Régression Logistique Binomiale - OVA

Régression Logistique Binomiale - One-Versus-All (OVA)

Théorie

La **régression logistique binomiale** est utilisée pour la classification binaire, mais elle peut être adaptée aux problèmes **multiclasse** via l'approche **One-Versus-All (OVA)**. Ici, un modèle est entraîné pour chaque classe contre toutes les autres combinées.

Hyperparamètres

Nous allons tester un seul hyperparamètre pour réduire le temps d'entraînement : - **Paramètre de régularisation (`C`)** : contrôle la pénalisation de la complexité du modèle (valeurs entre `0.1` et `1`).

Exemple en Python

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.linear_model import LogisticRegression
from sklearn.multiclass import OneVsRestClassifier
from sklearn.metrics import classification_report, confusion_matrix, accuracy_score
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler

# Chargement des ensembles de données
train_data = pd.read_csv('covertype_train.csv')
val_data = pd.read_csv('covertype_val.csv')
test_data = pd.read_csv('covertype_test.csv')
```

```python
# Préparation des données
X_train = train_data.drop('Cover_Type', axis=1)
y_train = train_data['Cover_Type']

X_val = val_data.drop('Cover_Type', axis=1)
y_val = val_data['Cover_Type']

X_test = test_data.drop('Cover_Type', axis=1)
y_test = test_data['Cover_Type']

# Standardisation des données
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_val = scaler.transform(X_val)
X_test = scaler.transform(X_test)

# Recherche du meilleur hyperparamètre (C seulement)
C_values = [0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1]   # Entre 0.1 et 1
train_accuracies = []
val_accuracies = []

for C in C_values:
    model = OneVsRestClassifier(LogisticRegression(solver='saga', C=C, penalty='l2', max_ite
    model.fit(X_train, y_train)

    y_train_pred = model.predict(X_train)
    y_val_pred = model.predict(X_val)

    train_accuracies.append(accuracy_score(y_train, y_train_pred))
    val_accuracies.append(accuracy_score(y_val, y_val_pred))

# Sélection du meilleur hyperparamètre
best_C = C_values[val_accuracies.index(max(val_accuracies))]
print(f"Meilleur hyperparamètre : C={best_C}")

# Affichage du graphique
plt.figure(figsize=(8, 6))
plt.plot(C_values, train_accuracies, marker='o', linestyle='dashed', label='Train Accuracy')
plt.plot(C_values, val_accuracies, marker='s', linestyle='dashed', label='Validation Accurac
plt.xlabel("Paramètre de régularisation (C)")
plt.ylabel("Précision")
plt.title("Impact de la régularisation sur la performance de la régression logistique (OVA)")
```

```
plt.legend()
plt.show()

# Modèle final avec le meilleur hyperparamètre
final_model = OneVsRestClassifier(LogisticRegression(solver='saga', C=best_C, penalty='l2', m
final_model.fit(X_train, y_train)
y_test_pred = final_model.predict(X_test)

# Affichage de la matrice de confusion
conf_matrix = confusion_matrix(y_test, y_test_pred)
print("\nMatrice de confusion :")
print(conf_matrix)

print("\nÉvaluation sur l'ensemble de test")
print(classification_report(y_test, y_test_pred))
```

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Meilleur hyperparamètre : C=0.4

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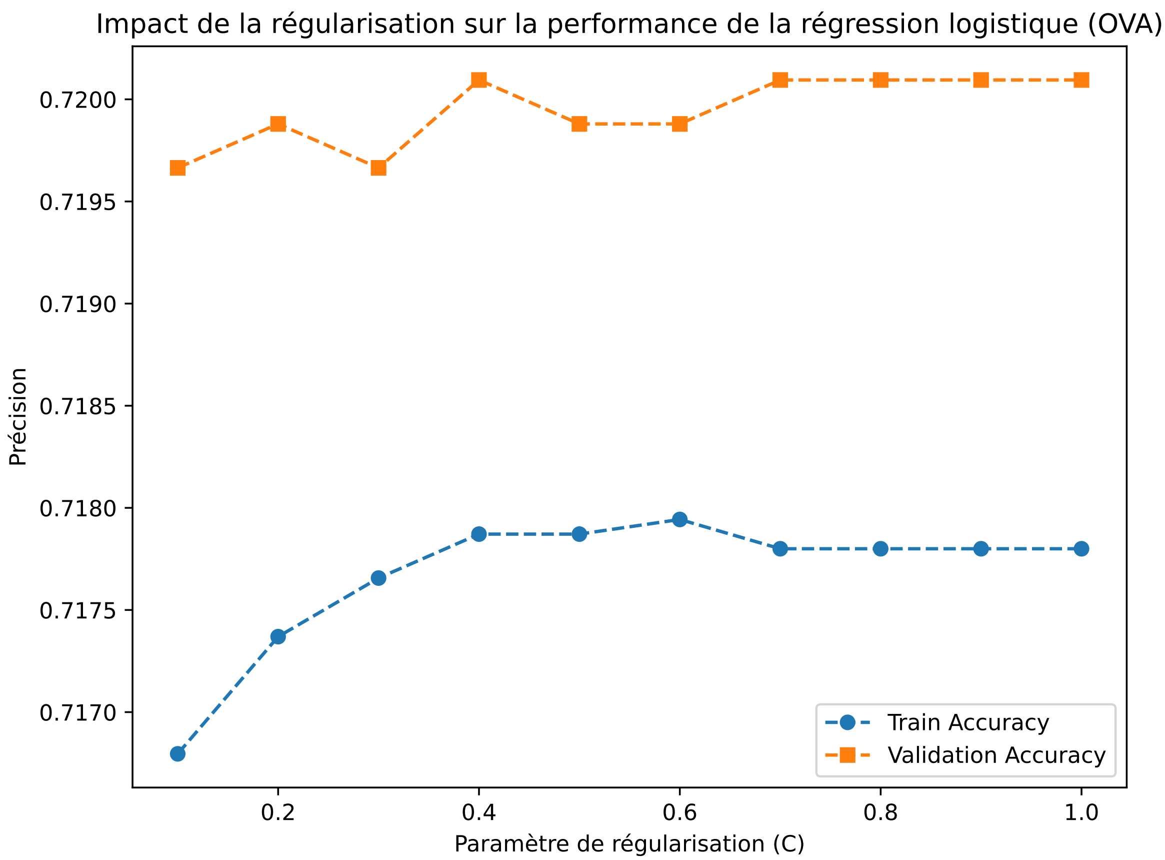


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```
Matrice de confusion :
[[1201  474    2    0    0    0   31]
 [ 413 1789   54    0    0    4    1]
```

```
 [   0   28  246    0    0    7    0]
 [   0    0   14    4    0    3    0]
 [   1   61   12    0    0    0    0]
 [   0   44   95    0    0    5    0]
 [  77    0    0    0    0    0   82]]

Évaluation sur l'ensemble de test
              precision    recall  f1-score   support

           1       0.71      0.70      0.71      1708
           2       0.75      0.79      0.77      2261
           3       0.58      0.88      0.70       281
           4       1.00      0.19      0.32        21
           5       0.00      0.00      0.00        74
           6       0.26      0.03      0.06       144
           7       0.72      0.52      0.60       159

    accuracy                           0.72      4648
   macro avg       0.57      0.44      0.45      4648
weighted avg       0.70      0.72      0.70      4648

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  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
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