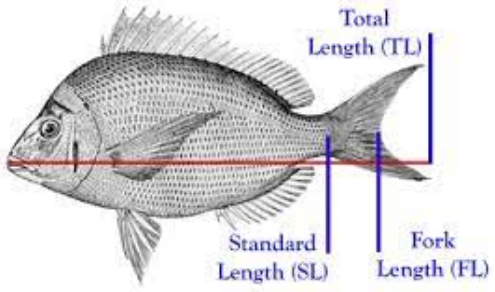
★ Classification Model to Identify Species of Fish



The Fish Catch data set contains measurements on 159 fish caught in the lake Laengelmavesi, Finland. For the 159 fishes of 7 species the weight, length, height, and width were measured. Three different length measurements are recorded: from the nose of the fish to the beginning of its tail, from the nose to the notch of its tail and from the nose to the end of its tail. The height and width are calculated as percentages of the third length variable. This results in 6 observed variables, Weight, Length1, Length2, Length3, Height, Width. The variable, Species, represents the grouping structure: the 7 species are 1=Bream, 2=Whitewish, 3=Roach, 4=Parkki, 5=Smelt, 6=Pike, 7=Perch.

- SL: Standard Length---Length1
- FL: Fork Length--------Length2
- TL: Total Length-------Length3
- BT: Body Thickness----Height
- BD: Body Depth--------Width

```
# import library
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

```
# import data
fish = pd.read_csv('https://github.com/ybifoundation/Dataset/raw/main/Fish.csv')
```

```
# view data
fish.head()
```

	Category	Species	Weight	Height	Width	Length1	Length2	Length3
0	1	Bream	242.0	11.5200	4.0200	23.2	25.4	30.0
1	1	Bream	290.0	12.4800	4.3056	24.0	26.3	31.2
2	1	Bream	340.0	12.3778	4.6961	23.9	26.5	31.1
3	1	Bream	363.0	12.7300	4.4555	26.3	29.0	33.5
4	1	Bream	430.0	12.4440	5.1340	26.5	29.0	34.0

```
# info of data
fish.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 159 entries, 0 to 158
Data columns (total 8 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   Category  159 non-null    int64  
 1   Species   159 non-null    object 
 2   Weight    159 non-null    float64
 3   Height    159 non-null    float64
 4   Width     159 non-null    float64
 5   Length1   159 non-null    float64
 6   Length2   159 non-null    float64
 7   Length3   159 non-null    float64
dtypes: float64(6), int64(1), object(1)
memory usage: 10.1+ KB
```

```
# summary statistics
fish.describe()
```

	Category	Weight	Height	Width	Length1	Length2	Le
count	159.000000	159.000000	159.000000	159.000000	159.000000	159.000000	159.0
mean	3.264151	398.326415	8.970994	4.417486	26.247170	28.415723	31.2
std	1.704249	357.978317	4.286208	1.685804	9.996441	10.716328	11.6
min	1.000000	0.000000	1.728400	1.047600	7.500000	8.400000	8.8
25%	2.000000	120.000000	5.944800	3.385650	19.050000	21.000000	23.1
50%	3.000000	273.000000	7.786000	4.248500	25.200000	27.300000	29.4
75%	4.500000	650.000000	12.365900	5.584500	32.700000	35.500000	39.6
max	7.000000	1650.000000	18.957000	8.142000	59.000000	63.400000	68.0

```
# check for missing value
fish.isna().sum()
```

```
Category    0
Species     0
Weight      0
Height      0
Width       0
Length1     0
Length2     0
Length3     0
dtype: int64
```

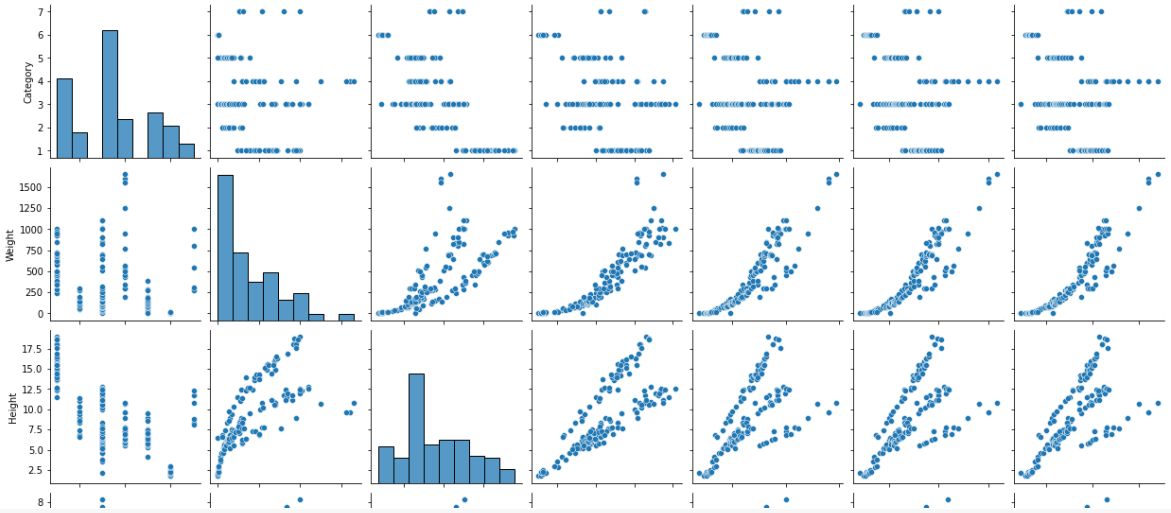
```
# check for categories
fish.nunique()
```

```
Category      7
Species       7
Weight      101
Height      154
Width       152
```

```
Length1     116
Length2      93
Length3     124
dtype: int64
```

```
# visualize pairplot
sns.pairplot(fish)
```

```
<seaborn.axisgrid.PairGrid at 0x7fc599853750>
```




```
# columns name
fish.columns
```

```
Index(['Category', 'Species', 'Weight', 'Height', 'Width', 'Length1',
       'Length2', 'Length3'],
      dtype='object')
```

```
# define y
y = fish['Category']
```



```
# define X
X = fish[['Weight', 'Height', 'Width', 'Length1',
       'Length2', 'Length3']]
```



```
# split data
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=.30, random_state=2529)
```

```
# verify shape
X_train.shape, X_test.shape, y_train.shape, y_test.shape
```

```
((111, 6), (48, 6), (111,), (48,))
```

```
# select model
from sklearn.ensemble import RandomForestClassifier
model = RandomForestClassifier()
```

```
# train model
model.fit(X_train,y_train)
```

```
RandomForestClassifier()
```

```
# predict with model
y_pred = model.predict(X_test)
```

```
# model evaluation
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
```

```
# model accuracy
accuracy_score(y_test,y_pred)
```

```
0.7708333333333334
```

```
# model confusion matrix
confusion_matrix(y_test, y_pred)
```

```
array([[11,  0,  0,  0,  0,  0,  0],
       [ 0,  1,  0,  0,  0,  0,  0],
       [ 0,  0, 16,  0,  1,  0,  0],
       [ 0,  0,  1,  4,  0,  0,  0],
       [ 0,  0,  5,  0,  1,  0,  1],
       [ 0,  0,  2,  0,  0,  4,  0],
       [ 0,  0,  1,  0,  0,  0,  0]])
```

```
# model classification report
print(classification_report(y_test, y_pred))
```

```
                  precision    recall  f1-score   support

               1       1.00      1.00      1.00        11
               2       1.00      1.00      1.00         1
               3       0.64      0.94      0.76        17
               4       1.00      0.80      0.89         5
               5       0.50      0.14      0.22         7
               6       1.00      0.67      0.80         6
               7       0.00      0.00      0.00         1

        accuracy                           0.77        48
       macro avg       0.73      0.65      0.67        48
    weighted avg       0.78      0.77      0.74        48
```

```
# future prediction
sample = fish.sample()
sample
```

	Category	Species	Weight	Height	Width	Length1	Length2	Length3
95	3	Perch	170.0	6.275	3.725	21.5	23.5	25.0

```
# define X_new
X_new = sample.loc[:,X.columns]
X_new
```

	Weight	Height	Width	Length1	Length2	Length3
95	170.0	6.275	3.725	21.5	23.5	25.0

```
# predict for X_new
model.predict(X_new)
```

```
array([3])
```

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