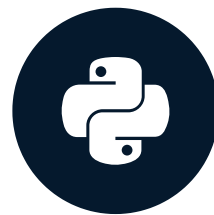


Python Tutorial: Datetime Module - How to work with Dates, Times, Timedeltas, and Timezones

<https://www.youtube.com/watch?v=eirjyP2qcQ>

There and Back Again a DateTime Journey

DATA TYPES FOR DATA SCIENCE IN PYTHON



Jason Myers
Instructor

From string to datetime

- The `datetime` module is part of the Python standard library
- Use the `datetime` type from inside the `datetime` module
- `.strptime()` method converts from a string to a `datetime` object

```
from datetime import datetime  
print(parking_violations_date)
```

```
06/11/2016
```

Parsing strings into datetimes

```
date_dt = datetime.strptime(parking_violations_date,  
                             '%m/%d/%Y')  
  
print(date_dt)
```

```
2016-06-11 00:00:00
```

Time Format Strings

Directive	Meaning	Example
%d	Day of the month as a zero-padded decimal number.	01, 02, ..., 31
%m	Month as a zero-padded decimal number.	01, 02, ..., 12
%Y	Year with century as a decimal number.	0001, 0002, ..., 2013, 2014, ..., 9998, 9999

Full list available in the Python documentation

Datetime to String

- `.strftime()` method uses a format string to convert a datetime object to a string

```
date_dt.strftime('%m/%d/%Y')
```

```
'06/11/2016'
```

- `isoformat()` method outputs a datetime as an ISO standard string

```
date_dt.isoformat()
```

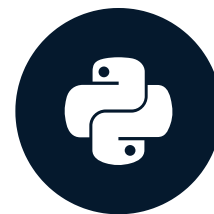
```
'2016-06-11T00:00:00'
```

Let's practice!

DATA TYPES FOR DATA SCIENCE IN PYTHON

Working with Datetime Components and current time

DATA TYPES FOR DATA SCIENCE IN PYTHON



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Datetime Components

- `day` , `month` , `year` , `hour` , `minute` , `second` , and more are available from a datetime instance
- Great for grouping data

```
daily_violations = defaultdict(int)
for violation in parking_violations:
    violation_date = datetime.strptime(violation[4],
                                       '%m/%d/%Y')
    daily_violations[violation_date.day] += 1
```

2. Datetime Components

All the parts of a datetime object are available as attributes, such as `day`, `month`, `year`, `hour`, `minute`, `second` etc. These are often used to group data by a particular time frame. Let's count the NYC parking violations for 2016 and group by day. We'll start by using a defaultdict of ints to count the records by day. Next, I'll loop over the parking violations to and parse the date which is found in the fifth element of our list. Next I increment the appropriate day based on the violation.

Datetime Components - Results

```
print(sorted(daily_violations.items()))
```

```
[(1, 80986), (2, 79831), (3, 74610), (4, 69555),  
(5, 68729), (6, 76232), (7, 82477), (8, 72472),  
(9, 80415), (10, 75387), (11, 73287), (12, 74614),  
(13, 75278), (14, 81803), (15, 79122), (16, 80692),  
(17, 73677), (18, 75927), (19, 80813), (20, 80992),  
(21, 78138), (22, 81872), (23, 78104), (24, 63490),  
(25, 78898), (26, 78830), (27, 80164), (28, 81954),  
(29, 80585), (30, 65864), (31, 44125)]
```

What is the deal with now

- `.now()` method returns the **current local datetime**
- `.utcnow()` method returns the current UTC datetime

```
from datetime import datetime
local_dt = datetime.now()
print(local_dt)
```

```
2017-05-05 12:30:00.740415
```

4. What is the deal with now

Often when working with datetime objects, you'll want to work on windows or ranges that start from the current date and time. We can do this using the datetime now functions. There is a `now()` method on the datetime object in the datetime module and a `utcnow()` method. The `now()` method returns the current local time on the machine on which it is run, and `utcnow()` does the same thing but returns the value in UTC timezone. We'll talk more about timezones in a second. Let's start by importing datetime type. Then we'll call the `now` method on it and it will return a new datetime representing the current time. Let's print it to see what we got.

What is the deal with **utcnow**

```
utc_dt = datetime.utcnow()  
print(utc_dt)
```

```
2017-05-05 17:30:05.467221
```

5. What is the deal with utcnow

Next, let's call `utcnow` and get the current time in the UTC timezone. Finally, print it. The UTC timezone is only timezone with this special kind of method. Let's learn a bit more about timezones.

Timezones

- Naive datetime objects have no timezone data
- Aware datetime objects have a timezone
- Timezone data is available via the `pytz` module via the `timezone` object
- Aware objects have `.astimezone()` so you can get the time in another timezone

6. Timezones

In order to work effectively with other timezones, you can use the `pytz` module and use the timezone names from the Olsen database, the standard for timezone information. An "aware" datetime object has an `astimezone()` method that accepts a `timezone` object and returns a new datetime object in the desired timezone. If the `tzinfo` is not set for the datetime object it assumes the timezone of the computer you are working on.

Timezones in action

```
from pytz import timezone
record_dt = datetime.strptime('07/12/2016 04:39PM',
    ...: '%m/%d/%Y %H:%M%p')
ny_tz = timezone('US/Eastern')
a_tz = timezone('US/Pacific')
ny_dt = record_dt.replace(tzinfo=ny_tz)
la_dt = ny_dt.astimezone(la_tz)
```

7. Timezones in action

I'll begin by importing `timezone` from `pytz`. I've got the `datetime` of a violation, and parsed it into a naive `datetime` object. .. Next, I use the `replace` method to replace the empty `timezone` on my `record datetime` and save it as my `datetime`. Now that I have an aware `datetime` instance, I can use the `as timezone` method to get the records time in LA.

Timezones in action - results

```
print(ny_dt)
```

```
2016-07-12 04:39:00-04:00
```

```
print(la_dt)
```

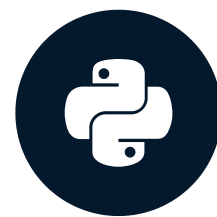
```
2016-07-12 01:39:00-07:00
```

Let's practice!

DATA TYPES FOR DATA SCIENCE IN PYTHON

Time Travel (Adding and Subtracting Time)

DATA TYPES FOR DATA SCIENCE IN PYTHON



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Instructor

Incrementing through time

- `timedelta` is used to represent an amount of change in time
- Used to add or subtract a set amount of time from a datetime object

```
from datetime import timedelta  
flashback = timedelta(days=90)  
print(record_dt)
```

```
2016-07-12 04:39:00
```

Adding and subtracting timedeltas

```
print(record_dt - flashback)
```

```
2016-04-13 04:39:00
```

```
print(record_dt + flashback)
```

```
2016-10-10 04:39:00
```

Datetime differences

- Use the `-` operator to calculate the difference
- Returns a timedelta with the difference

```
time_diff = record_dt - record2_dt  
type(time_diff)
```

```
datetime.timedelta
```

```
print(time_diff)
```

```
0:00:04
```

Let's practice!

DATA TYPES FOR DATA SCIENCE IN PYTHON

HELP! Libraries to make it easier

DATA TYPES FOR DATA SCIENCE IN PYTHON



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Parsing time with pendulum

- `.parse()` will attempt to convert a string to a pendulum datetime object without the need of the format string

```
import pendulum
```

```
occurred = violation[4] + ' ' + violation[5] + 'M'
```

```
occurred_dt = pendulum.parse(occurred, tz='US/Eastern')
```

```
print(occured_dt)
```

```
'2016-06-11T14:38:00-04:00'
```

Timezone hopping with pendulum

- `.in_timezone()` method converts a pendulum time object to a desired timezone.
- `.now()` method accepts a timezone you want to get the current time in

```
print(violation_dts)
```

```
[<Pendulum [2016-06-11T14:38:00-04:00]>,
 <Pendulum [2016-04-25T14:09:00-04:00]>,
 <Pendulum [2016-04-23T07:49:00-04:00]>,
 <Pendulum [2016-04-26T07:09:00-04:00]>,
 <Pendulum [2016-01-04T09:52:00-05:00]>]
```

More timezone hopping

```
for violation_dt in violation_dts:  
    print(violation_dt.in_timezone('Asia/Tokyo'))
```

```
2016-06-12T03:38:00+09:00  
2016-04-26T03:09:00+09:00  
2016-04-23T20:49:00+09:00  
2016-04-26T20:09:00+09:00  
2016-01-04T23:52:00+09:00
```

```
print(pendulum.now('Asia/Tokyo'))
```

```
<Pendulum [2017-05-06T08:20:40.104160+09:00]>
```


Humanizing differences

- `.in_XXX()` methods provide the difference in a chosen metric
- `.in_words()` provides the difference in a nice expressive form

```
diff = violation_dts[3] - violation_dts[2]  
diff
```

```
<Period [2016-04-26T07:09:00-04:00 ->  
        2016-04-23T07:49:00-04:00]>
```

```
print(diff.in_words())
```

```
'2 days 23 hours 20 minutes'
```

More human than human

```
print(diff.in_days())
```

2

```
print(diff.in_hours())
```

71

Let's practice!

DATA TYPES FOR DATA SCIENCE IN PYTHON