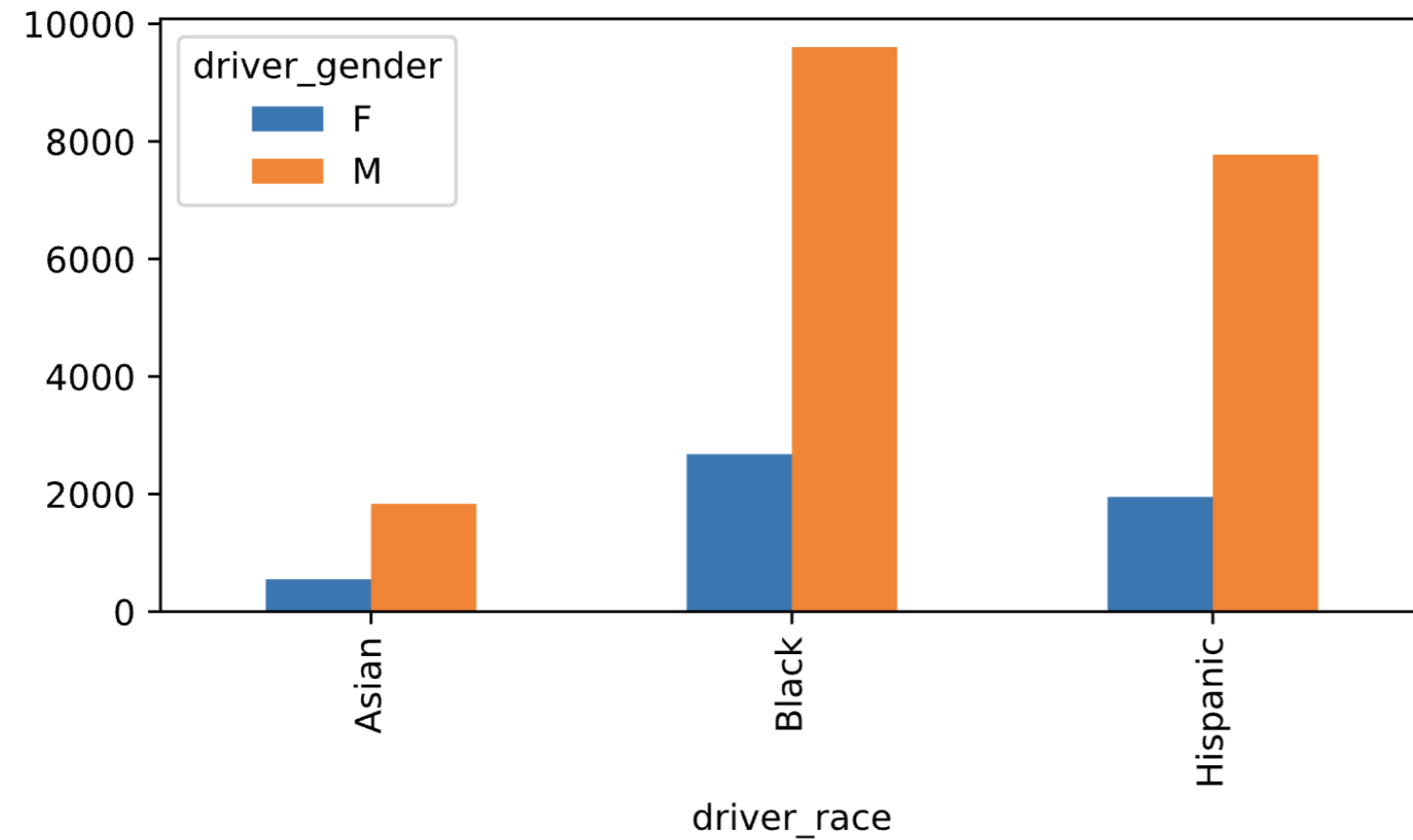
Creating a line plot

```
table.plot()  
plt.show()
```



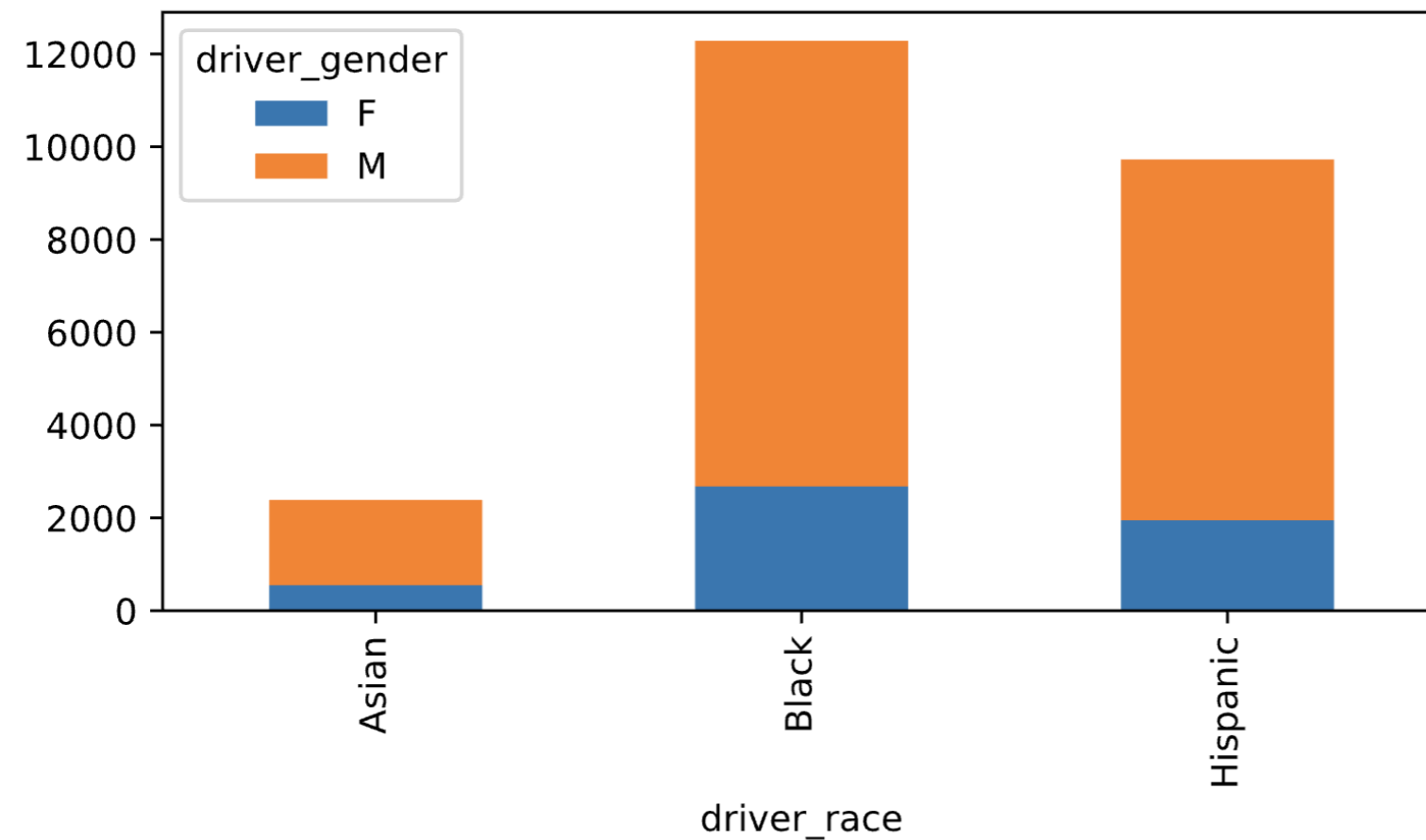
Creating a bar plot

```
table.plot(kind='bar')  
plt.show()
```



Stacking the bars

```
table.plot(kind='bar', stacked=True)  
plt.show()
```

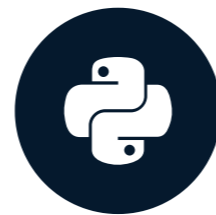


Let's practice!

ANALYZING POLICE ACTIVITY WITH PANDAS

How long might you be stopped for a violation?

ANALYZING POLICE ACTIVITY WITH PANDAS



Kevin Markham
Founder, Data School

Analyzing an object column

```
apple
```

```
date_and_time    price    volume    change
2018-01-08 16:00:00  174.35  20567800    down
...             ...           ...           ...
2018-03-09 16:00:00  179.98  32185200     up
```

- Create a Boolean column:
`True` if the price went up,
and `False` otherwise
- Calculate how often the price went up by taking the column mean

```
apple.change.dtype
```

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

- `.astype()` can't be used in this case

Mapping one set of values to another

- Dictionary maps the values you have to the values you want

```
mapping = {'up':True, 'down':False}
apple['is_up'] = apple.change.map(mapping)
apple
```

```
date_and_time      price      volume change  is_up
2018-01-08 16:00:00  174.35  20567800  down  False
...
2018-03-09 16:00:00  179.98  32185200   up   True
```

```
apple.is_up.mean()
```

```
0.5
```

Calculating the search rate

- Visualize how often searches were done after each violation type

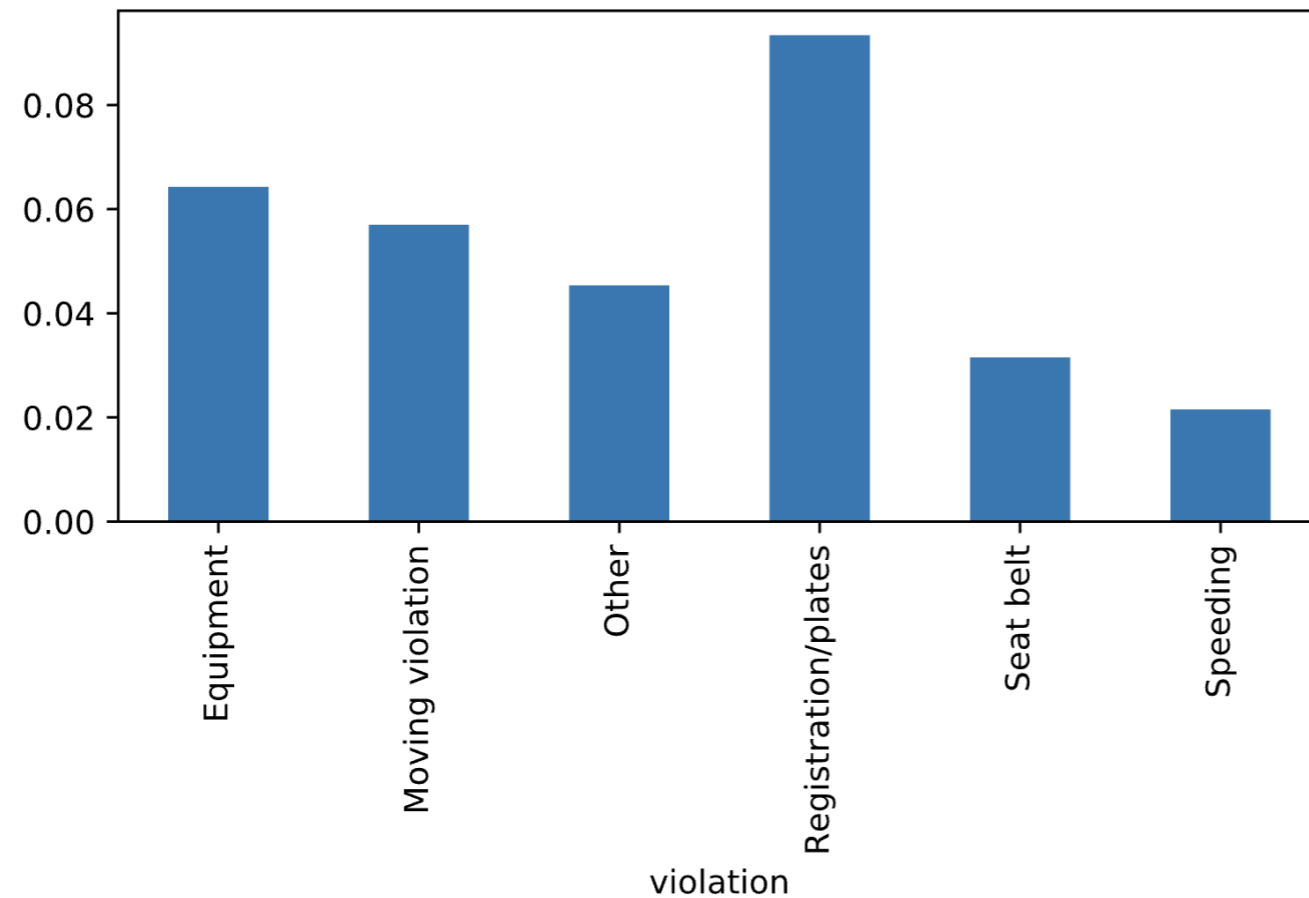
```
ri.groupby('violation').search_conducted.mean()
```

```
violation
Equipment      0.064280
Moving violation 0.057014
Other           0.045362
Registration/plates 0.093438
Seat belt      0.031513
Speeding       0.021560
```

```
search_rate = ri.groupby('violation').search_conducted.mean()
```

Creating a bar plot

```
search_rate.plot(kind='bar')  
plt.show()
```



Ordering the bars (1)

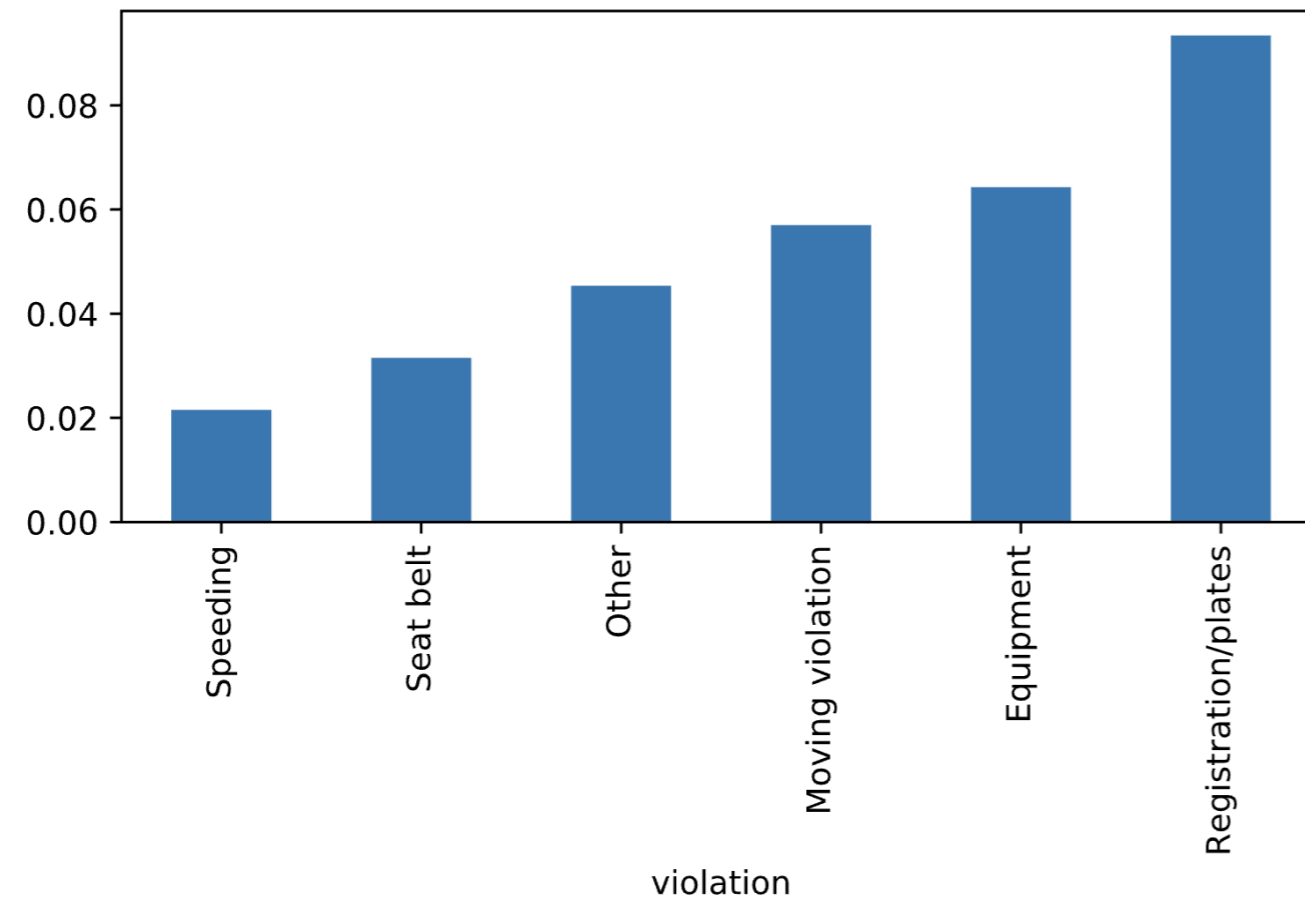
- Order the bars from left to right by size

```
search_rate.sort_values()
```

```
violation
Speeding      0.021560
Seat belt    0.031513
Other         0.045362
Moving violation 0.057014
Equipment    0.064280
Registration/plates 0.093438
Name: search_conducted, dtype: float64
```

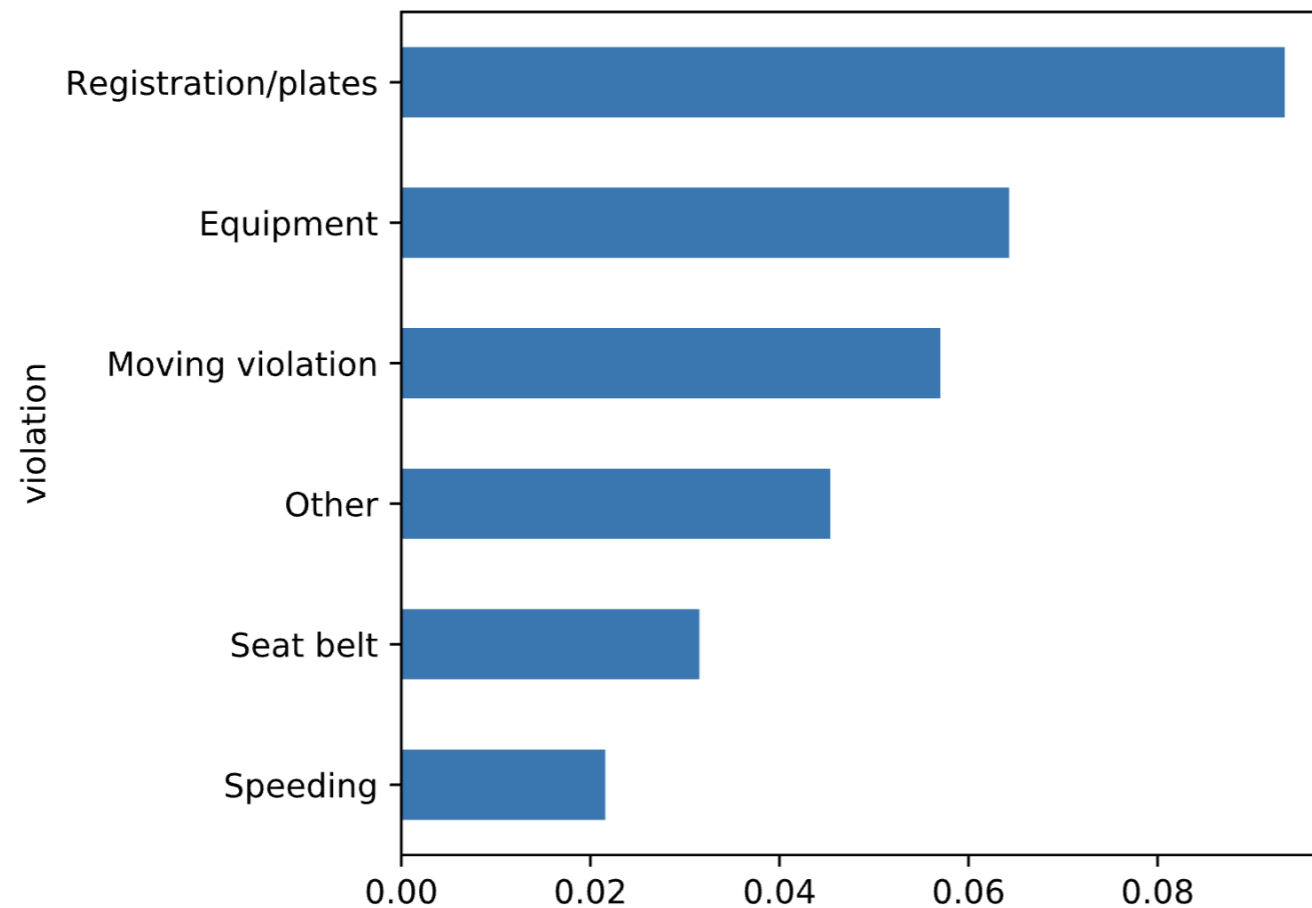
Ordering the bars (2)

```
search_rate.sort_values().plot(kind='bar')  
plt.show()
```



Rotating the bars

```
search_rate.sort_values().plot(kind='barh')  
plt.show()
```



Let's practice!

ANALYZING POLICE ACTIVITY WITH PANDAS