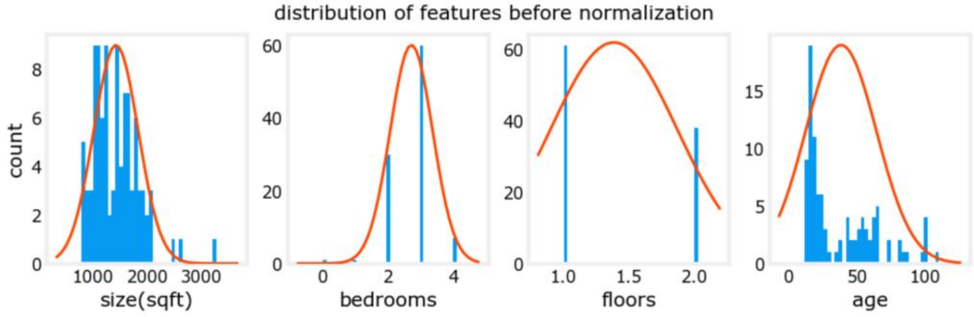
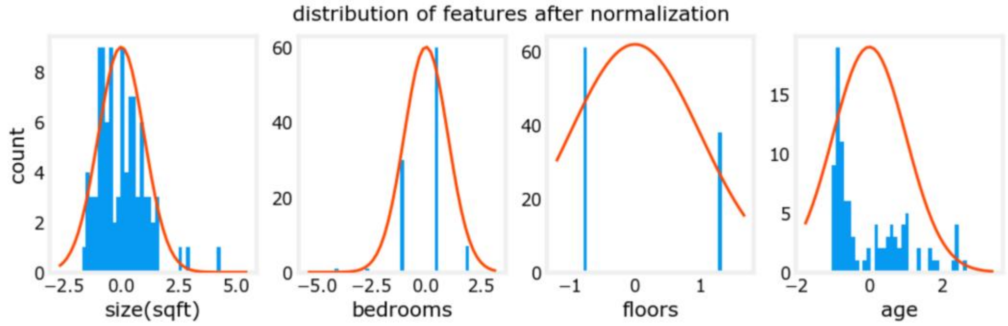
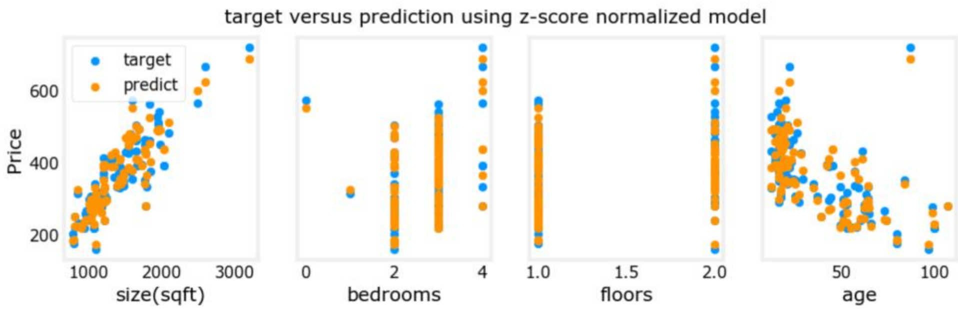
```
fig,ax=plt.subplots(1, 4, figsize=(12, 3))
for i in range(len(ax)):
    norm_plot(ax[i],X_train[:,i],)
    ax[i].set_xlabel(X_features[i])
ax[0].set_ylabel("count");
fig.suptitle("distribution of features before normalization")
plt.show()
fig,ax=plt.subplots(1,4,figsize=(12,3))
for i in range(len(ax)):
    norm_plot(ax[i],X_norm[:,i],)
    ax[i].set_xlabel(X_features[i])
ax[0].set_ylabel("count");
fig.suptitle(f"distribution of features after normalization")

plt.show()
```





[15]:
```
#predict target using normalized features
m = X_norm.shape[0]
yp = np.zeros(m)
for i in range(m):
    yp[i] = np.dot(X_norm[i], w_norm) + b_norm

    # plot predictions and targets versus original features
fig,ax=plt.subplots(1,4,figsize=(12, 3),sharey=True)
for i in range(len(ax)):
    ax[i].scatter(X_train[:,i],y_train, label = 'target')
    ax[i].set_xlabel(X_features[i])
    ax[i].scatter(X_train[:,i],yp,color=dlorange, label = 'predict')
ax[0].set_ylabel("Price"); ax[0].legend();
fig.suptitle("target versus prediction using z-score normalized model")
plt.show()
```



```
Iteration     30000, Cost: 1.98242e-03
Iteration     40000, Cost: 1.41169e-04
Iteration     50000, Cost: 1.00527e-05
Iteration     60000, Cost: 7.15855e-07
Iteration     70000, Cost: 5.09763e-08
Iteration     80000, Cost: 3.63004e-09
Iteration     90000, Cost: 2.58497e-10
w,b found by gradient descent: w: [5.27e-05 1.13e+02 8.43e-05], b: 123.5000
```