5-MicrosoftMalwarePrediction-RegresionLogistica

May 22, 2020

1 Microsoft Malware Prediction

1.0.1 Regresión Logística

https://www.aprendemachinelearning.com/regresion-logistica-con-python-paso-a-paso/

1.0.2 Importamos las librerías

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sb
import pickle
import plotly.express as px
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn import linear_model
from sklearn import model_selection
from sklearn.metrics import classification_report
from sklearn.metrics import f1_score, precision_score, recall_score
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn import metrics
from time import time
```

1.1 ——

Lectura de los datos

[ ]:
```
# Leemos los datos originales (para el submission necesitamos la variable␣
↪identificadora de test)

# Leemos el fichero json
import json

with open('datos/datatype.json', 'r') as myfile:
```

```
    data = myfile.read()

# Obtenemos los tipos de datos para el train
dtypes_train = json.loads(data) # Parse file

# Hacemos una copia de los tipos de datos a modificar para test
dtypes_test = dtypes_train.copy()

# Eliminamos la variable 'target'
del dtypes_test['HasDetections']

# Lectura de nuevo del conjunto de train y test, con los tipos de datos que␣
 ↪hemos definido
train = pd.read_csv("./datos/train_malware.csv", dtype = dtypes_train)
test = pd.read_csv("./datos/test_malware.csv", dtype = dtypes_test)
```

[ ]:
```
# Leemos los datos con label encoding
train_label_encoding = pd.read_csv("./datos/train_filtrado_encoding.csv")
test_label_encoding = pd.read_csv("./datos/test_filtrado_encoding.csv")
```

Partición

[ ]:
```
# Dividimos la variable target de
x = train_label_encoding.drop('HasDetections', axis=1)
y = train_label_encoding['HasDetections']
```

[ ]:
```
# Creamos el conjunto de validación
X_train, X_val, y_train, y_val = train_test_split(x, y, test_size=0.25,␣
 ↪random_state = 3)
print(X_train.shape, y_train.shape, X_val.shape, y_val.shape)
```

1.1.1 Lectura del conjunto de datos particionados

[2]:
```
# Lectura del conjunto de datos particionado
X_train = pd.read_csv("./datos/X_train.csv")
X_val = pd.read_csv("./datos/X_val.csv")
y_train = pd.read_csv("./datos/y_train.csv")
y_val = pd.read_csv("./datos/y_val.csv")
```

1.1.2 Algoritmo de Regresión Logística

1. `LogisticRegression()`
2. `LogisticRegression(n_jobs=-1, max_iter=300)`

	tiempo (seg.)	tiempo	accuracy
1	6529.6771960258	1.81 horas	0.6014360512693098

	tiempo (seg.)	tiempo	accuracy
2	8016.7667407990	2.22 horas	0.6054214354586133

Modelo 1

[7]:
```
# Configuración del algoritmo de Regresión Logística
rl_model_01 = linear_model.LogisticRegression()
rl_model_01 # Vemos los hiperparámetros del modelo
```

[7]:
```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
          intercept_scaling=1, max_iter=100, multi_class='warn',
          n_jobs=None, penalty='l2', random_state=None, solver='warn',
          tol=0.0001, verbose=0, warm_start=False)
```

[8]:
```
# Entrenamiento del modelo
start_time = time()
rl_model_01.fit(X_train,y_train)
time_rl_model_01 = time() - start_time

y_pred_01 = rl_model_01.predict(X_val)

print("Tiempo de entrenamiento: %.10f segundos" % time_rl_model_01)
print("Accuracy: ", metrics.accuracy_score(y_val, y_pred_01))
```

```
/Users/gema/anaconda3/lib/python3.7/site-
packages/sklearn/linear_model/logistic.py:433: FutureWarning: Default solver
will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.
  FutureWarning)
/Users/gema/anaconda3/lib/python3.7/site-
packages/sklearn/utils/validation.py:761: DataConversionWarning: A column-vector
y was passed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
/Users/gema/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:931:
ConvergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  "the number of iterations.", ConvergenceWarning)

Tiempo de entrenamiento: 6529.6771960258 segundos
Accuracy:  0.6014360512693098
```

[10]:
```
# Imprimimos algunas métricas
logloss = metrics.log_loss(y_val, y_pred_01)
accuracy = metrics.accuracy_score(y_val, y_pred_01)
F1 = metrics.f1_score(y_val, y_pred_01)
precision = precision_score(y_val, y_pred_01, average='binary')
recall = recall_score(y_val, y_pred_01, average='binary')
auc = metrics.roc_auc_score(y_val, y_pred_01)
```

```
metricas = [logloss, accuracy, F1, precision, recall, auc, time_rl_model_01]
nombre_metricas = ['Log loss', 'Accuracy', 'F1 Score', 'Precision', 'Recall',␣
 ↪'AUC', 'Tiempo de entrenamiento']

pd.DataFrame(metricas, nombre_metricas, columns = ['Regresión Logística']).T
```

[10]:
```
                        Log loss  Accuracy  F1 Score  Precision    Recall  \
Regresión Logística  13.766044  0.601436  0.573078   0.617083  0.534931

                            AUC  Tiempo de entrenamiento
Regresión Logística  0.601446              6529.677196
```

[11]:
```
# Guardamos el modelo
pkl_filename = "modelos/regresion_logistica_01.pkl"
with open(pkl_filename, 'wb') as file:
    pickle.dump(rl_model_01, file)
```

Modelo 2

[12]:
```
# Configuración del algoritmo de Regresión Logística
rl_model_02 = linear_model.LogisticRegression(n_jobs=-1, max_iter=300)
rl_model_02 # Vemos los hiperparámetros del modelo
```

[12]:
```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
          intercept_scaling=1, max_iter=300, multi_class='warn', n_jobs=-1,
          penalty='l2', random_state=None, solver='warn', tol=0.0001,
          verbose=0, warm_start=False)
```

[13]:
```
# Entrenamiento del modelo
start_time = time()
rl_model_02.fit(X_train,y_train)
time_rl_model_02 = time() - start_time

y_pred_02 = rl_model_02.predict(X_val)

print("Tiempo de entrenamiento: %.10f segundos" % time_rl_model_02)
print("Accuracy: ", metrics.accuracy_score(y_val, y_pred_02))
```

```
/Users/gema/anaconda3/lib/python3.7/site-
packages/sklearn/linear_model/logistic.py:433: FutureWarning: Default solver
will be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.
  FutureWarning)
/Users/gema/anaconda3/lib/python3.7/site-
packages/sklearn/utils/validation.py:761: DataConversionWarning: A column-vector
y was passed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
/Users/gema/anaconda3/lib/python3.7/site-
packages/sklearn/linear_model/logistic.py:1300: UserWarning: 'n_jobs' > 1 does
not have any effect when 'solver' is set to 'liblinear'. Got 'n_jobs' = 4.
  " = {}.".format(effective_n_jobs(self.n_jobs)))
```

```
Tiempo de entrenamiento: 8016.7667407990 segundos
Accuracy:  0.6054214354586133
```

[14]:
```
# Imprimimos algunas métricas
logloss = metrics.log_loss(y_val, y_pred_02)
accuracy = metrics.accuracy_score(y_val, y_pred_02)
F1 = metrics.f1_score(y_val, y_pred_02)
precision = precision_score(y_val, y_pred_02, average='binary')
recall = recall_score(y_val, y_pred_02, average='binary')
auc = metrics.roc_auc_score(y_val, y_pred_02)

metricas = [logloss, accuracy, F1, precision, recall, auc, time_rl_model_02]
nombre_metricas = ['Log loss', 'Accuracy', 'F1 Score', 'Precision', 'Recall',␣
↪'AUC', 'Tiempo de entrenamiento']

pd.DataFrame(metricas, nombre_metricas, columns = ['Regresión Logística']).T
```

[14]:

	Log loss	Accuracy	F1 Score	Precision	Recall	AUC	Tiempo de entrenamiento
Regresión Logística	13.628411	0.605421	0.598193	0.609451	0.587343	0.605424	8016.766741

[15]:
```
# Guardamos el modelo
pkl_filename = "modelos/regresion_logistica_02.pkl"
with open(pkl_filename, 'wb') as file:
    pickle.dump(rl_model_02, file)
```

[3]:
```
# Cargamos el modelo 01 (el mejor)
pkl_filename_01 = "modelos/regresion_logistica_01.pkl"
with open(pkl_filename_01, 'rb') as file:
    rl_model_01 = pickle.load(file)
```

1.1.3 Vamos a sacar las variables más importantes

Con Regresión Logística no funciona lo mismo que para Random Forest, usar `rl_model_01.coef_`

[4]:
```
feature_importance = pd.DataFrame(sorted(zip(rl_model_01.coef_.
↪tolist()[0],X_train.columns)),
                                  columns=['Valor','Variable'])
```

[5]:
```
feature_importance = feature_importance.sort_values('Valor', ascending=False)
feature_importance.head(10)
```

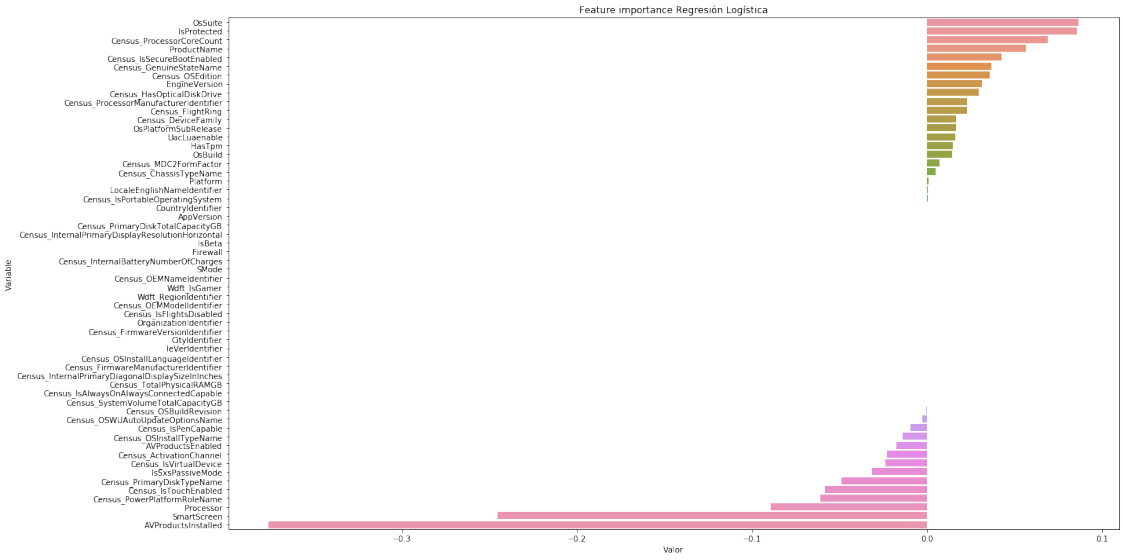
[5]:

	Valor	Variable
57	0.086621	OsSuite
56	0.085686	IsProtected
55	0.069224	Census_ProcessorCoreCount
54	0.056616	ProductName

```
53  0.042874              Census_IsSecureBootEnabled
52  0.036846                 Census_GenuineStateName
51  0.035804                         Census_OSEdition
50  0.031611                            EngineVersion
49  0.029470              Census_HasOpticalDiskDrive
48  0.022990  Census_ProcessorManufacturerIdentifier
```

[6]:
```
fig = px.bar(feature_importance, x='Valor', y='Variable', orientation='h')
fig.update_layout(title_text='Feature importance Regresión Logística',␣
 ↪title_x=0, xaxis=dict(title='Valor'),
                margin=dict(l=10, r=10, t=100, b=0), template='seaborn',
                 uniformtext_minsize=6,)
fig.show()
```

[60]:
```
plt.figure(figsize=(20, 10))
sns.barplot(x="Valor", y="Variable",
            data=feature_importance.sort_values(by="Valor", ascending=False))
plt.title('Feature importance Regresión Logística')
plt.tight_layout()
plt.show()
```



Submission en Kaggle

[ ]:
```
pred_rl_model = rl_model.predict(test_label_encoding)
(pred_rl_model, len(y_pred))
```

[ ]:
```
# Cogemos los identificadores del conjunto test
id_test = test['MachineIdentifier']

# Leemos el CSV para realizar el submission
```

```
submission = pd.read_csv("./datos/Submissions/RegresionLogistica/
 ↪sample_submission.csv")
# Vemos que 'submission.head()' coincide con 'id_test' de manera ordenada

# Pegamos la lista de los identificadores a la columna␣
 ↪submission['HasDetections']
submission['HasDetections'] = pred_rl_model
submission.head()
```

[ ]:
```
# Guardamos el fichero CSV
submission.to_csv('./datos/Submissions/RegresionLogistica/sample_submission.
 ↪csv', index = False, header = True)
```

1.1.4 Validación cruzada de nuestro modelo

No mejora (y tarda más)

[7]:
```
'''
name='Logistic Regression'
seed = 7
kfold = model_selection.KFold(n_splits=5, random_state=seed)
cv_results = model_selection.cross_val_score(rl_model_01, X_train, y_train,␣
 ↪cv=kfold, scoring='accuracy')
msg = "%s: %f (%f)" % (name, cv_results.mean(), cv_results.std())
print(msg)

predictions = rl_model_01.predict(X_val)
print(accuracy_score(y_val, predictions))
'''
```

[7]:
```
'\nname=\'Logistic Regression\'\nseed = 7\nkfold =
model_selection.KFold(n_splits=5, random_state=seed)\ncv_results =
model_selection.cross_val_score(rl_model_01, X_train, y_train, cv=kfold,
scoring=\'accuracy\')\nmsg = "%s: %f (%f)" % (name, cv_results.mean(),
cv_results.std())\nprint(msg)\n\npredictions =
rl_model_01.predict(X_val)\nprint(accuracy_score(y_val, predictions))\n'
```