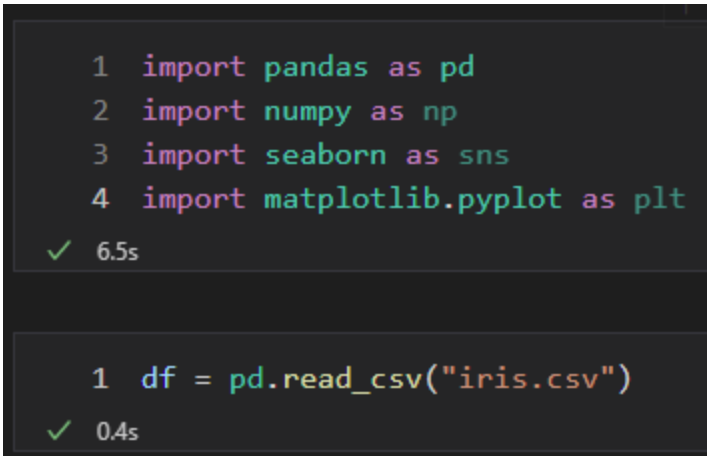
# Multiclass Regr




▼ Model

- imports, prepare and train test split

```
1  X = df.drop("species", axis=1)
2  y = df["species"]
```
✓ 0.3s

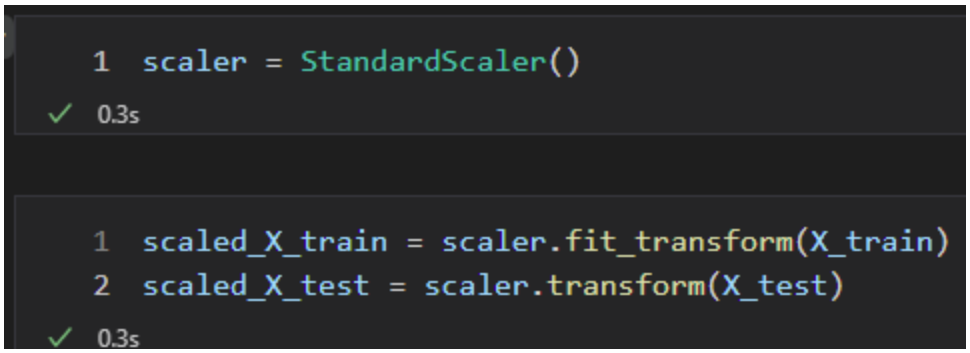
```
1  y
```
✓ 0.3s

```
0         setosa
1         setosa
2         setosa
3         setosa
4         setosa
        ...
145    virginica
146    virginica
147    virginica
148    virginica
149    virginica
Name: species, Length: 150, dtype: object
```

```
1  from sklearn.model_selection import train_test_split
2  from sklearn.preprocessing import StandardScaler
```
✓ 0.8s

```
1  X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=101)
```
✓ 0.4s

- Scaler Model




- Regression tool import
  Penalty, l1 and C values
  Param grid
  grid model

```
1 from sklearn.linear_model import LogisticRegression
2 from sklearn.model_selection import GridSearchCV
```
✓ 0.5s

```
1 log_model = LogisticRegression(solver="saga",multi_class="ovr", max_iter=5000)
```
✓ 0.5s

```
1 penalty = ["l1","l2","elasticnet"]
2 l1_ratio = np.linspace(0,1,20)
3 C = np.logspace(0,10,20)
4
5 param_grid={
6     "penalty" : penalty,
7     "l1_ratio" : l1_ratio,
8     "C" : C
9 }
```
✓ 0.3s

```
1 grid_model = GridSearchCV(log_model, param_grid=param_grid)
```
✓ 0.4s

- grid model fit

```
1 grid_model.fit(scaled_X_train, y_train)
```
✓ 3m 36.9s

```
Output exceeds the size limit. Open the full output data in a text editor
C:\Users\mbatu\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:1317: UserWarning: l1_ratio
parameter is only used when penalty is 'elasticnet'. Got (penalty=l1)
  warnings.warn("l1_ratio parameter is only used when penalty is "
C:\Users\mbatu\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:1317: UserWarning: l1_ratio
parameter is only used when penalty is 'elasticnet'. Got (penalty=l1)
  warnings.warn("l1_ratio parameter is only used when penalty is "
C:\Users\mbatu\anaconda3\lib\site-packages\sklearn\linear_model\_logistic.py:1317: UserWarning: l1_ratio
parameter is only used when penalty is 'elasticnet'. Got (penalty=l1)
```

- Best Parameters

```
1  from sklearn.metrics import accuracy_score, confusion_matrix
2  from sklearn.metrics import classification_report, plot_confusion_matrix
```
✓ 0.3s

```
1  grid_model.best_params_
```
✓ 0.6s

```
{'C': 11.28837891684689, 'l1_ratio': 0.0, 'penalty': 'l1'}
```

- predictions

```
1  y_pred = grid_model.predict(scaled_X_test)
2  y_pred
```
0.6s

```
ray(['setosa', 'setosa', 'setosa', 'virginica', 'versicolor',
    'virginica', 'versicolor', 'versicolor', 'virginica', 'setosa',
    'virginica', 'setosa', 'setosa', 'virginica', 'virginica',
    'versicolor', 'versicolor', 'versicolor', 'setosa', 'versicolor',
    'versicolor', 'setosa', 'versicolor', 'versicolor', 'versicolor',
    'versicolor', 'versicolor', 'virginica', 'setosa', 'setosa',
    'virginica', 'versicolor', 'virginica', 'versicolor', 'virginica',
    'versicolor', 'versicolor', 'versicolor'], dtype=object)
```

- accuracy score, confusion matrix and its plot

```
1  accuracy_score(y_test,y_pred)
```
✓ 0.9s

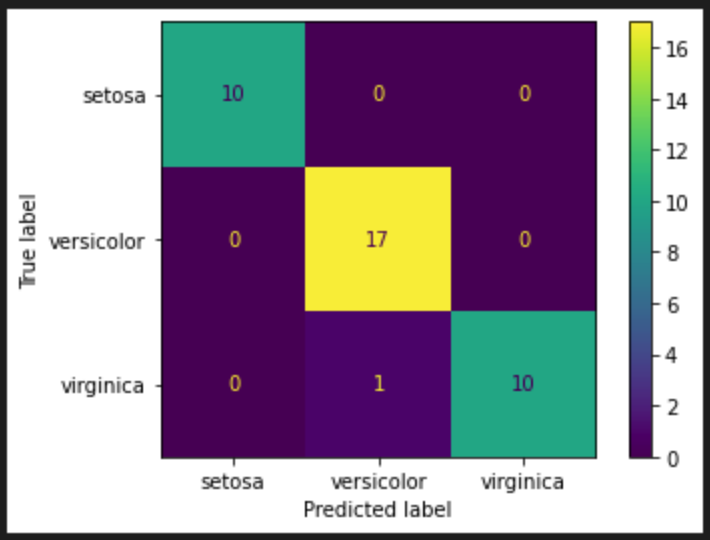
```
0.9736842105263158
```

```
1  confusion_matrix(y_test,y_pred)
```
✓ 0.8s

```
array([[10,  0,  0],
       [ 0, 17,  0],
       [ 0,  1, 10]], dtype=int64)
```

```
1  plot_confusion_matrix(grid_model, scaled_X_test,y_test)
```
✓ 0.4s

```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay
```




- classification report

```
1  print(classification_report(y_test,y_pred))
✓ 0.8s
```

| | precision | recall | f1-score | support |
|---|---|---|---|---|
| setosa | 1.00 | 1.00 | 1.00 | 10 |
| versicolor | 0.94 | 1.00 | 0.97 | 17 |
| virginica | 1.00 | 0.91 | 0.95 | 11 |
| accuracy | | | 0.97 | 38 |
| macro avg | 0.98 | 0.97 | 0.97 | 38 |
| weighted avg | 0.98 | 0.97 | 0.97 | 38 |

- imports and plot multi label ROC plot

```python
from sklearn.metrics import plot_roc_curve
from sklearn.metrics import roc_curve, auc
```

✓ 0.7s

```python
def plot_multiclass_roc(clf, X_test, y_test, n_classes, figsize=(5,5)):
    y_score = clf.decision_function(X_test)

    # structures
    fpr = dict()
    tpr = dict()
    roc_auc = dict()

    # calculate dummies once
    y_test_dummies = pd.get_dummies(y_test, drop_first=False).values
    for i in range(n_classes):
        fpr[i], tpr[i], _ = roc_curve(y_test_dummies[:, i], y_score[:, i])
        roc_auc[i] = auc(fpr[i], tpr[i])

    # roc for each class
    fig, ax = plt.subplots(figsize=figsize)
    ax.plot([0, 1], [0, 1], 'k--')
    ax.set_xlim([0.0, 1.0])
    ax.set_ylim([0.0, 1.05])
    ax.set_xlabel('False Positive Rate')
    ax.set_ylabel('True Positive Rate')
    ax.set_title('Receiver operating characteristic example')
    for i in range(n_classes):
        ax.plot(fpr[i], tpr[i], label='ROC curve (area = %0.2f) for label %i' % (roc_auc[i], i))
    ax.legend(loc="best")
    ax.grid(alpha=.4)
    sns.despine()
    plt.show()
```

✓ 0.1s

- ROC plot

```
1  plot_multiclass_roc(grid_model, scaled_X_test, y_test, n_classes=3, figsize=(16, 10))
```

✓ 0.3s