Importing libraries

In [1]:
```
from sklearn.datasets import load_boston
from sklearn.linear_model import LinearRegression
import matplotlib.pyplot as plt
import pandas as pd
from sklearn.model_selection import train_test_split
import seaborn as sns;
import numpy as np;
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import Normalizer
boston = load_boston()
from sklearn.metrics import mean_squared_error
from sklearn.linear_model import SGDRegressor
```

In [2]:
```
print(boston.data.shape)
```

```
(506, 13)
```

In [3]:
```
print(boston.feature_names)
```

```
['CRIM' 'ZN' 'INDUS' 'CHAS' 'NOX' 'RM' 'AGE' 'DIS' 'RAD' 'TAX' 'PTRATI
O'
 'B' 'LSTAT']
```

Importing Data

In [4]:
```
X_data = pd.DataFrame(boston.data)
y_data = pd.DataFrame(boston.target)
```

In [5]:
```
norm = StandardScaler()
norm.fit(X_data)
```

```
X_1=pd.DataFrame(norm.transform(X_data))
```

In [6]:
```
bigdata = pd.concat([X_1,y_data], axis=1,ignore_index=True)
```

In [7]:
```
bigdata.head(2)
```

Out[7]:

	0	1	2	3	4	5	6	7	
0	-0.417713	0.284830	-1.287909	-0.272599	-0.144217	0.413672	-0.120013	0.140214	-0
1	-0.415269	-0.487722	-0.593381	-0.272599	-0.740262	0.194274	0.367166	0.557160	-0

My Own SGD implementation

In [109]:
```
w=pd.DataFrame(X_1.loc[0,:])
w=w.T
```

In [110]:
```
w
```

Out[110]:

	0	1	2	3	4	5	6	7	
0	-0.417713	0.28483	-1.287909	-0.272599	-0.144217	0.413672	-0.120013	0.140214	-0.9ŧ

In [111]:
```
b = -1.982843
r=1
```

In [112]:
```
while(True):
    data_random=bigdata.sample(n=100)
    data_random=data_random.reset_index(drop=True)
    X=data_random.loc[:,0:12]
    y=data_random.loc[:,13]
    finalW=0.0
```

```
    finalB=0.0
    for j in range(100):
        finalW+=-2*X.loc[j]*(y.loc[j]-np.dot(X.loc[j],w.T)-b)
        finalB+=float(-2*(y.loc[j]-np.dot(X.loc[j],w.T)-b))

    w0=w-r*(finalW/100)
    b0=b-r*(finalB/100)
    r=r/2
    if(np.array(w)==np.array(w0)).all():
        break;
    else:
        w=w0
        b=b0
```

In [113]:
```
w0
```

Out[113]:

	0	1	2	3	4	5	6	7	
0	-0.26278	-0.508248	-0.350512	0.343687	-0.571994	4.117632	0.490615	-0.767429	-0.3

In [114]:
```
b0
```

Out[114]:
```
22.542622099781354
```

In [115]:
```
y_pred=[]
X=bigdata.loc[:,0:12]
y=bigdata.loc[:,13]
for i in range(506):
    y_pred.append(np.dot(X.loc[i],w0.T)+b0)
y_pred=np.asarray(y_pred)
```

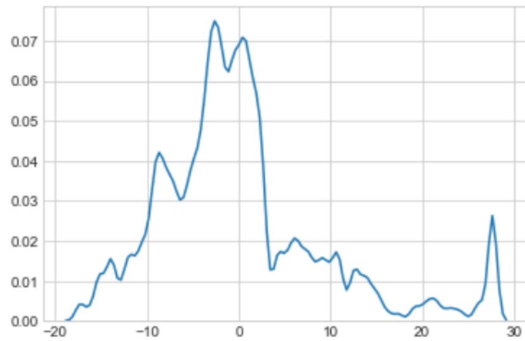
In [116]:
```
import matplotlib.pyplot as plt


plt.scatter(y, y_pred)
plt.xlabel("Prices: $Y_i$")
```

```
plt.ylabel("Predicted prices: $\hat{Y}_i$")
plt.title("Prices vs Predicted prices: $Y_i$ vs $\hat{Y}_i$")
plt.show()
```

In [117]:
```
for i in range(506):
    delta_y=y-y_pred[i]

sns.set_style('whitegrid')
sns.kdeplot(np.array(delta_y), bw=0.5)
plt.show()
```



In [118]:
```
print(mean_squared_error(y,y_pred))
```

25.911953139691168

SGD regressor of sklearn

In [119]:
```
import warnings
warnings.filterwarnings("ignore")
clf = SGDRegressor()
clf.fit(X_1, y_data)
print(mean_squared_error(y_data, clf.predict(X_1)))
```

22.78061237519471

In [146]:
```
SGD_sk=pd.DataFrame(list(clf.coef_))
```

In [122]:
```
clf.intercept_
```

Out[122]: array([22.33127935])

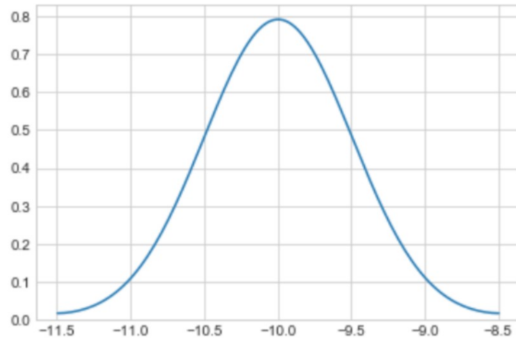
In [120]:
```
plt.scatter(y_data, clf.predict(X_1))
```

```
plt.xlabel("Prices: $Y_i$")
plt.ylabel("Predicted prices: $\hat{Y}_i$")
plt.title("Prices vs Predicted prices: $Y_i$ vs $\hat{Y}_i$")
plt.show()
```

In [80]:

```
for i in range(506):
    delta_y=y_data.loc[i]-y_pred2[i]

sns.set_style('whitegrid')
sns.kdeplot(np.array(delta_y), bw=0.5)
plt.show()
```



Summary

In [149]:
```
from prettytable import PrettyTable
x = PrettyTable()
x.field_names = ["Parameters", "Own SGD", "Sklearn SGD"]
x.add_row(["Mean Squared error",  25.9119, 22.7806])
x.add_row(["Intercept term ",  22.5426, 22.3312])
print(x)
```

```
+--------------------+---------+-------------+
|     Parameters     | Own SGD | Sklearn SGD |
+--------------------+---------+-------------+
| Mean Squared error | 25.9119 |   22.7806   |
|  Intercept term    | 22.5426 |   22.3312   |
+--------------------+---------+-------------+
```

In [148]:
```
from IPython.display import HTML, display
import tabulate
print("My own SGD weights")
display(HTML(tabulate.tabulate(w0,tablefmt='html',showindex=False)))
print("Sklearn SGD weights")
```

```python
display(HTML(tabulate.tabulate(SGD_sk.T,tablefmt='html',showindex=False
)))
```

```
My own SGD weights
```

-0.26278	-0.508248	-0.350512	0.343687	-0.571994	4.11763	0.490615	-0.767429	-0.33677

```
Sklearn SGD weights
```

-0.674931	0.570432	-0.368917	0.779491	-1.06763	3.15977	-0.163153	-2.09836	0.869476