ProjetoAD

September 15, 2023

#Miniprojeto AD

##Grupo - Camila Vieira - José Vinicius

##Importações e Downloads

[180]:
```
import graphviz
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from imblearn.over_sampling import SMOTE
from sklearn.tree import export_graphviz
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import GridSearchCV
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import StratifiedKFold
from sklearn.model_selection import train_test_split
from imblearn.over_sampling import RandomOverSampler
from sklearn.metrics import accuracy_score, confusion_matrix,␣
↪classification_report, make_scorer, f1_score
```

##Preparação dos Dados

[181]:
```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call
drive.mount("/content/drive", force_remount=True).
```

[182]:
```
cd /content/drive/MyDrive/Colab/ArvoreDecisao/
```

```
/content/drive/MyDrive/Colab/ArvoreDecisao
```

[183]:
```
df = pd.read_csv('train.csv')
df
```

[183]:

	PassengerId	Survived	Pclass	\
0	1	0	3	
1	2	1	1	

```
2              3         1       3
3              4         1       1
4              5         0       3
..           …       …     …
886          887         0       2
887          888         1       1
888          889         0       3
889          890         1       1
890          891         0       3

                                                 Name     Sex   Age  SibSp  \
0                             Braund, Mr. Owen Harris    male  22.0      1
1    Cumings, Mrs. John Bradley (Florence Briggs Th…  female  38.0      1
2                              Heikkinen, Miss. Laina  female  26.0      0
3        Futrelle, Mrs. Jacques Heath (Lily May Peel)  female  35.0      1
4                            Allen, Mr. William Henry    male  35.0      0
..                                                ...     …   …    …
886                            Montvila, Rev. Juozas    male  27.0      0
887                     Graham, Miss. Margaret Edith  female  19.0      0
888         Johnston, Miss. Catherine Helen "Carrie"  female   NaN      1
889                            Behr, Mr. Karl Howell    male  26.0      0
890                              Dooley, Mr. Patrick    male  32.0      0

     Parch            Ticket     Fare Cabin Embarked
0        0         A/5 21171   7.2500   NaN        S
1        0          PC 17599  71.2833   C85        C
2        0  STON/O2. 3101282   7.9250   NaN        S
3        0            113803  53.1000  C123        S
4        0            373450   8.0500   NaN        S
..     …              …      …   …      …
886      0            211536  13.0000   NaN        S
887      0            112053  30.0000   B42        S
888      2        W./C. 6607  23.4500   NaN        S
889      0            111369  30.0000  C148        C
890      0            370376   7.7500   NaN        Q

[891 rows x 12 columns]
```

[184]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   PassengerId  891 non-null    int64
 1   Survived     891 non-null    int64
```

```
 2   Pclass       891 non-null    int64
 3   Name         891 non-null    object
 4   Sex          891 non-null    object
 5   Age          714 non-null    float64
 6   SibSp        891 non-null    int64
 7   Parch        891 non-null    int64
 8   Ticket       891 non-null    object
 9   Fare         891 non-null    float64
 10  Cabin        204 non-null    object
 11  Embarked     889 non-null    object
dtypes: float64(2), int64(5), object(5)
memory usage: 83.7+ KB
```

[185]:
```
len(np.unique(df["PassengerId"])), len(np.unique(df["Name"])), len(np.
↪unique(df["Ticket"])), len(np.unique(df["Cabin"].dropna()))
```

[185]:
```
(891, 891, 681, 147)
```

[186]:
```
df.drop("PassengerId", axis=1, inplace=True)
df.drop("Name", axis=1, inplace=True)
df.drop("Ticket", axis=1, inplace=True)
```

[187]:
```
df_cabin = df['Cabin']

mapeamento = {
    'A': 1,
    'B': 2,
    'C': 3,
    'D': 4,
    'E': 5,
    'F': 6,
    'G': 7
}

def mapear_para_inteiro(valor):
  if isinstance(valor, str) and len(valor) > 0:
    char = valor[0]
    return mapeamento.get(char, 0)
  else:
    return 0

df_cabin = df_cabin.apply(mapear_para_inteiro)

df['Cabin'] = df_cabin
df
```

[187]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Cabin	Embarked
0	0	3	male	22.0	1	0	7.2500	0	S
1	1	1	female	38.0	1	0	71.2833	3	C
2	1	3	female	26.0	0	0	7.9250	0	S
3	1	1	female	35.0	1	0	53.1000	3	S
4	0	3	male	35.0	0	0	8.0500	0	S
..	…	…	…	…	…	…	…	…	
886	0	2	male	27.0	0	0	13.0000	0	S
887	1	1	female	19.0	0	0	30.0000	2	S
888	0	3	female	NaN	1	2	23.4500	0	S
889	1	1	male	26.0	0	0	30.0000	3	C
890	0	3	male	32.0	0	0	7.7500	0	Q

[891 rows x 9 columns]

[188]:
```
df['Sex'] = df['Sex'].map({"male": 0, "female": 1})
df['Embarked'] = df['Embarked'].map({'S': 0, 'Q': 1, 'C': 2})
```

[189]:
```
df_age = df['Age']


def mapear_para_faixa_etaria(idade):
    if idade < 8:
        return 1
    elif 8 <= idade <= 16:
        return 2
    elif 16 <= idade <= 24:
        return 3
    elif 24 <= idade <= 32:
        return 4
    elif 32 <= idade <= 40:
        return 5
    elif 40 <= idade <= 48:
        return 6
    elif 48 <= idade <= 56:
        return 7
    elif 56 <= idade <= 64:
        return 8
    elif 64 <= idade <= 72:
        return 9
    else:
        return 0

df_age = df_age.apply(mapear_para_faixa_etaria)

df_age
```

[189]:
```
0      3
1      5
2      4
3      5
4      5
      ..
886    4
887    3
888    0
889    4
890    4
Name: Age, Length: 891, dtype: int64
```

[190]:
```
df["Age"].fillna(0, inplace=True)

mean_embarked = df["Embarked"].mean()
df["Embarked"].fillna(mean_embarked, inplace=True)
```

[191]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 9 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   Survived  891 non-null    int64
 1   Pclass    891 non-null    int64
 2   Sex       891 non-null    int64
 3   Age       891 non-null    float64
 4   SibSp     891 non-null    int64
 5   Parch     891 non-null    int64
 6   Fare      891 non-null    float64
 7   Cabin     891 non-null    int64
 8   Embarked  891 non-null    float64
dtypes: float64(3), int64(6)
memory usage: 62.8 KB
```

[192]:
```
df.isna().sum()
```

[192]:
```
Survived    0
Pclass      0
Sex         0
Age         0
SibSp       0
Parch       0
Fare        0
Cabin       0
```

```
Embarked    0
dtype: int64
```

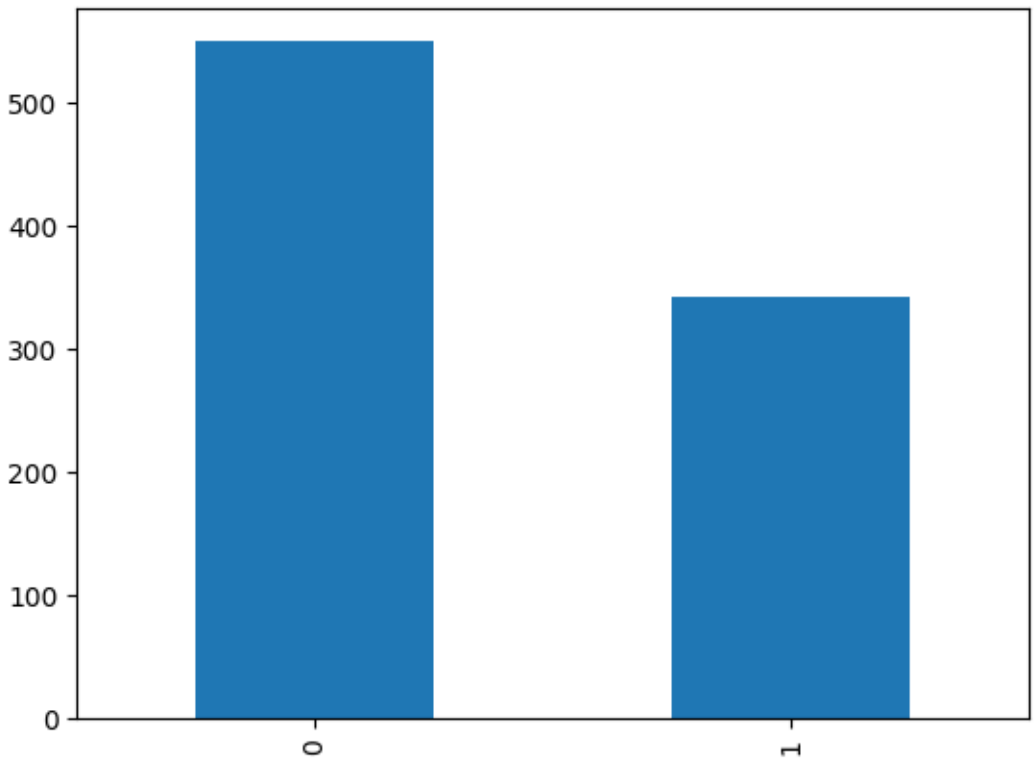
##Divisão do Dataset

[193]:
```
X = df.loc[:, df.columns != 'Survived']
y = df['Survived']
X, y
```

[193]:
```
(     Pclass  Sex   Age  SibSp  Parch     Fare  Cabin  Embarked
 0         3    0  22.0      1      0   7.2500      0       0.0
 1         1    1  38.0      1      0  71.2833      3       2.0
 2         3    1  26.0      0      0   7.9250      0       0.0
 3         1    1  35.0      1      0  53.1000      3       0.0
 4         3    0  35.0      0      0   8.0500      0       0.0
 ..      ...  ...   ...    ...    ...      ...    ...       ...
 886       2    0  27.0      0      0  13.0000      0       0.0
 887       1    1  19.0      0      0  30.0000      2       0.0
 888       3    1   0.0      1      2  23.4500      0       0.0
 889       1    0  26.0      0      0  30.0000      3       2.0
 890       3    0  32.0      0      0   7.7500      0       1.0

 [891 rows x 8 columns],
 0      0
 1      1
 2      1
 3      1
 4      0
       ..
 886    0
 887    1
 888    0
 889    1
 890    0
 Name: Survived, Length: 891, dtype: int64)
```

[194]:
```
y.value_counts().plot(kind='bar')
plt.show()
```



[195]:
```
oversampler = RandomOverSampler(random_state=42)
X_resampled, y_resampled = oversampler.fit_resample(X, y)
```

[196]:
```
len(X_resampled)
```

[196]: 1098

[197]:
```
X_train, X_test, y_train, y_test = train_test_split(X_resampled, y_resampled,␣
 ↪test_size=0.2, random_state=42)
```

##AD: Parâmetros Padrão

[198]:
```
ad = DecisionTreeClassifier(criterion='gini', splitter='best', max_depth=None,␣
 ↪min_samples_split=2, min_samples_leaf=1, min_weight_fraction_leaf=0.0,␣
 ↪max_features=None, random_state=42, max_leaf_nodes=None,␣
 ↪min_impurity_decrease=0.0, class_weight=None, ccp_alpha=0.0)
ad.fit(X_train, y_train)
```

[198]: DecisionTreeClassifier(random_state=42)

[199]:
```
y_pred = ad.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
confusion = confusion_matrix(y_test, y_pred)
```

```
report = classification_report(y_test, y_pred)

print(f"Acurácia: {accuracy}")
print("Matriz de Confusão:\n", confusion)
print("Relatório de Classificação:\n", report)
```

```
Acurácia: 0.8318181818181818
Matriz de Confusão:
 [[ 76  27]
 [ 10 107]]
Relatório de Classificação:
              precision    recall  f1-score   support

           0       0.88      0.74      0.80       103
           1       0.80      0.91      0.85       117

    accuracy                           0.83       220
   macro avg       0.84      0.83      0.83       220
weighted avg       0.84      0.83      0.83       220
```

[200]:
```
dot_data = export_graphviz(ad, out_file=None, feature_names=X.columns,␣
 ↪class_names=str(y.unique()), filled=True, rounded=True)
graph = graphviz.Source(dot_data)
graph.render("arvore_de_decisao")
```

[200]:
```
'arvore_de_decisao.pdf'
```

[201]:
```
accuracy = []
for i in range(5):
  ad = DecisionTreeClassifier(criterion='gini', splitter='best',␣
 ↪max_depth=None, min_samples_split=2, min_samples_leaf=1,␣
 ↪min_weight_fraction_leaf=0.0, max_features=None, random_state=None,␣
 ↪max_leaf_nodes=None, min_impurity_decrease=0.0, class_weight=None,␣
 ↪ccp_alpha=0.0)
  ad.fit(X_train, y_train)
  y_pred = ad.predict(X_test)
  accuracy.append(accuracy_score(y_test, y_pred))
np.mean(accuracy)
```

[201]:
```
0.8272727272727272
```

##Otimização de Hiperparâmetros

[202]:
```
param_grid = {
    'criterion': ['gini', 'entropy'],
    'splitter': ['best', 'random'],
```

```
    'max_depth': [None, 10, 20, 30],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4],
    'max_features': [None, 'sqrt', 'log2'],
    'max_leaf_nodes': [None, 10, 20, 30],
    'class_weight': [None, 'balanced']
}

decision_tree =  DecisionTreeClassifier(random_state=42,␣
 ↪class_weight='balanced')

scorer = make_scorer(f1_score, pos_label=1)

grid_search = GridSearchCV(estimator= decision_tree, param_grid=param_grid,␣
 ↪cv=5, scoring=scorer)
```

[ ]:
```
grid_search.fit(X_train, y_train)
```

[ ]:
```
print("Melhores hiperparâmetros:", grid_search.best_params_)
print("Melhor pontuação de validação cruzada:", grid_search.best_score_)
```

[ ]:
```
melhor_modelo = grid_search.best_estimator_
melhor_modelo.fit(X_train, y_train)
```

[ ]:
```
y_pred = melhor_modelo.predict(X_test)
f1 = f1_score(y_test, y_pred)
accuracy = accuracy_score(y_test, y_pred)
confusion = confusion_matrix(y_test, y_pred)
report = classification_report(y_test, y_pred)
plt.figure(figsize=(8, 6))
sns.heatmap(confusion, annot=True, fmt="d", cmap="Blues", cbar=False)


print(f"Acurácia: {accuracy}")
print("F1 Score no conjunto de teste:", f1)
plt.xlabel('Previsto')
plt.ylabel('Verdadeiro')
plt.title('Matriz de Confusão')
plt.show()
print("Relatório de Classificação:\n", report)
```

[ ]:
```
dot_data = export_graphviz(melhor_modelo, out_file=None, feature_names=X.
 ↪columns, class_names=str(y.unique()), filled=True, rounded=True)
graph = graphviz.Source(dot_data)
graph.render("arvore_de_decisao_otimizada")  # Salva a árvore em um arquivo
```

[ ]:
```
accuracy = []
for i in range(5):
  melhor_modelo = DecisionTreeClassifier(**grid_search.best_estimator_.
 ↪get_params())
  melhor_modelo.set_params(random_state=None)
  melhor_modelo.fit(X_train, y_train)
  y_pred = melhor_modelo.predict(X_test)
  accuracy.append(accuracy_score(y_test, y_pred))
np.mean(accuracy)
```

[ ]:
```
accuracy = []
for i in range(5):
  rf = RandomForestClassifier(n_estimators=100, random_state=42)
  rf.fit(X_train, y_train)
  y_pred = rf.predict(X_test)
accuracy.append(accuracy_score(y_test, y_pred))
np.mean(accuracy)
```

##Salvar como PDF

[ ]:
```
!apt-get install texlive texlive-xetex texlive-latex-extra pandoc
!pip install pypandoc
```

[ ]:
```
!jupyter nbconvert --to PDF "/content/drive/MyDrive/Colab Notebooks/ProjetoAD.
 ↪ipynb"
```