# modelo_predicao

April 27, 2023

Gerar o modelo de predicao

Projeto Integrador UNIVESP, 2023, Semestre 1

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https://github.com/d-gaspar/univesp-integrador-2023-sem1

## 1 Imports

[1]:

```
import os
import pandas as pd
import re
from collections import Counter

from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import confusion_matrix, roc_curve, roc_auc_score,␣
  ↪accuracy_score
import matplotlib.pyplot as plt
from sklearn.tree import export_graphviz
from IPython.display import Image
import graphviz
import tensorflow as tf

import pickle # usado para exportar o modelo
import onnx
from skl2onnx import convert_sklearn
from skl2onnx.common.data_types import FloatTensorType
```

```
2023-04-27 18:39:21.897861: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  SSE4.1 SSE4.2 AVX AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
```

[2]:
```
output_dir = "./android-app/app/src/main/assets/"

if not os.path.exists(output_dir):
    os.makedirs(output_dir)
```

## 2 Carrega os dados

[3]:
```
data_list = []

for filename in os.listdir("data/raw"):
    if filename.endswith(".txt"): # substitua pelo tipo de arquivo que deseja␣
 ↪ler
        with open(os.path.join("data/raw", filename)) as file:
            match = re.search('.*-(.*).txt', filename)
            if match:
                weather = match.group(1)
                for line in file:
                    if not re.compile(".*(connect).*", re.IGNORECASE).
 ↪match(line):
                        line = re.sub('[:HhTPgAa*%mC]', '', line)
                        line = re.sub('\s+', ' ', line)
                        data = line.split()
                        date = data[0]
                        time = data[1]
                        temperature = float(data[2])
                        humidity = float(data[3])/100
                        altitude = float(data[4])
                        pressure = float(data[5])
                        data_list.append([date, time, temperature, humidity,␣
 ↪altitude, pressure, weather])
            else:
                print("ERRO (WEATHER): " + filename)

# criar um DataFrame do pandas com a lista de valores
df = pd.DataFrame(data_list, columns=["date", "time", "temperature",␣
 ↪"humidity", "altitude", "pressure", "weather"])

print(df)
```

```
            date        time  temperature  humidity  altitude  pressure  \
0     2023-04-13  203212.638        25.98    0.6999    874.16    912.57
1     2023-04-13  203218.768        25.91    0.6942    874.10    912.57
2     2023-04-13  203221.828        25.88    0.6943    874.13    912.57
3     2023-04-13  203224.844        25.85    0.6934    874.47    912.53
4     2023-04-13  203227.927        25.82    0.6932    874.86    912.49
…            …           …            …         …         …         …
```

```
5783  2023-04-03  110718.278        20.55    0.6527    824.34    918.08
5784  2023-04-03  110721.357        20.54    0.6527    824.40    918.07
5785  2023-04-03  110724.545        20.55    0.6526    824.53    918.06
5786  2023-04-03  110727.524        20.54    0.6524    824.58    918.05
5787  2023-04-03  110730.573        20.56    0.6520    824.59    918.05

     weather
0      night
1      night
2      night
3      night
4      night
…      …
5783   sunny
5784   sunny
5785   sunny
5786   sunny
5787   sunny

[5788 rows x 7 columns]
```

## 3 Adiciona as colunas ao dataframe

### 3.1 rainy_timedelta

```
[4]: # Convertendo as colunas "date" e "time" para datetime
     df['datetime'] = pd.to_datetime(df['date'] + ' ' + df['time'], format='%Y-%m-%d␣
       ↪%H%M%S.%f')

     df = df.sort_values(by='datetime').reset_index(drop=True)

     # calcula tempo ate rainy
     df['rainy_timedelta'] = 0
     for i in range(len(df)):
         if df.loc[i, 'weather'] == 'rainy': # se ja for 'rainy', tempo para o␣
       ↪proximo 'rainy' == 0
             df.loc[i, 'rainy_timedelta'] = 0
         else: # se nao, calcula tempo ate o proximo 'rainy'
             rainy_index = (df['datetime'] > df.loc[i, 'datetime']) & (df['weather']␣
       ↪== 'rainy')
             if rainy_index.any():
                 first_rainy_index = next((i for i, x in enumerate(rainy_index) if␣
       ↪x), None)
                 first_rainy_datetime = df.loc[first_rainy_index,'datetime']
                 first_rainy_timedelta = int((df.loc[first_rainy_index,'datetime'] -␣
       ↪df.loc[i,'datetime']).total_seconds() / 3600)
                 df.loc[i, 'rainy_timedelta'] = first_rainy_timedelta
```

```
        else: # nao houve chuva apos estas leituras
            df.loc[i, 'rainy_timedelta'] = -1

# remove todas as linhas onde rainy_timedata = -1
df = df.loc[~df['rainy_timedelta'].isin([-1])].reset_index(drop=True)

df
```

[4]:

```
            date        time  temperature  humidity  altitude  pressure  \
0     2023-03-29  093526.903        24.43    0.6767    827.66    917.71
1     2023-03-29  093529.995        24.43    0.6759    827.87    917.69
2     2023-03-29  093533.044        24.42    0.6754    827.80    917.69
3     2023-03-29  093536.202        24.42    0.6766    827.57    917.72
4     2023-03-29  093539.150        24.42    0.6768    827.68    917.71
…          …         …          …       …       …       …
5523  2023-04-12  170203.427        23.45    0.7328    865.51    913.52
5524  2023-04-12  170206.453        23.46    0.7329    865.25    913.54
5525  2023-04-12  170209.541        23.45    0.7338    865.56    913.52
5526  2023-04-12  170212.593        23.45    0.7341    865.29    913.55
5527  2023-04-12  170215.664        23.46    0.7342    865.40    913.57

     weather                datetime  rainy_timedelta
0      sunny 2023-03-29 09:35:26.903               10
1      sunny 2023-03-29 09:35:29.995               10
2      sunny 2023-03-29 09:35:33.044               10
3      sunny 2023-03-29 09:35:36.202               10
4      sunny 2023-03-29 09:35:39.150               10
…      …                     …              …
5523   rainy 2023-04-12 17:02:03.427                0
5524   rainy 2023-04-12 17:02:06.453                0
5525   rainy 2023-04-12 17:02:09.541                0
5526   rainy 2023-04-12 17:02:12.593                0
5527   rainy 2023-04-12 17:02:15.664                0

[5528 rows x 9 columns]
```

### 3.2 rainy__6h, rainy__12h, rainy__24h

[5]:

```
df['rainy_6h'] = (df['rainy_timedelta'] <= 6).astype(str)
df['rainy_12h'] = (df['rainy_timedelta'] <= 12).astype(str)

# df['rainy_24h'] = (df['rainy_timedelta'] <= 24).astype(int)
df['rainy_24h'] = (df['rainy_timedelta'] <= 24).astype(str)

df
```

```
[5]:             date        time  temperature  humidity  altitude  pressure  \
     0     2023-03-29  093526.903        24.43    0.6767    827.66    917.71
     1     2023-03-29  093529.995        24.43    0.6759    827.87    917.69
     2     2023-03-29  093533.044        24.42    0.6754    827.80    917.69
     3     2023-03-29  093536.202        24.42    0.6766    827.57    917.72
     4     2023-03-29  093539.150        24.42    0.6768    827.68    917.71
     …          …         …          …       …       …       …
     5523  2023-04-12  170203.427        23.45    0.7328    865.51    913.52
     5524  2023-04-12  170206.453        23.46    0.7329    865.25    913.54
     5525  2023-04-12  170209.541        23.45    0.7338    865.56    913.52
     5526  2023-04-12  170212.593        23.45    0.7341    865.29    913.55
     5527  2023-04-12  170215.664        23.46    0.7342    865.40    913.57

          weather                datetime  rainy_timedelta rainy_6h rainy_12h  \
     0      sunny 2023-03-29 09:35:26.903               10    False      True
     1      sunny 2023-03-29 09:35:29.995               10    False      True
     2      sunny 2023-03-29 09:35:33.044               10    False      True
     3      sunny 2023-03-29 09:35:36.202               10    False      True
     4      sunny 2023-03-29 09:35:39.150               10    False      True
     …      …                     …              …      …       …
     5523   rainy 2023-04-12 17:02:03.427                0     True      True
     5524   rainy 2023-04-12 17:02:06.453                0     True      True
     5525   rainy 2023-04-12 17:02:09.541                0     True      True
     5526   rainy 2023-04-12 17:02:12.593                0     True      True
     5527   rainy 2023-04-12 17:02:15.664                0     True      True

          rainy_24h
     0         True
     1         True
     2         True
     3         True
     4         True
     …        …
     5523      True
     5524      True
     5525      True
     5526      True
     5527      True

     [5528 rows x 12 columns]
```

# 4 predicao para 6h

[6]:

```
# Separa as variaveis independentes da variavel dependente
X = df[["temperature", "humidity", "pressure"]]
y = df["rainy_6h"]

# Dividindo os dados em conjuntos de treinamento e teste
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=0)
```

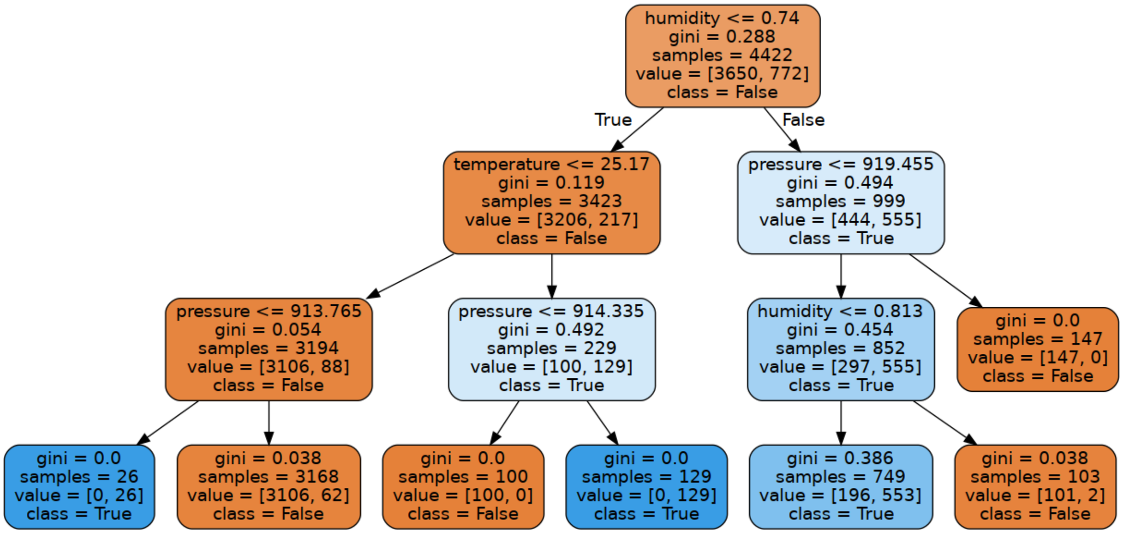
## 4.1 arvore de decisao

[7]:

```
model_dt = DecisionTreeClassifier(max_depth=3)
model_dt.fit(X_train, y_train)

# Fazendo previsões nos dados de teste
y_pred = model_dt.predict(X_test)

# Avaliando o desempenho do modelo com a métrica de acurácia
accuracy = accuracy_score(y_test, y_pred)
print('Accuracy: %.2f' % accuracy)

dot_data = export_graphviz(
        model_dt,
        out_file=None,
        feature_names=X.columns,#["temperature", "humidity", "pressure"],
        class_names=y.unique(),
        rounded=True,
        filled=True
    )

graph = graphviz.Source(dot_data)
Image(graph.pipe(format='png'))
```

```
Accuracy: 0.95
```

[7]:



### 4.2 regressao logistica

[8]:

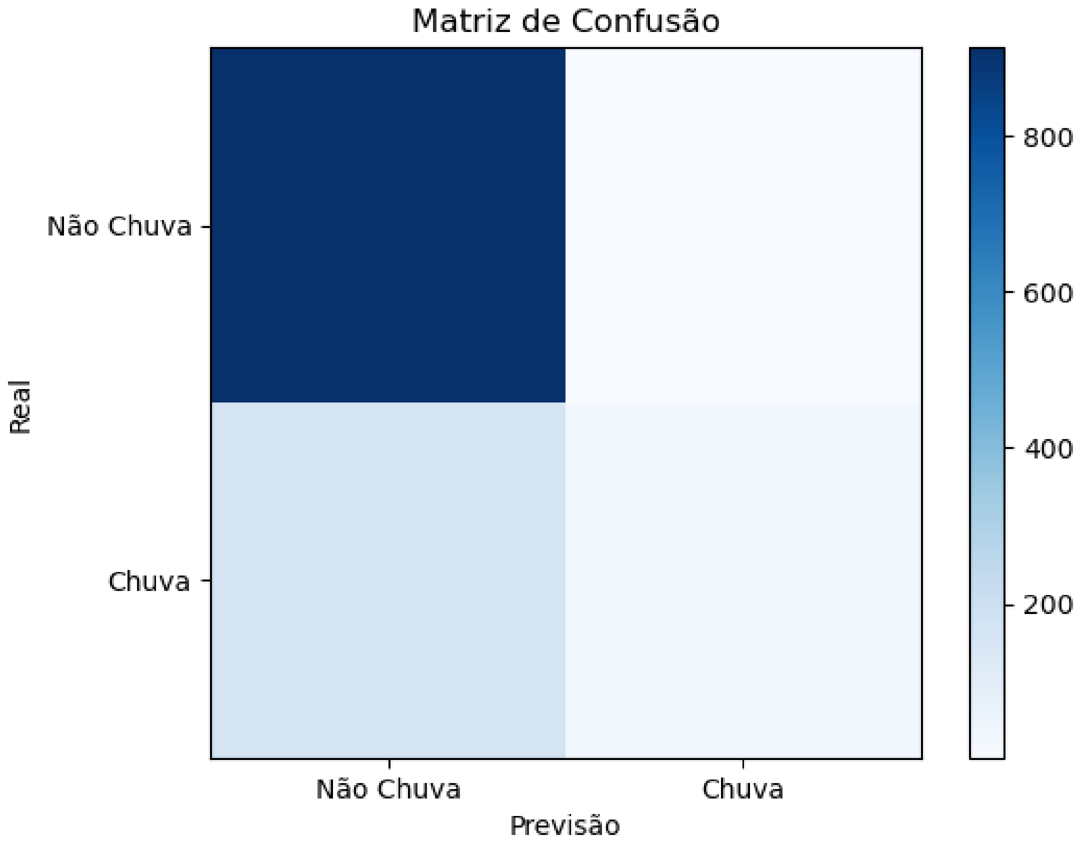
```
model_lr = LogisticRegression(random_state=0)
model_lr.fit(X_train, y_train)

# faz previsões nos dados de teste
y_pred = model_lr.predict(X_test)

# avalia o desempenho do modelo com a métrica de acurácia
accuracy = accuracy_score(y_test, y_pred)
print('Accuracy: %.2f' % accuracy)
```

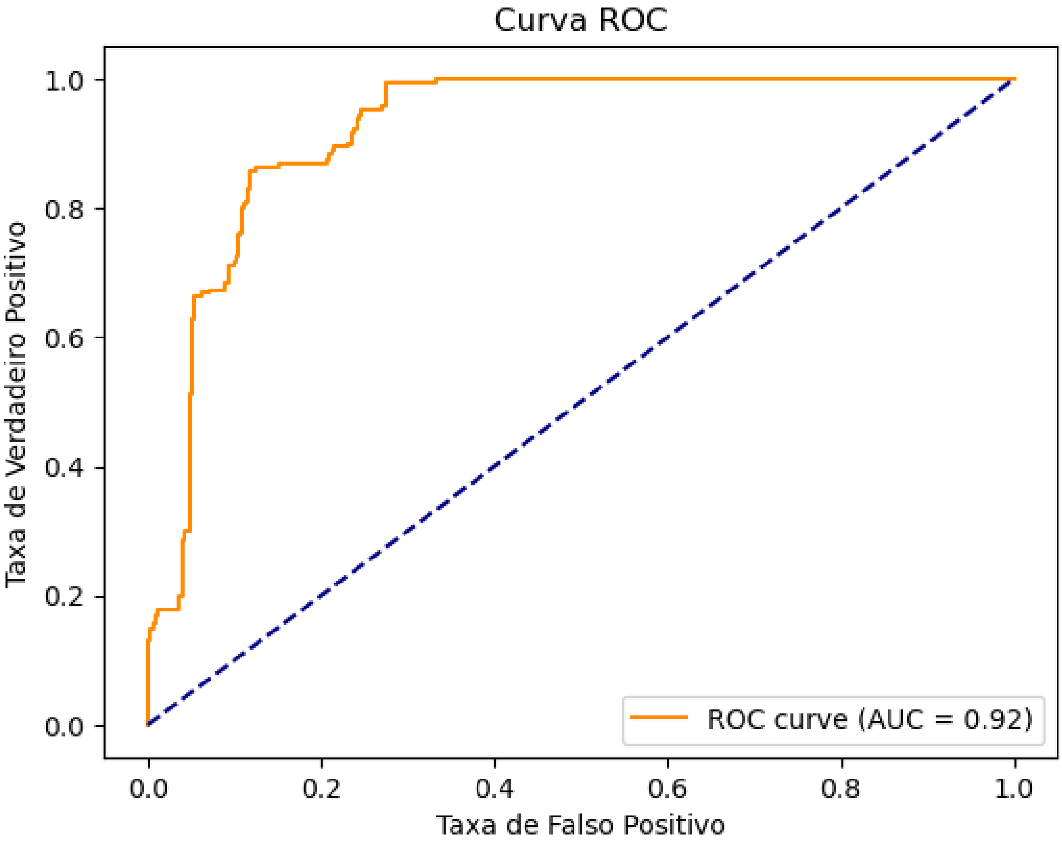
```
Accuracy: 0.85
```

[9]:

```
# cálculo da matriz de confusão
cm = confusion_matrix(y_test, y_pred)

# plotagem da matriz de confusão
plt.imshow(cm, cmap=plt.cm.Blues, interpolation='nearest')
plt.colorbar()
plt.xticks([0, 1], ['Não Chuva', 'Chuva'])
plt.yticks([0, 1], ['Não Chuva', 'Chuva'])
plt.xlabel('Previsão')
plt.ylabel('Real')
plt.title('Matriz de Confusão')
plt.show()

# cálculo da curva ROC
y_prob = model_lr.predict_proba(X_test)[:, 1]
```

```
fpr, tpr, thresholds = roc_curve(y_test, y_prob, pos_label="True")

# cálculo da área sob a curva ROC (AUC)
roc_auc = roc_auc_score(y_test, y_prob)

# plotagem da curva ROC
plt.plot(fpr, tpr, color='darkorange', label='ROC curve (AUC = %0.2f)' %␣
 ↪roc_auc)
plt.plot([0, 1], [0, 1], color='navy', linestyle='--')
plt.xlabel('Taxa de Falso Positivo')
plt.ylabel('Taxa de Verdadeiro Positivo')
plt.title('Curva ROC')
plt.legend(loc="lower right")
plt.show()
```





[10]:
```
with open(output_dir + 'model_logisticReg_6h.pkl', 'wb') as f:
    pickle.dump(model_lr, f)

# Especifique um tipo inicial para o modelo (similar a forma de entrada para o␣
 ↪modelo)
tipo_inicial = [('input', FloatTensorType([None,3]))]

# Salvar o modelo ONNX
converter = convert_sklearn(model_lr, initial_types=tipo_inicial)
with open(output_dir + "model_logisticReg_6h.onnx", "wb" ) as f:
    f.write(converter.SerializeToString())
```

## 5 predicao para 12h

[11]:
```
# Separa as variaveis independentes da variavel dependente
X = df[["temperature", "humidity", "pressure"]]
y = df["rainy_12h"]

# Dividindo os dados em conjuntos de treinamento e teste
```

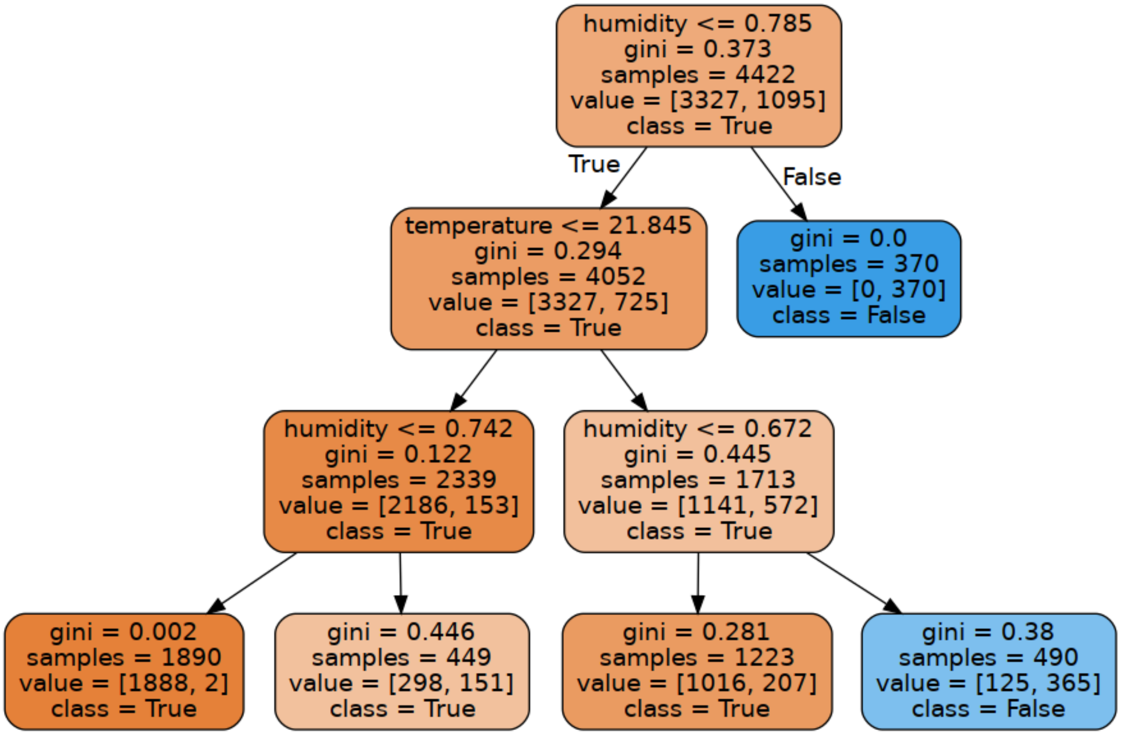
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=0)
```

### 5.1 arvore de decisao

[12]:
```
model_dt = DecisionTreeClassifier(max_depth=3)
model_dt.fit(X_train, y_train)

# Fazendo previsões nos dados de teste
y_pred = model_dt.predict(X_test)

# Avaliando o desempenho do modelo com a métrica de acurácia
accuracy = accuracy_score(y_test, y_pred)
print('Accuracy: %.2f' % accuracy)

dot_data = export_graphviz(
        model_dt,
        out_file=None,
        feature_names=X.columns,#["temperature", "humidity", "pressure"],
        class_names=y.unique(),
        rounded=True,
        filled=True
    )

graph = graphviz.Source(dot_data)
Image(graph.pipe(format='png'))
```

```
Accuracy: 0.90
```

[12]:



### 5.2 regressao logistica

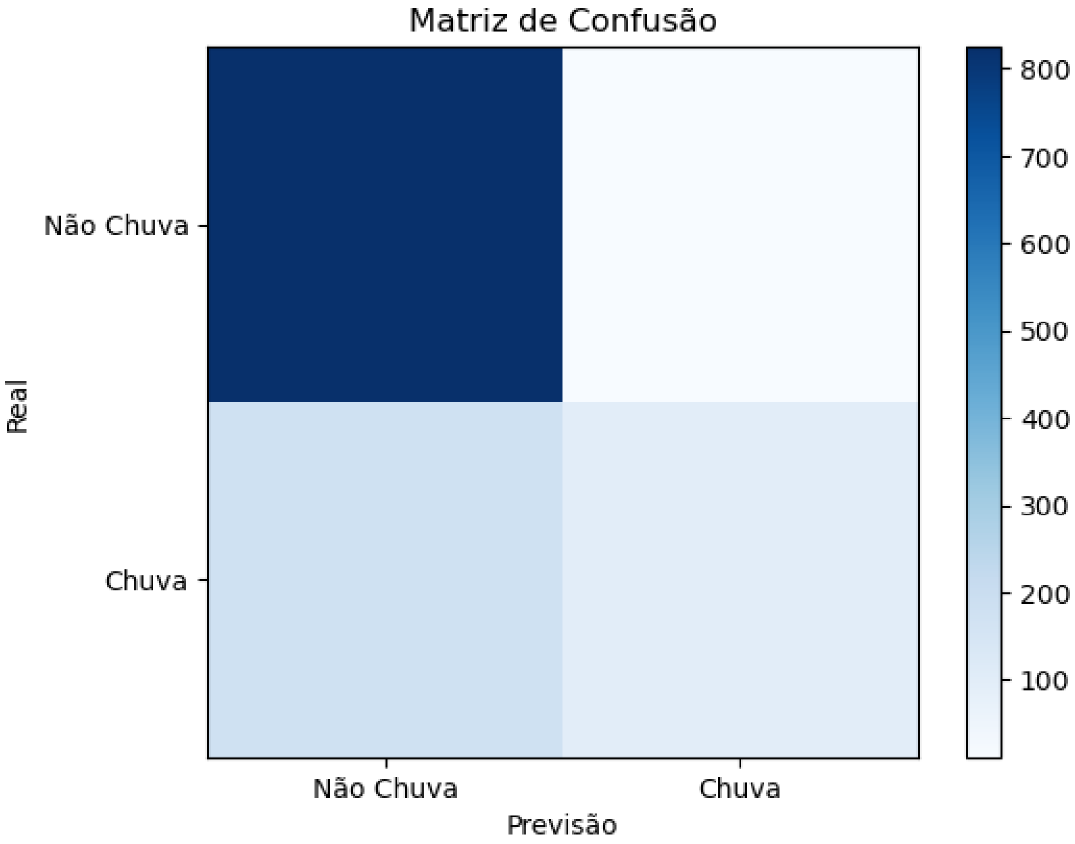
[13]:

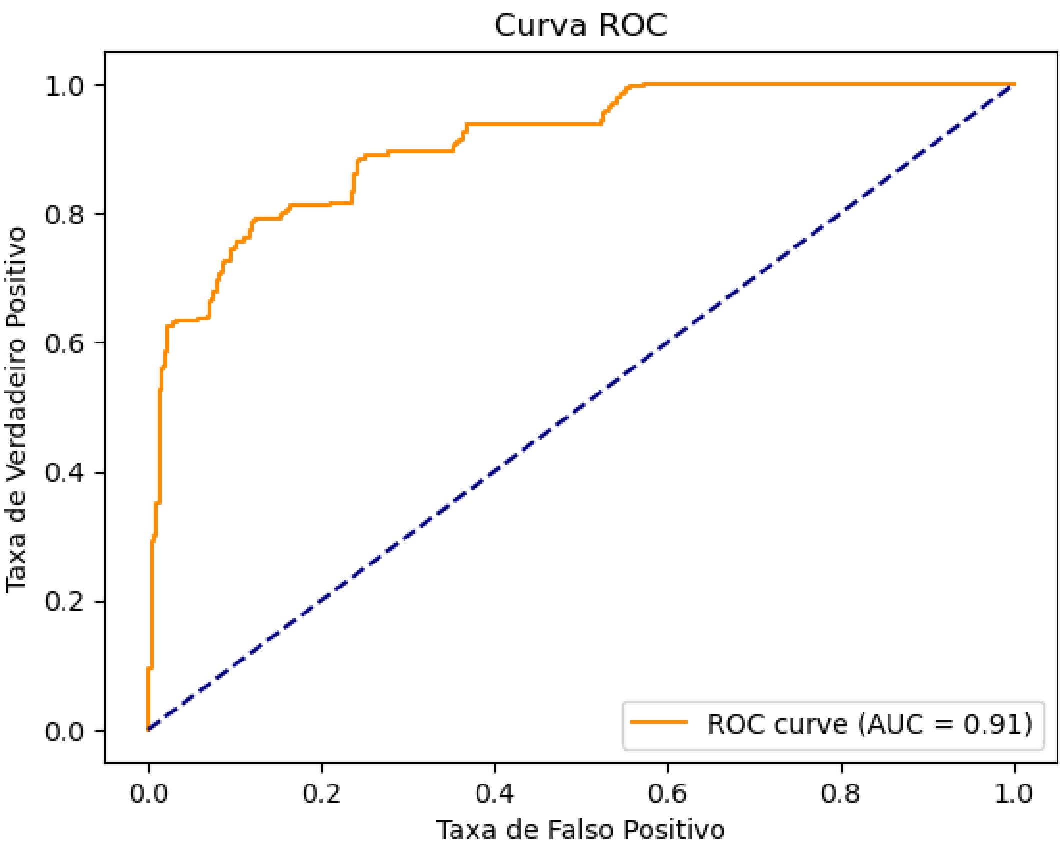
```
model_lr = LogisticRegression(random_state=0)
model_lr.fit(X_train, y_train)

# faz previsões nos dados de teste
y_pred = model_lr.predict(X_test)

# avalia o desempenho do modelo com a métrica de acurácia
accuracy = accuracy_score(y_test, y_pred)
print('Accuracy: %.2f' % accuracy)
```

```
Accuracy: 0.83
```

[14]:

```
# cálculo da matriz de confusão
cm = confusion_matrix(y_test, y_pred)

# plotagem da matriz de confusão
plt.imshow(cm, cmap=plt.cm.Blues, interpolation='nearest')
plt.colorbar()
plt.xticks([0, 1], ['Não Chuva', 'Chuva'])
plt.yticks([0, 1], ['Não Chuva', 'Chuva'])
plt.xlabel('Previsão')
plt.ylabel('Real')
plt.title('Matriz de Confusão')
plt.show()

# cálculo da curva ROC
y_prob = model_lr.predict_proba(X_test)[:, 1]
fpr, tpr, thresholds = roc_curve(y_test, y_prob, pos_label="True")

# cálculo da área sob a curva ROC (AUC)
roc_auc = roc_auc_score(y_test, y_prob)

# plotagem da curva ROC
plt.plot(fpr, tpr, color='darkorange', label='ROC curve (AUC = %0.2f)' % roc_auc)
plt.plot([0, 1], [0, 1], color='navy', linestyle='--')
plt.xlabel('Taxa de Falso Positivo')
plt.ylabel('Taxa de Verdadeiro Positivo')
plt.title('Curva ROC')
plt.legend(loc="lower right")
plt.show()
```





[15]:
```
with open(output_dir + 'model_logisticReg_12h.pkl', 'wb') as f:
    pickle.dump(model_lr, f)

# Especifique um tipo inicial para o modelo (similar a forma de entrada para o␣
 ↪modelo)
tipo_inicial = [('input', FloatTensorType([None,3]))]

# Salvar o modelo ONNX
converter = convert_sklearn(model_lr, initial_types=tipo_inicial)
with open(output_dir + "model_logisticReg_12h.onnx", "wb" ) as f:
    f.write(converter.SerializeToString())
```

## 6 predicao para 24h

[16]:
```
# Separa as variaveis independentes da variavel dependente
X = df[["temperature", "humidity", "pressure"]]
y = df["rainy_24h"]

# Dividindo os dados em conjuntos de treinamento e teste
```

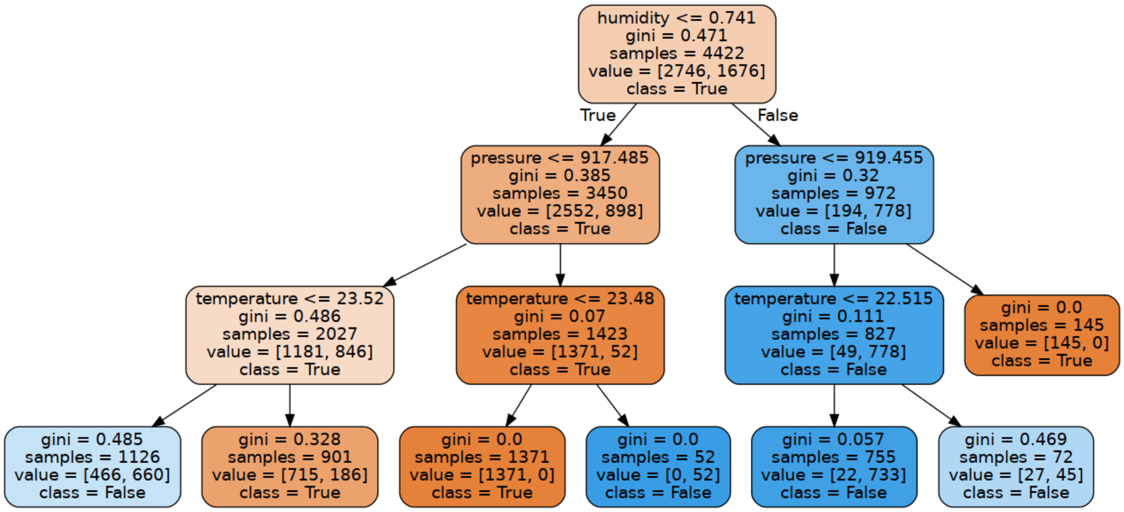
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=0)
```

### 6.1 arvore de decisao

[17]:
```
model_dt = DecisionTreeClassifier(max_depth=3)
model_dt.fit(X_train, y_train)

# Fazendo previsões nos dados de teste
y_pred = model_dt.predict(X_test)

# Avaliando o desempenho do modelo com a métrica de acurácia
accuracy = accuracy_score(y_test, y_pred)
print('Accuracy: %.2f' % accuracy)

dot_data = export_graphviz(
        model_dt,
        out_file=None,
        feature_names=X.columns,#["temperature", "humidity", "pressure"],
        class_names=y.unique(),
        rounded=True,
        filled=True
    )

graph = graphviz.Source(dot_data)
Image(graph.pipe(format='png'))
```

```
Accuracy: 0.84
```

[17]:



### 6.2 regressao logistica

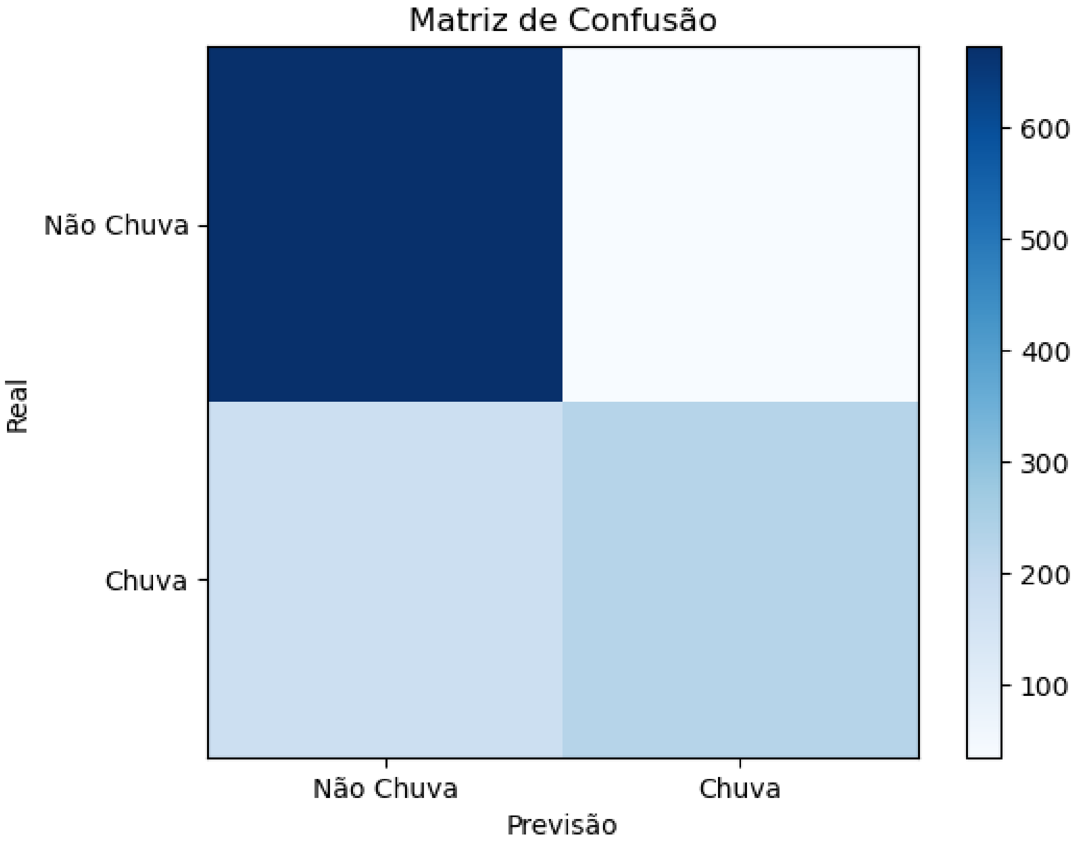
[18]:

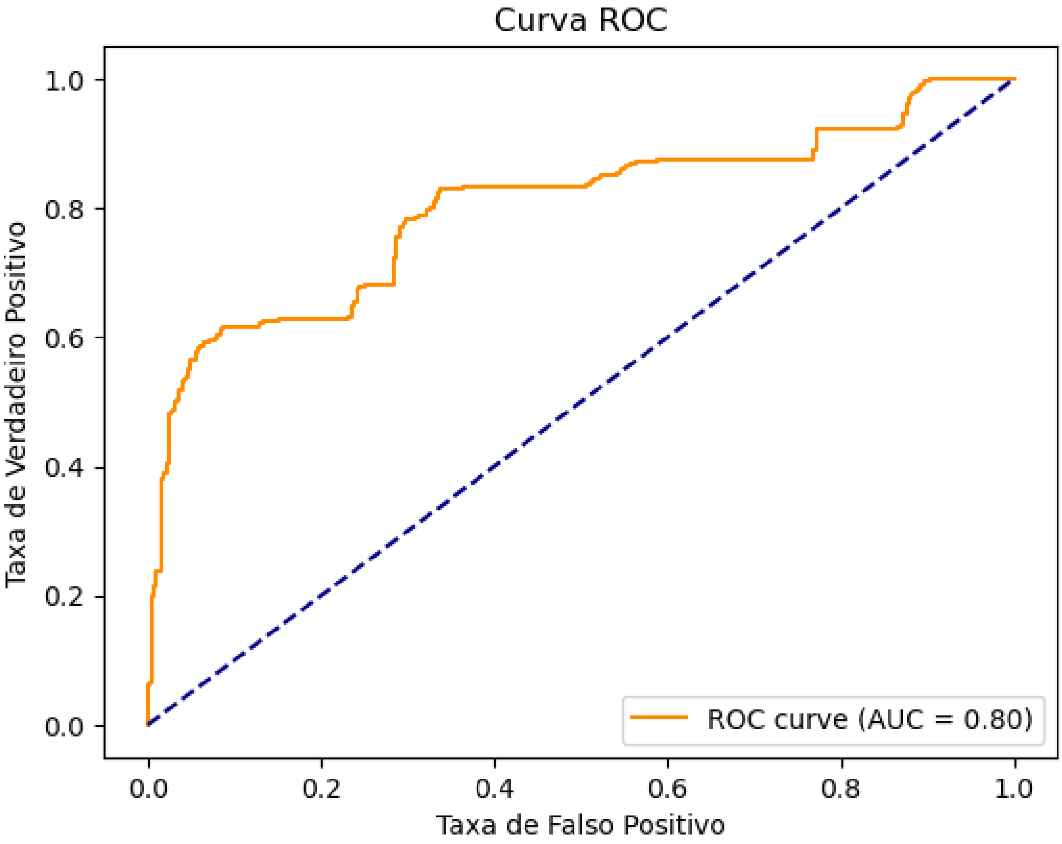
```
model_lr = LogisticRegression(random_state=0)
model_lr.fit(X_train, y_train)

# faz previsões nos dados de teste
y_pred = model_lr.predict(X_test)

# avalia o desempenho do modelo com a métrica de acurácia
accuracy = accuracy_score(y_test, y_pred)
print('Accuracy: %.2f' % accuracy)
```

```
Accuracy: 0.81
```

[19]:

```
# cálculo da matriz de confusão
cm = confusion_matrix(y_test, y_pred)

# plotagem da matriz de confusão
plt.imshow(cm, cmap=plt.cm.Blues, interpolation='nearest')
plt.colorbar()
plt.xticks([0, 1], ['Não Chuva', 'Chuva'])
plt.yticks([0, 1], ['Não Chuva', 'Chuva'])
plt.xlabel('Previsão')
plt.ylabel('Real')
plt.title('Matriz de Confusão')
plt.show()

# cálculo da curva ROC
y_prob = model_lr.predict_proba(X_test)[:, 1]
fpr, tpr, thresholds = roc_curve(y_test, y_prob, pos_label="True")

# cálculo da área sob a curva ROC (AUC)
roc_auc = roc_auc_score(y_test, y_prob)

# plotagem da curva ROC
plt.plot(fpr, tpr, color='darkorange', label='ROC curve (AUC = %0.2f)' %␣
 ↪roc_auc)
plt.plot([0, 1], [0, 1], color='navy', linestyle='--')
plt.xlabel('Taxa de Falso Positivo')
plt.ylabel('Taxa de Verdadeiro Positivo')
plt.title('Curva ROC')
plt.legend(loc="lower right")
plt.show()
```


Matriz de Confusão
Real
Não Chuva
Chuva
Previsão
Não Chuva
Chuva
600
500
400
300
200
100



[20]:

```python
with open(output_dir + 'model_logisticReg_24h.pkl', 'wb') as f:
    pickle.dump(model_lr, f)

# Especifique um tipo inicial para o modelo (similar a forma de entrada para o␣
 ↪modelo)
tipo_inicial = [('input', FloatTensorType([None,3]))]

# Salvar o modelo ONNX
converter = convert_sklearn(model_lr, initial_types=tipo_inicial)
with open(output_dir + "model_logisticReg_24h.onnx", "wb" ) as f:
    f.write(converter.SerializeToString())
```