# Módulo 2 Análisis y Reporte sobre el desempeño del modelo.


## Cristian Aldo Sandoval Suarez A01751137


---

Para este analisis, tomare la solucion del portafolio de implementacion (KNN).

In [146...]
```
from sklearn.datasets import load_wine
from sklearn.neighbors import KNeighborsClassifier
from sklearn.preprocessing import StandardScaler
from fast_ml.model_development import train_valid_test_split
import matplotlib.pyplot as plt
from sklearn.metrics import zero_one_loss
from mlxtend.evaluate import bias_variance_decomp
import pandas as pd
```

## Cargado de datos

UCI ML Wine Data Set dataset

In [236...]
```
data = load_wine()
```

In [237...]
```
X = pd.DataFrame(data.data)
y = pd.DataFrame(data.target, columns=["target"])

scaler = StandardScaler()
X = scaler.fit_transform(X)

df = pd.concat([pd.DataFrame(X), y], axis=1)
```

## 1. Separacion de datos para entrenamiento, pruebas y validacion.

In [238...]
```
X_train, y_train, X_valid, y_valid, X_test, y_test = train_valid_test_split(
                                                                            df,
                                                                            target = 'target',
                                                                            train_size=0.6,
                                                                            valid_size=0.2,
                                                                            test_size=0.2,
                                                                            random_state=21
)
```

In [239...]
```
print(X_train.shape), print(y_train.shape)
print(X_valid.shape), print(y_valid.shape)
print(X_test.shape), print(y_test.shape)
```

```
(106, 13)
(106,)
(36, 13)
(36,)
(36, 13)
(36,)
```

Out[239… (None, None)

Como se observa, tenemos listos nuestros 3 sets de datos:

- Entrenamiento: 106 registros
- Pruebas: 36 registros.
- Validacion: 36 registros.

### Entranamiento del modelo

In [240…
```
knn = KNeighborsClassifier()
```

In [241…
```
knn.fit(X_train, y_train)
```

Out[241… ▾ KNeighborsClassifier

KNeighborsClassifier()

Parametros iniciales (deafult):

In [242…
```
default_params = knn.get_params()
default_params
```

Out[242…
```
{'algorithm': 'auto',
 'leaf_size': 30,
 'metric': 'minkowski',
 'metric_params': None,
 'n_jobs': None,
 'n_neighbors': 5,
 'p': 2,
 'weights': 'uniform'}
```

## 2. Diagnóstico del grado de bias y varianza

In [243…
```
print(f'Score: {knn.score(X_valid, y_valid)}')
```

```
Score: 1.0
```

In [244…
```
avg_expected_loss, avg_bias, avg_var = bias_variance_decomp(
                                        knn,
                                        X_train.to_numpy(),
                                        y_train.to_numpy(),
                                        X_valid.to_numpy(),
                                        y_valid.to_numpy(),
                                        loss='0-1_loss',
                                        random_seed=42
)
```

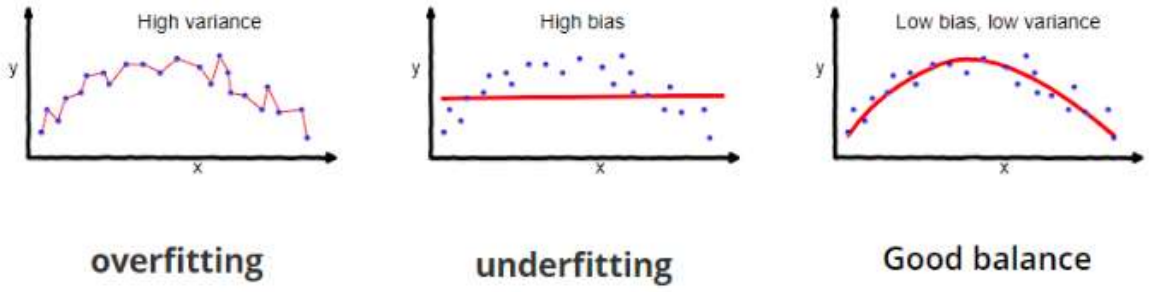
In [245…
```
print('Average expected loss: %.3f' % avg_expected_loss)
print('Average bias: %.3f' % avg_bias)
print('Average variance: %.3f' % avg_var)
print('Sklearn 0-1 loss: %.3f' % zero_one_loss(y_test,y_pred))
```

```
Average expected loss: 0.019
Average bias: 0.000
```

```
Average variance: 0.019
Sklearn 0-1 loss: 0.639
```

## 3. Diagnostico del grado de ajuste del modelo

Se tiene un bias y una varianza relativamente bajos, tambien se obtuvo un buen score, lo que nos indica que el modelo se encuentra casi perfectamente **balanceado**, sin embargo, podemos intenentar mejorarlo.




## 4. Ajuste de hiperparametros

In [248…

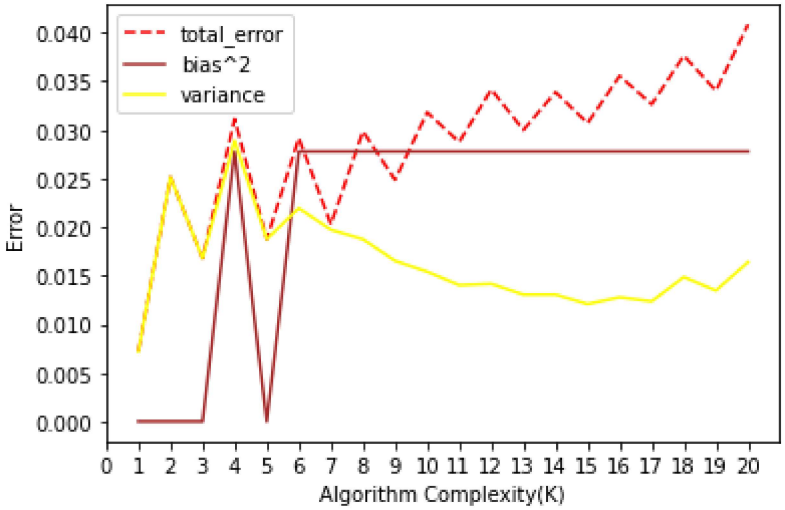
```
bias_KnnClass, var_KnnClass, error_KnnClass, = [], [], []

top = 21

for k in range(1,top):
    clf_knn = KNeighborsClassifier(n_neighbors=k)
    avg_expected_loss, avg_bias, avg_var = bias_variance_decomp(
                                        clf_knn,
                                        X_train.to_numpy(),
                                        y_train.to_numpy(),
                                        X_valid.to_numpy(),
                                        y_valid.to_numpy(),
                                        loss='0-1_loss',
                                        random_seed=42
    )


    bias_KnnClass.append(avg_bias)
    var_KnnClass.append(avg_var)
    error_KnnClass.append(avg_expected_loss)
```

In [249…

```
plt.plot(range(1,top), error_KnnClass, 'red', label = 'total_error',linestyle='dashe
plt.plot(range(1,top), bias_KnnClass, 'brown', label = 'bias^2')
plt.plot(range(1,top), var_KnnClass, 'yellow', label = 'variance')
plt.xlabel('Algorithm Complexity(K)')
plt.xticks(range(0, top, 1))
plt.ylabel('Error')
plt.legend()
```

Out[249…

```
<matplotlib.legend.Legend at 0x7f370d200a60>
```




En la grafica se observa que con n_neighbors = 1 se tiene el mejor balance entre bias y varianza (niveles mas bajos posibles) por lo que ajustaremos nuestro modelo con ese parametro.

In [250…
```
knn = KNeighborsClassifier(n_neighbors=1)
```

In [251…
```
avg_expected_loss, avg_bias, avg_var = bias_variance_decomp(
                                        knn,
                                        X_train.to_numpy(),
                                        y_train.to_numpy(),
                                        X_valid.to_numpy(),
                                        y_valid.to_numpy(),
                                        loss='0-1_loss',
                                        random_seed=42
    )
```

In [252…
```
print(f'Score: {knn.score(X_valid, y_valid)}')
```

```
Score: 0.9722222222222222
```

In [253…
```
print('Average expected loss: %.3f' % avg_expected_loss)
print('Average bias: %.3f' % avg_bias)
print('Average variance: %.3f' % avg_var)
print('Sklearn 0-1 loss: %.3f' % zero_one_loss(y_test,y_pred))
```

```
Average expected loss: 0.007
Average bias: 0.000
Average variance: 0.007
Sklearn 0-1 loss: 0.639
```

Como era previsto, mejoro el score, el bias bajo y la varianza mantuvo un nivel bajo. Por lo que podemos decir que nuestro modelo se encuentra perfectamente balanceado.

## 4. Predicciones con set de prueba.

In [255…
```
knn.score(X_test, y_test)
```

Out[255…
```
1.0
```