Implement SGD for linear regression [M]

May 30, 2018

In [127]:
```
import numpy as np
import pandas as pd
import pdb
```

In [596]:
```
class LinearRegression():

    def __init__(self, fit_intercept=True, copy_X=True):
        self.params = {"fit_intercept" : fit_intercept, "copy_X" : copy_X}

    def fit(self, X, y, n_ite):
        """Fit model to training data"""
        n_samples = X.shape[0]
        n_features = X.shape[1]
        y=np.reshape(y, (-1,1))
        self.coef_ = np.zeros((n_features,1), dtype=float)
        self.intercept_ = 0

        if self.params['copy_X']:
            copy_x = np.copy(X)

        r=.0001
        batch_size=int(n_samples/100)

        i=0
        while i<n_ite:
            #r=float(r0/np.power(3,i))
            indices=np.random.randint(n_samples, size=batch_size)

            term1=y[indices]*copy_x[indices]
            term2=np.dot(copy_x[indices], self.coef_)*copy_x[indices]
            term3=self.intercept_*copy_x[indices]

            gradient_w=np.reshape(np.sum(2*(term1-term2-term3), axis=0), (n_features,
            #pdb.set_trace()

            coef_prev=self.coef_
            self.coef_=self.coef_ + r*gradient_w
```

```
                    term1=y[indices]
                    term2=np.dot(copy_x[indices], coef_prev)
                    term3=self.intercept_

                    gradient_b=np.sum(2*(term1-term2-term3))/n_samples

                    intercept_prev=self.intercept_
                    self.intercept_=self.intercept_ + r * gradient_b

                    i+=1

                self.i_=i
                return self

            def predict(self, X):
                return np.dot(X, self.coef_)+self.intercept_

            def get_params(self):
                return self.params

            def score(self, X, y):
                """Calculate coefficient of determination R^2"""
                predictions = self.predict(X)
                u = np.sum((y-predictions)**2)
                mean=np.mean(y)
                v=np.sum((y-mean)**2)
                return 1-float(u/v)
```

In [437]:
```
from sklearn.datasets import load_boston
boston = load_boston()
import pandas as pd
bos = pd.DataFrame(boston.data)
bos['PRICE'] = boston.target

X = bos.drop('PRICE', axis = 1)
Y = bos['PRICE']
from sklearn.model_selection import train_test_split
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size = 0.33, random_sta
```

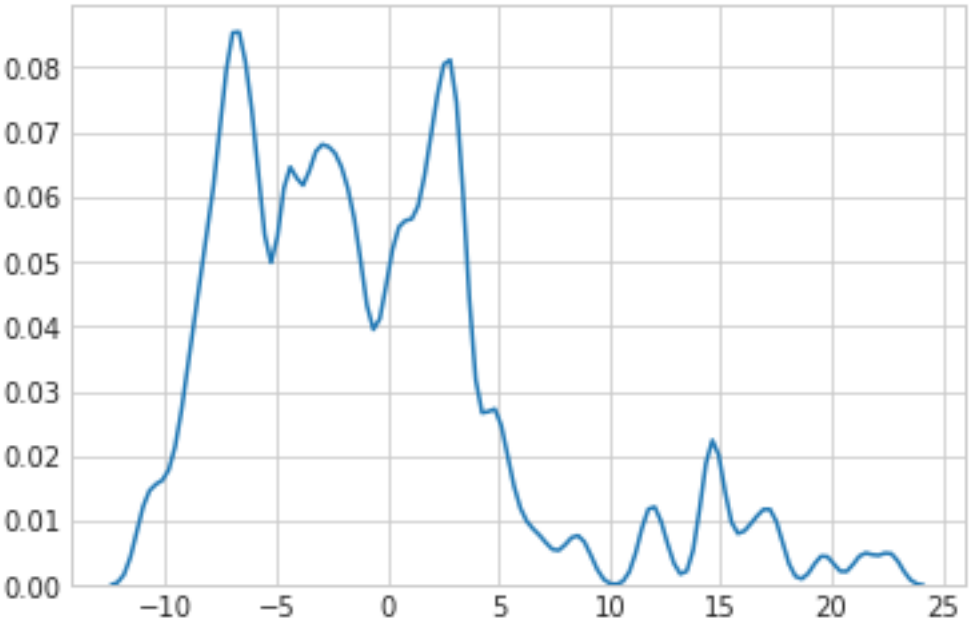
In [615]:
```
lm = LinearRegression()
lm.fit(X_train, Y_train, 150000)

Y_pred = lm.predict(X_test)
```

```
/home/vishal/anaconda3/lib/python3.6/site-packages/numpy/core/fromnumeric.py:57: FutureWarning:
  return getattr(obj, method)(*args, **kwds)
```

In [616]:
```
delta_y = np.array(Y_test) - Y_pred.ravel();

import seaborn as sns;
import numpy as np;
sns.set_style('whitegrid')
sns.kdeplot(np.array(delta_y), bw=0.5)
plt.show()
```



In [617]:
```
lm.score(X_test, np.reshape(Y_test, (-1,1)))
```

```
/home/vishal/anaconda3/lib/python3.6/site-packages/numpy/core/fromnumeric.py:57: FutureWarning:
  return getattr(obj, method)(*args, **kwds)
```

Out[617]:
```
0.49608642392756375
```

0.1 Conclusion

Most of the errors are distributed around 0. R^2 score is close to 0.5 which is a good enough value