

12-01_LOESS_example

December 6, 2021

```
[1]: import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

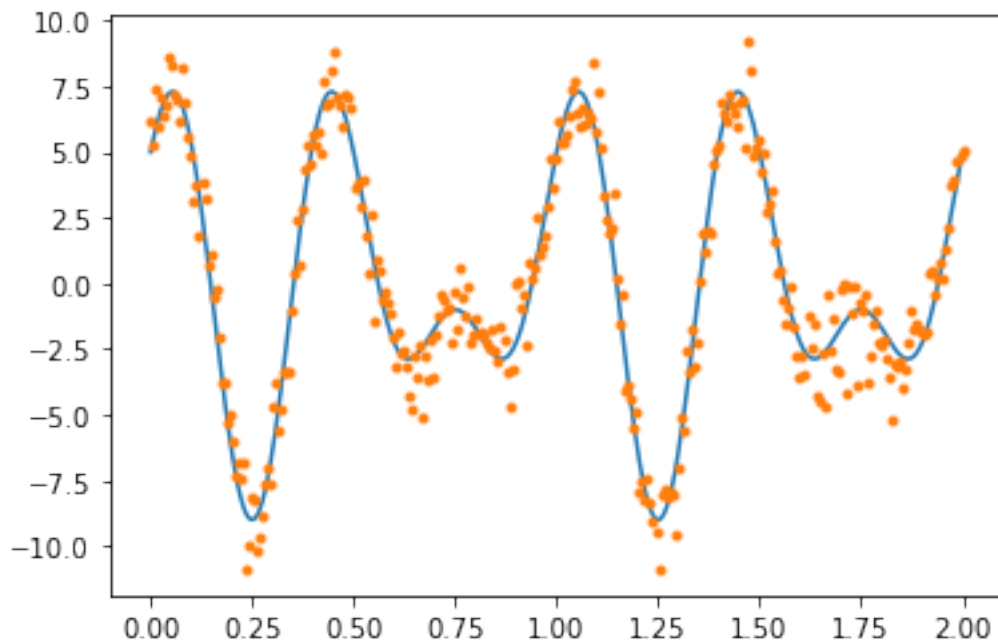
```
[28]: T = np.linspace(0, 2, 300)
```

```
[29]: a1 = 5
a2 = 4
```

```
[57]: y_clean = a1 * np.cos(4 * np.pi * T) + a2 * np.sin(6 * np.pi * T)
y = y_clean + np.random.randn(*y_clean.shape)
```

```
[58]: plt.plot(T, y_clean)
plt.plot(T, y, '.')
```

```
[58]: [<matplotlib.lines.Line2D at 0x7f7f74e3b2b0>]
```



```
[59]: X = np.vstack((np.ones_like(T), T))
      Y = y.reshape(1, -1)
```

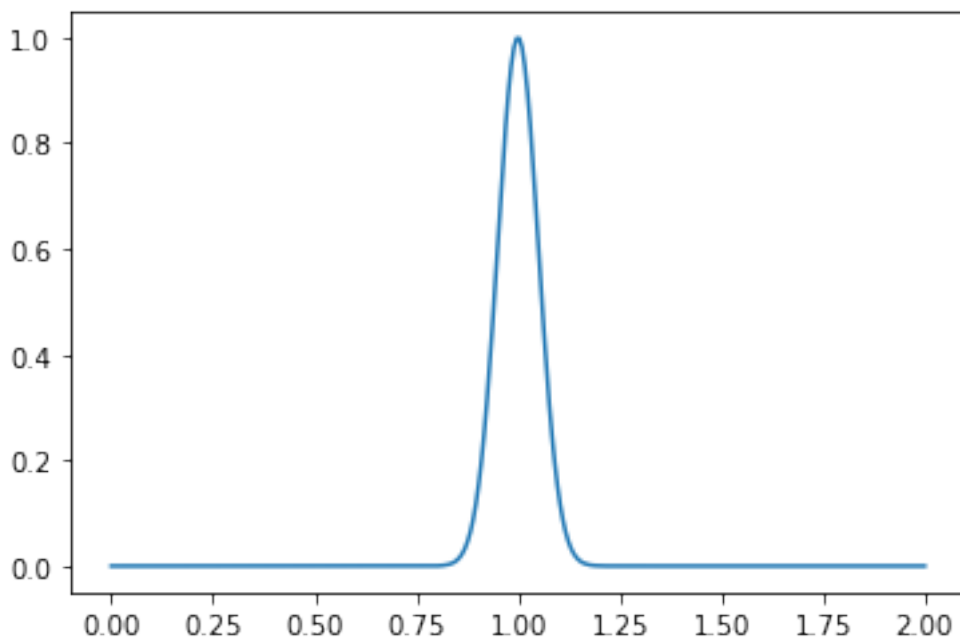
```
[60]: sigma = 0.05
      def w(t):
          return np.diag(np.exp(-(t-T)**2 / (2 * sigma**2)))
```

```
[61]: w(0.5)
```

```
[61]: array([[1.92874985e-022, 0.00000000e+000, 0.00000000e+000, ...,
            0.00000000e+000, 0.00000000e+000, 0.00000000e+000],
          [0.00000000e+000, 7.28426281e-022, 0.00000000e+000, ...,
            0.00000000e+000, 0.00000000e+000, 0.00000000e+000],
          [0.00000000e+000, 0.00000000e+000, 2.70223296e-021, ...,
            0.00000000e+000, 0.00000000e+000, 0.00000000e+000],
          ...,
          [0.00000000e+000, 0.00000000e+000, 0.00000000e+000, ...,
            1.09122392e-192, 0.00000000e+000, 0.00000000e+000],
          [0.00000000e+000, 0.00000000e+000, 0.00000000e+000, ...,
            0.00000000e+000, 2.02574497e-194, 0.00000000e+000],
          [0.00000000e+000, 0.00000000e+000, 0.00000000e+000, ...,
            0.00000000e+000, 0.00000000e+000, 3.69388307e-196]])
```

```
[62]: plt.plot(T, np.diag(w(1)))
```

```
[62]: [<matplotlib.lines.Line2D at 0x7f7f74e05b50>]
```

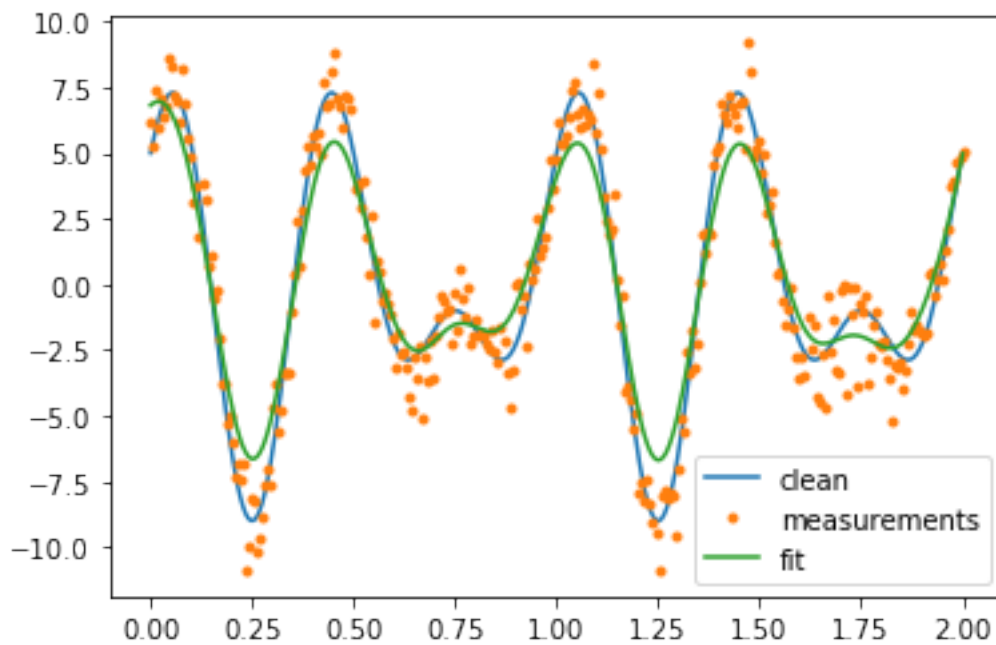


```
[63]: @np.vectorize
def loess(t):
    A = Y @ w(t) @ X.T @ np.linalg.inv(X @ w(t) @ X.T)
    return A @ np.array([1, t])
```

```
[64]: y_est = loess(T)
```

```
[67]: plt.plot(T, y_clean, label="clean")
plt.plot(T, y, '.', label="measurements")
plt.plot(T, y_est, label="fit")
plt.legend()
```

```
[67]: <matplotlib.legend.Legend at 0x7f7f74d6b340>
```



```
[ ]:
```