Assignment 5.3: Housing Regression

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

from keras import models
from keras import layers
from tensorflow.keras import optimizers
from keras.datasets import boston_housing
from keras import losses
from keras import metrics
from keras.utils.np_utils import to_categorical
```

In [2]:
```
(train_data, train_targets), (test_data, test_targets) = boston_housing.load
```

Normalizing Data

In [4]:
```
mean = train_data.mean(axis=0)
train_data -= mean
```

In [5]:
```
std = train_data.std(axis=0)
train_data /= std
```

In [6]:
```
test_data -= mean
test_data /= std
```

Building the Network

In [7]:
```
def build_model():
    model = models.Sequential()
    model.add(layers.Dense(64, activation='relu',
                           input_shape=(train_data.shape[1],)))
    model.add(layers.Dense(64, activation='relu'))
    model.add(layers.Dense(1))
    model.compile(optimizer='rmsprop', loss='mse', metrics=['mae'])
    return model
```

K-Fold Validation

In [8]:
```
k=4
num_val_samples = len(train_data) // k
num_epochs = 100
all_scores = []
```

Training the Model

In [9]:
```
for i in range(k):
    print('processing fold #', i)
    val_data = train_data[i * num_val_samples: (i + 1) * num_val_samples]
    val_targets = train_targets[i * num_val_samples: (i + 1) * num_val_sampl
```

```
    partial_train_data = np.concatenate(
        [train_data[:i * num_val_samples],
         train_data[(i + 1) * num_val_samples:]], axis=0)
    partial_train_targets = np.concatenate(
        [train_targets[:i * num_val_samples],
         train_targets[(i + 1) * num_val_samples:]], axis=0)

    model = build_model()
    model.fit(partial_train_data, partial_train_targets,
              epochs=num_epochs, batch_size=1, verbose=0)

    val_mse, val_mae = model.evaluate(val_data, val_targets, verbose=0)
    all_scores.append(val_mae)
```

```
processing fold # 0
processing fold # 1
processing fold # 2
processing fold # 3
```

Comparing Folds

In [13]:
```
all_mae_histories = []
```

In [14]:
```
model = build_model()
history = model.fit(partial_train_data, partial_train_targets,
                    validation_data=(val_data, val_targets),
                    epochs=num_epochs, batch_size=1, verbose=0)
```

In [15]:
```
mae_history = history.history['val_mae']
all_mae_histories.append(mae_history)
```

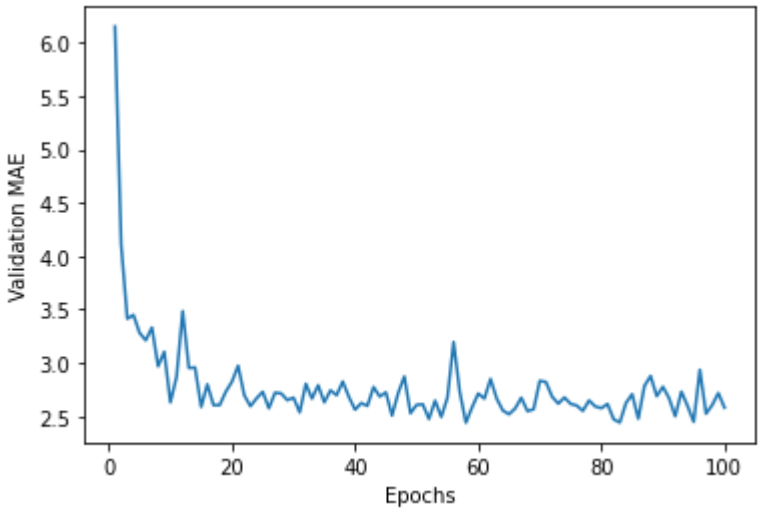
In [16]:
```
average_mae_history = [np.mean([x[i] for x in all_mae_histories]) for i in r
```

Plotting Validation Scores

In [17]:
```
plt.plot(range(1, len(average_mae_history) + 1), average_mae_history)

plt.xlabel('Epochs')
plt.ylabel('Validation MAE')

plt.show()
```



Results

In [27]:
```
all_scores
```

Out[27]:
```
[2.2805142402648926, 2.825031042098999, 2.5533194541931152, 2.4775116443634
033]
```

In [28]:
```
np.mean(all_scores)
```

Out[28]:
```
2.5340940952301025
```

The model has an average error of $2,534.