Real_data_example_Poisson-MGWR

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Notebook Outline:

Branch - gsco19
PR - https://github.com/pysal/mgwr/pull/60

0.0.1 Set up Cells

```
In [1]: import sys
        #append path here to point to your folder
        sys.path.append("C:/Users/msachde1/Downloads/Research/Development/mgwr")
```

```
In [2]: import warnings
        warnings.filterwarnings("ignore")
        import pandas as pd
        import numpy as np

        from mgwr.gwr import GWR
        from spglm.family import Gaussian, Binomial, Poisson
        from mgwr.gwr import MGWR
        from mgwr.sel_bw import Sel_BW
        import multiprocessing as mp
        pool = mp.Pool()
        from scipy import linalg
        import numpy.linalg as la
        from scipy import sparse as sp
        from scipy.sparse import linalg as spla
        from spreg.utils import spdot, spmultiply
        from scipy import special
        import libpysal as ps
```

```
import seaborn as sns
import matplotlib.pyplot as plt
from copy import deepcopy
import copy
from collections import namedtuple
import spglm
```

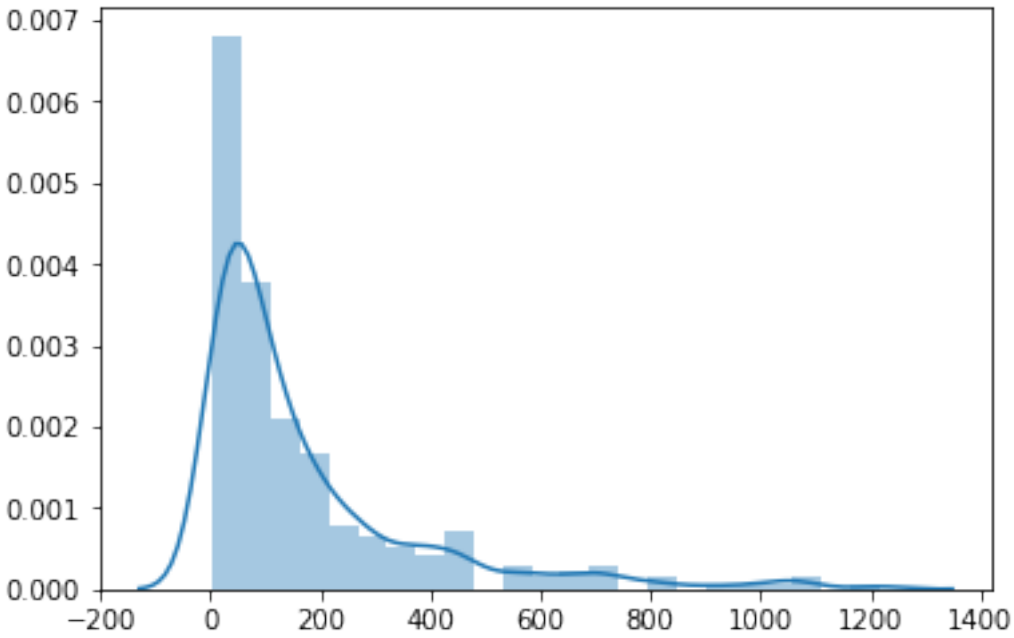
0.0.2 Tokyo Mortality Dataset

In [3]:
```
data_p = ps.io.open(ps.examples.get_path('Tokyomortality.csv'))
coords = list(zip(data_p.by_col('X_CENTROID'),data_p.by_col('Y_CENTROID')))
off = np.array(data_p.by_col('eb2564')).reshape((-1,1))
y = np.array(data_p.by_col('db2564')).reshape((-1,1))
occ = np.array(data_p.by_col('OCC_TEC')).reshape((-1,1))
own = np.array(data_p.by_col('OWNH')).reshape((-1,1))
pop = np.array(data_p.by_col('POP65')).reshape((-1,1))
unemp = np.array(data_p.by_col('UNEMP')).reshape((-1,1))
#X set for multivariate example
X = np.hstack([occ,own,pop,unemp])
#x set for univariate example
x = occ
```

In [4]:
```
X_std = (X-X.mean(axis=0))/X.std(axis=0)
x_std = (x-x.mean(axis=0))/x.std(axis=0)
y_std = (y-y.mean(axis=0))/y.std(axis=0)
off_std = (off-off.mean(axis=0))/off.std(axis=0)
```

In [5]:
```
#checking distribution of y
sns.distplot(y)
```

Out[5]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x142bf8b5c88>
```



0.0.3 Univariate example

First example: checking GWR and MGWR models with one independent variable and constant = False

```
In [6]: bw=Sel_BW(coords,y,x_std,family=Poisson(),offset=off,constant=False)
        bw=bw.search()
        gwr_model=GWR(coords,y,x_std,bw,family=Poisson(),offset=off,constant=False).fit()

In [7]: bw

Out[7]: 43.0

In [8]: selector=Sel_BW(coords,y,x_std,multi=True,family=Poisson(),offset=off,constant=False)

In [9]: selector.search(verbose=True)

Current iteration: 1 ,SOC: 0.0
Bandwidths: 43.0


Out[9]: array([43.])

In [10]: mgwr_model=MGWR(coords,y,x_std,selector,family=Poisson(),offset=off,constant=False).fi

HBox(children=(IntProgress(value=0, description='Inference', max=1), HTML(value='')))
```

Bandwidth: Random initialization check

```
In [ ]: selector.search(verbose=True,init_multi=100)
```

Parameter check

```
In [11]: y.shape[0]

Out[11]: 262

In [12]: np.sum(((gwr_model.params-mgwr_model.params)==0.0)==True)

Out[12]: 262

In [13]: gwr_model.aic,mgwr_model.aic

Out[13]: (619.7791467932716, 621.8839585099654)

In [14]: np.sum((gwr_model.predy-mgwr_model.predy==0)==True)

Out[14]: 262
```

0.0.4 Multivariate example

```
In [15]: bw=Sel_BW(coords,y,X_std,family=Poisson(),offset=off)
         bw=bw.search()
         gwr_model=GWR(coords,y,X_std,bw,family=Poisson(),offset=off).fit()

In [16]: bw

Out[16]: 107.0

In [17]: selector=Sel_BW(coords,y,X_std,multi=True,family=Poisson(),offset=off)

In [18]: selector.search(verbose=True)

Current iteration: 1 ,SOC: 0.0002848
Bandwidths: 64.0, 66.0, 83.0, 95.0, 44.0
Current iteration: 2 ,SOC: 0.0001778
Bandwidths: 171.0, 65.0, 105.0, 95.0, 44.0
Current iteration: 3 ,SOC: 7.21e-05
Bandwidths: 241.0, 65.0, 134.0, 106.0, 44.0
Current iteration: 4 ,SOC: 4.75e-05
Bandwidths: 261.0, 65.0, 212.0, 95.0, 44.0
Current iteration: 5 ,SOC: 2.22e-05
Bandwidths: 261.0, 65.0, 261.0, 95.0, 44.0
Current iteration: 6 ,SOC: 1.52e-05
Bandwidths: 260.0, 65.0, 261.0, 95.0, 44.0
Current iteration: 7 ,SOC: 1.57e-05
Bandwidths: 261.0, 65.0, 261.0, 95.0, 45.0
Current iteration: 8 ,SOC: 1.4e-05
```

```
Bandwidths: 261.0, 65.0, 261.0, 95.0, 44.0
Current iteration: 9 ,SOC: 1.09e-05
Bandwidths: 261.0, 65.0, 261.0, 95.0, 44.0
Current iteration: 10 ,SOC: 9.2e-06
Bandwidths: 261.0, 65.0, 261.0, 95.0, 44.0
```

```
Out[18]: array([261.,  65., 261.,  95.,  44.])
```

Bandwidths: Random initialization check

```
In [ ]: selector.search(verbose=True, init_multi=50)
```

```
In [19]: mgwr_model=MGWR(coords,y,X_std,selector,family=Poisson(),offset=off).fit()
```

```
HBox(children=(IntProgress(value=0, description='Inference', max=1), HTML(value='')))
```

0.0.5 AIC, AICc, BIC check

```
In [20]: mgwr_model.aicc,gwr_model.aicc
```

```
Out[20]: (362.36478481908165, 368.06775592811084)
```

```
In [ ]: mgwr_model.aic,gwr_model.aic
```

```
In [ ]: mgwr_model.bic,gwr_model.bic
```