modelo-logisticregression

September 7, 2024

[1]:
```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import precision_score, recall_score, accuracy_score,␣
 ↪classification_report
import pickle
import matplotlib.pyplot as plt
import seaborn as sns
from mpl_toolkits.mplot3d import Axes3D
```

1 Load dataset

[2]:
```
# Load data (from a dataset in sklearn)
from sklearn.datasets import fetch_california_housing
california_housing = fetch_california_housing(as_frame=True)
california_housing.keys()
```

[2]:
```
dict_keys(['data', 'target', 'frame', 'target_names', 'feature_names', 'DESCR'])
```

[4]:
```
california_housing.frame.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20640 entries, 0 to 20639
Data columns (total 9 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   MedInc       20640 non-null  float64
 1   HouseAge     20640 non-null  float64
 2   AveRooms     20640 non-null  float64
 3   AveBedrms    20640 non-null  float64
 4   Population   20640 non-null  float64
 5   AveOccup     20640 non-null  float64
 6   Latitude     20640 non-null  float64
 7   Longitude    20640 non-null  float64
 8   MedHouseVal  20640 non-null  float64
```

```
dtypes: float64(9)
memory usage: 1.4 MB
```

2 Selección de features y labels.

Tomando en cuenta la estructura del dataset California Housing el dataset se dividirá de la siguiente manera:

- **Features**: MedInc, HouseAge, AveRooms, AveBedrms, Population, AveOccup, Latitude, Longitude
- **Labels**: median_house_value_larger_than3

Se ha agregado una nueva variable binaria que indica si el valor mediano de la casa es mayor que $300,000.

[7]:
```
df = pd.DataFrame(california_housing.data, columns=california_housing.
 ↪feature_names)
df["median_house_value"] = california_housing.target
df["median_house_value_larger_than3"] = (df["median_house_value"] > 3).
 ↪astype(int)

df.head()
```

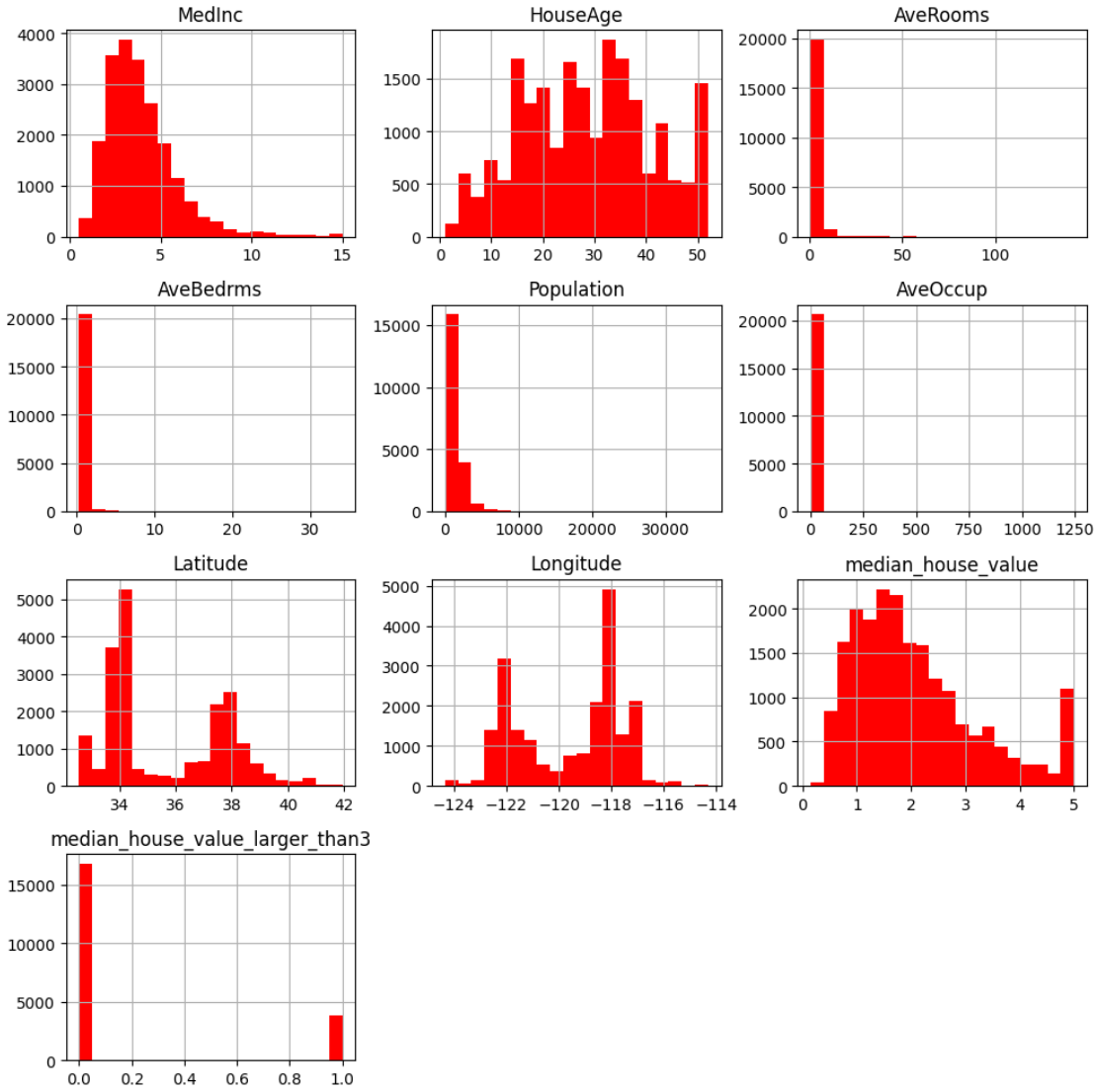
[7]:

	MedInc	HouseAge	AveRooms	AveBedrms	Population	AveOccup	Latitude	\
0	8.3252	41.0	6.984127	1.023810	322.0	2.555556	37.88	
1	8.3014	21.0	6.238137	0.971880	2401.0	2.109842	37.86	
2	7.2574	52.0	8.288136	1.073446	496.0	2.802260	37.85	
3	5.6431	52.0	5.817352	1.073059	558.0	2.547945	37.85	
4	3.8462	52.0	6.281853	1.081081	565.0	2.181467	37.85	

	Longitude	median_house_value	median_house_value_larger_than3
0	-122.23	4.526	1
1	-122.22	3.585	1
2	-122.24	3.521	1
3	-122.25	3.413	1
4	-122.25	3.422	1

3 Visualización de los datos

[6]:
```
df.hist(bins=20, figsize=(10,10), color='red')
plt.tight_layout()
plt.show()
```



#Entrenamiento del modelo

[135]:
```
X = df[['MedInc', 'HouseAge', 'AveRooms', 'AveBedrms', 'Population',␣
 ↪'AveOccup', 'Latitude', 'Longitude']]
y = df["median_house_value_larger_than3"]
X_train, X_test, y_train, y_test =  train_test_split(X,y, test_size=0.3,␣
 ↪stratify=y, random_state=42)
```

[136]:
```
model = LogisticRegression(solver="liblinear", max_iter=1000)␣
 ↪#class_weight='balanced')
model.fit(X_train, y_train)
```

[136]:
```
LogisticRegression(max_iter=1000, solver='liblinear')
```

[137]:
```
y_pred = model.predict(X_test)
y_pred_proba = model.predict_proba(X_test)[:, 1]
```

[138]:
```
# Determine the performance of the model with different techniques
y_pred = model.predict(X_test)
y_pred_proba = model.predict_proba(X_test)[:, 1]
print(f"Accuracy on test set:{round( model.score (X_test, y_test),2)}")
```

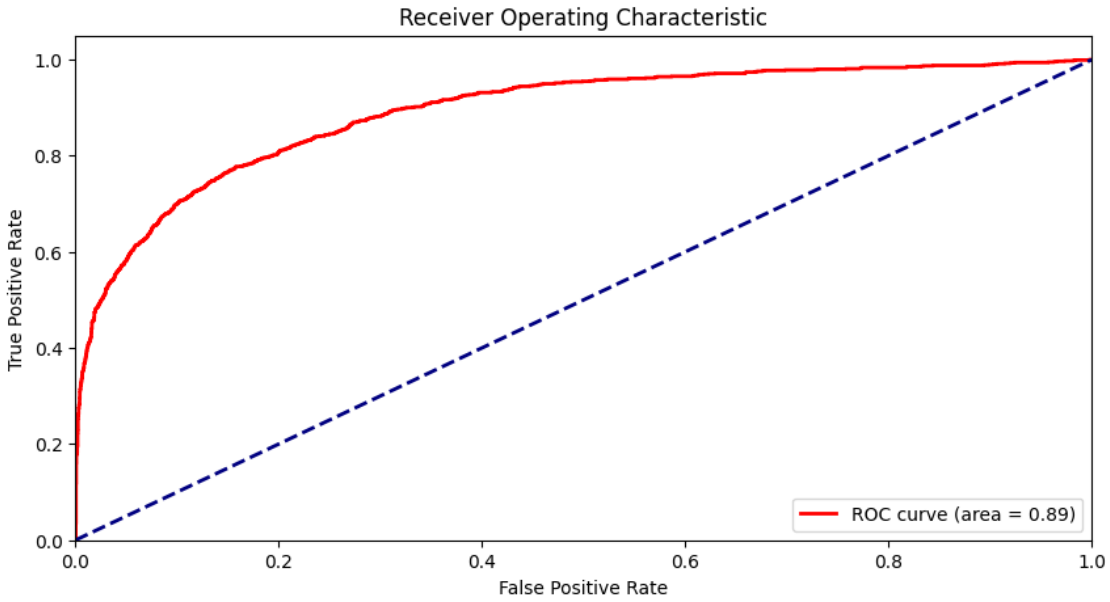
```
Accuracy on test set:0.89
```

[139]:
```
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.89      0.98      0.93      5041
           1       0.83      0.49      0.62      1151

    accuracy                           0.89      6192
   macro avg       0.86      0.73      0.77      6192
weighted avg       0.88      0.89      0.87      6192
```

#Curva ROC

[140]:
```
from sklearn.metrics import classification_report, confusion_matrix, roc_curve,␣
 ↪auc
# Curva ROC y AUC
fpr, tpr, thresholds = roc_curve(y_test, y_pred_proba)
roc_auc = auc(fpr, tpr)

plt.figure(figsize=(10, 5))
plt.plot(fpr, tpr, color='red', lw=2, label='ROC curve (area = %0.2f)' %␣
 ↪roc_auc)
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic')
plt.legend(loc="lower right")
plt.show()
```

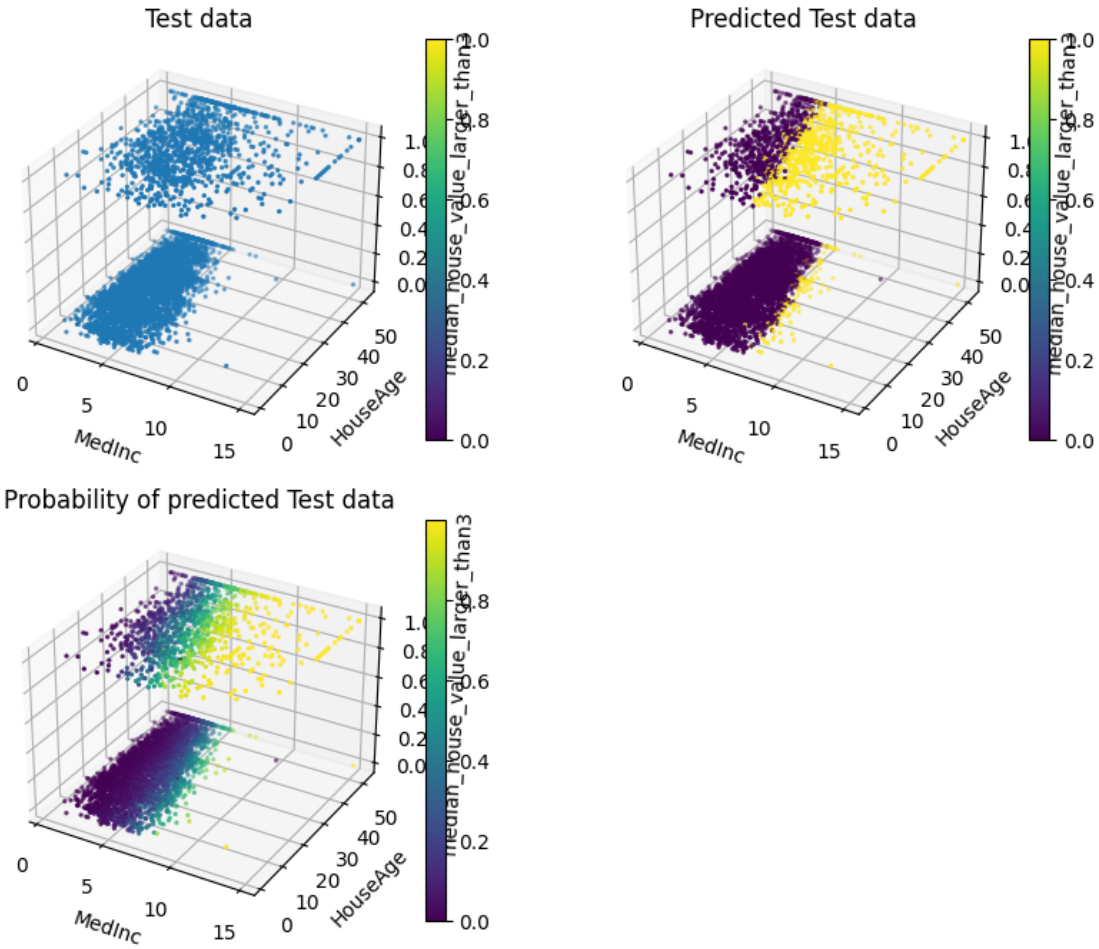


[133]:

```
Reporte de clasificación después de regularización:
              precision    recall  f1-score   support

           0       0.89      0.97      0.93      3378
           1       0.78      0.45      0.57       750

    accuracy                           0.88      4128
   macro avg       0.83      0.71      0.75      4128
weighted avg       0.87      0.88      0.86      4128


/usr/local/lib/python3.10/dist-packages/sklearn/linear_model/_logistic.py:460:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  n_iter_i = _check_optimize_result(
```

4 Visualización datos de prueba

[119]:
```
# 3D visualization
fig = plt.figure(figsize=(10,8))
ax = fig.add_subplot(221, projection='3d')
p = ax.scatter(X_test.MedInc, X_test.HouseAge, y_test, s=2)
fig.colorbar(p)
ax.set_xlabel("MedInc")
ax.set_ylabel("HouseAge")
ax.set_zlabel("median_house_value_larger_than3")
plt.title("Test data")

ax = fig.add_subplot(222, projection='3d')
p = ax.scatter(X_test.MedInc, X_test.HouseAge, y_test, c=model.predict(X_test),␣
 ↪s=2)
fig.colorbar(p)
ax.set_xlabel("MedInc")
ax.set_ylabel("HouseAge")
ax.set_zlabel("median_house_value_larger_than3")
plt.title("Predicted Test data")

ax = fig.add_subplot(223,projection='3d')
p = ax.scatter(X_test.MedInc, X_test.HouseAge, y_test, c=model.
 ↪predict_proba(X_test)[:,1], s=2)
fig.colorbar(p)
ax.set_xlabel("MedInc")
ax.set_ylabel("HouseAge")
ax.set_zlabel("median_house_value_larger_than3")
plt.title("Probability of predicted Test data")


plt.show()
plt.tight_layout()
```



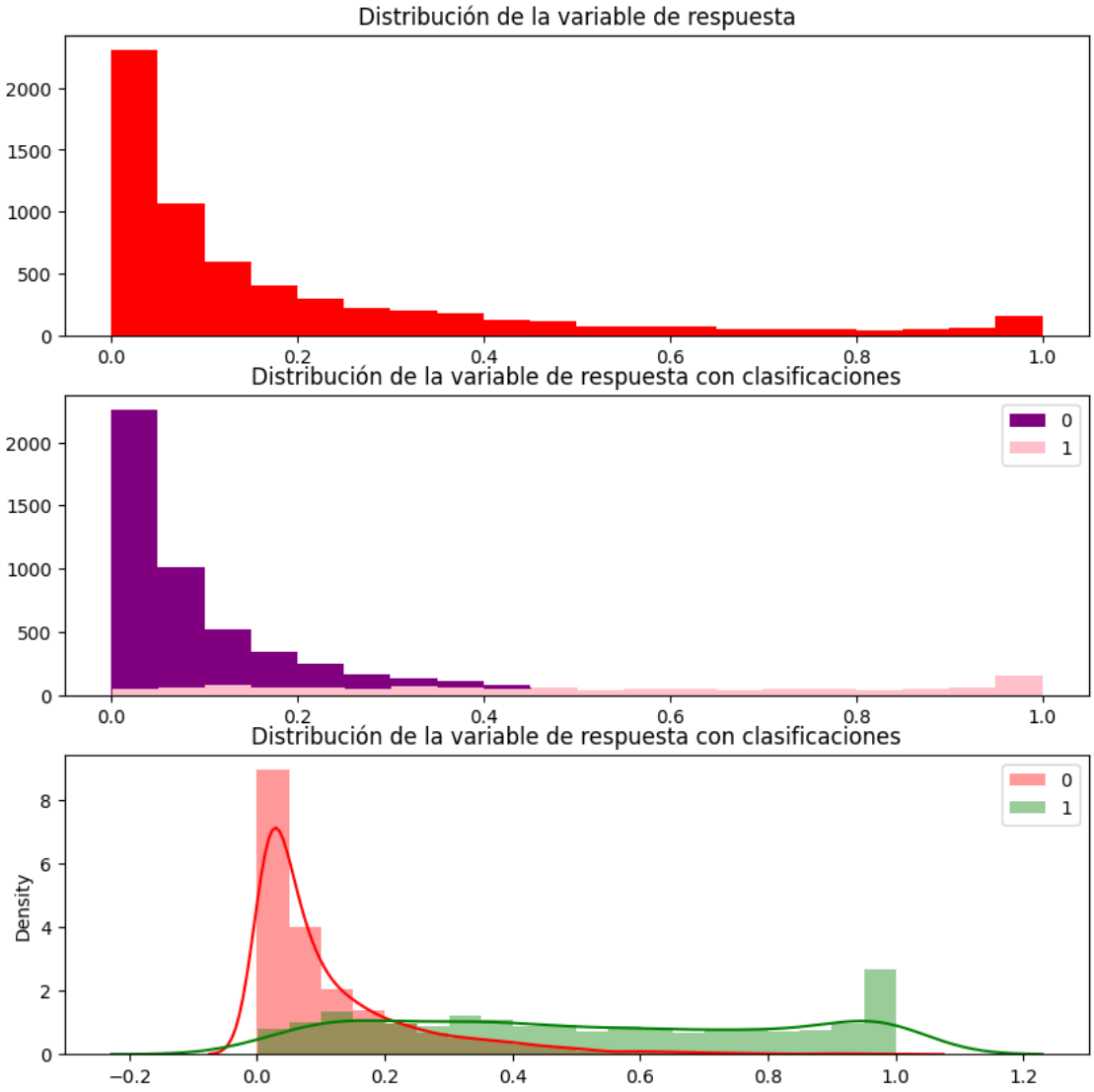

```
<Figure size 640x480 with 0 Axes>
```

#Distributions

[126]:
```
#sns.distplot()
plt.figure(figsize=(10,10))
plt.subplot(311)
plt.title('Distribución de la variable de respuesta')
plt.hist(model.predict_proba(X_test)[:,1], bins=20 , color='red')
plt.subplot(312)
plt.title('Distribución de la variable de respuesta con clasificaciones')
plt.hist(model.predict_proba(X_test[y_test==0])[:,1], bins=20, color='purple',␣
↪,label='0')
plt.hist(model.predict_proba(X_test[y_test==1])[:,1], bins=20, color='pink',␣
↪label='1')
plt.legend()
plt.subplot(313)
plt.title('Distribución de la variable de respuesta con clasificaciones')
```

```
sns.distplot(model.predict_proba(X_test[y_test==0])[:,1], bins=20, color='red',␣
 ↪label='0')
sns.distplot(model.predict_proba(X_test[y_test==1])[:,1], bins=20,␣
 ↪color='green', label='1')
plt.legend()
plt.show()
plt.show()
```

```
<ipython-input-126-e7966b4014a9>:13: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(model.predict_proba(X_test[y_test==0])[:,1], bins=20,
color='red', label='0')
<ipython-input-126-e7966b4014a9>:14: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(model.predict_proba(X_test[y_test==1])[:,1], bins=20,
color='green', label='1')
```


Distribución de la variable de respuesta
2000
1500
1000
500
0
0.0
0.2
0.4
0.6
0.8
1.0
Distribución de la variable de respuesta con clasificaciones
0
1
Distribución de la variable de respuesta con clasificaciones
Density
8
6
4
2
−0.2
1.2