Actividad 3 | Kmeans.

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Análisis de la base de datos de las flores Iris.

```
# Import the packages that we will be using
import numpy as np                  # For array
import pandas as pd                 # For data handling
import seaborn as sns               # For advanced plotting
import matplotlib.pyplot as plt     # For showing plots

# Import sklearn KMeans
from sklearn.cluster import KMeans


# Define where you are running the code: colab or local
RunInColab          = True     # (False: no  | True: yes)

# If running in colab:
if RunInColab:
    # Mount your google drive in google colab
    from google.colab import drive
    drive.mount('/content/drive')

    # Find location
    #!pwd
    #!ls
    #!ls "/content/drive/My Drive/Colab Notebooks/MachineLearningWithPython/"

    # Define path del proyecto
    Ruta            = "/content/drive/My Drive/Colab Notebooks/MachineLearningWithPython/"

else:
    # Define path del proyecto
    Ruta            = ""
```

```
Mounted at /content/drive
```

```
# Dataset url
url = Ruta + "iris.csv"

# Load the dataset
df  = pd.read_csv(url)

#Cargar la base de datos
url = Ruta + "iris.csv"
df = pd.read_csv(url,names=['SepalLength', 'SepalWidth', 'PetalLength','PetalWidth','FlowerType'])
df.head()
```

	SepalLength	SepalWidth	PetalLength	PetalWidth	FlowerType
0	5.1	3.5	1.4	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa

```
# get the number of observations and variables
Ob = df.shape[0]
Va = df.shape[1]
print("La base de datos posee un total de ", Ob ,"filas y son ", Va, "Variables.")
```

```
La base de datos posee un total de  150 filas y son  5 Variables.
```

```
# Drop rows with NaN values if existing
Nan = df.isnull().sum()

# Print the new shape
# Print the new shape
print("Nuestra base de datos no presenta observaciones vacias como se muestra en la siguiente tabla:")
print(Nan)
```

```
Nuestra base de datos no presenta observaciones vacias como se muestra en la siguiente tabla:
SepalLength    0
SepalWidth     0
PetalLength    0
PetalWidth     0
FlowerType     0
dtype: int64
```

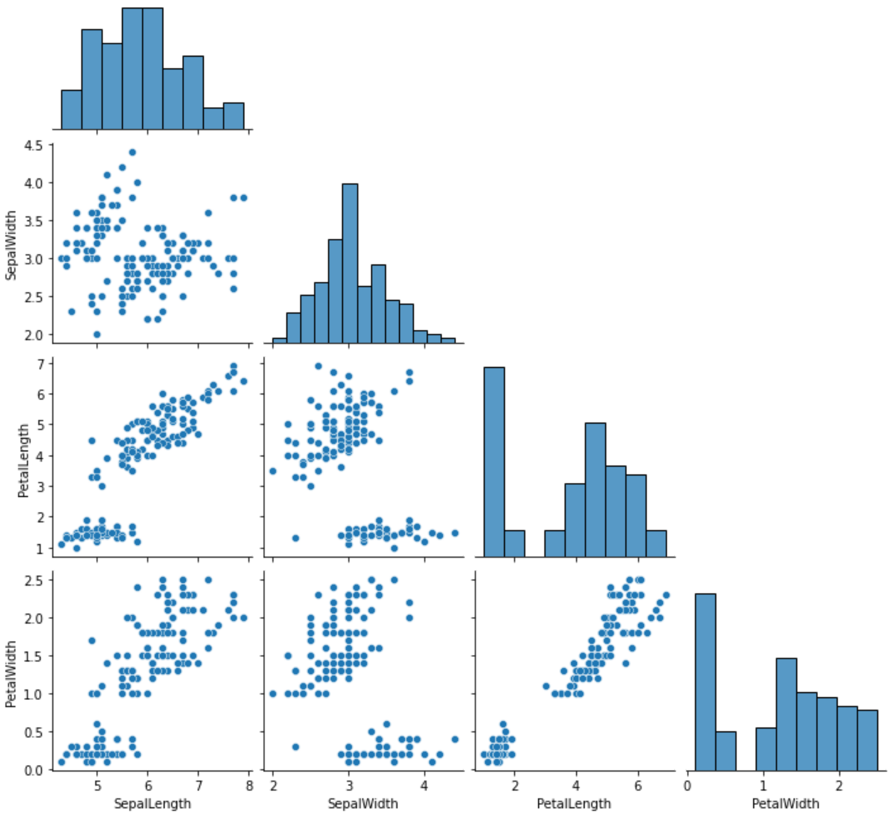
1. Do clustering with the iris flower dataset to form clusters using as features the four features

```
df1 = df.loc[:,["SepalLength","SepalWidth","PetalLength","PetalWidth"]]
df1.head()
```

	SepalLength	SepalWidth	PetalLength	PetalWidth
0	5.1	3.5	1.4	0.2
1	4.9	3.0	1.4	0.2
2	4.7	3.2	1.3	0.2
3	4.6	3.1	1.5	0.2
4	5.0	3.6	1.4	0.2

```
# Pairplot: Scatterplot of all variables
sp1= sns.pairplot(data= df1, diag_kind="hist",corner=True)
sp1
```

```
<seaborn.axisgrid.PairGrid at 0x7fb26aabc640>
```



```
# Import sklearn KMeans
from sklearn.cluster import KMeans

# Define number of clusters
```

```
#Let's assume there are 2,3,4,5...? clusters/groups
K  = 3

#Creat the Kmeans box
km = KMeans(n_clusters = K, n_init='auto')

# Do K-means clustering (assing each point in the dataset to a cluster)
yestimated1 = km.fit_predict(df1)


# Print estimated cluster of each point in the dataset
yestimated1
```

```
array([0, 2, 2, 2, 0, 0, 2, 0, 2, 2, 0, 0, 2, 2, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 2, 2, 0, 0, 0, 2, 2, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 2, 2, 0,
       0, 2, 0, 2, 0, 0, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 2, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1], dtype=int32)
```

```
# Add a new column to the dataset with the cluster information
df1['yestimated'] = yestimated1
df1.head()
```

	SepalLength	SepalWidth	PetalLength	PetalWidth	yestimated
0	5.1	3.5	1.4	0.2	0
1	4.9	3.0	1.4	0.2	2
2	4.7	3.2	1.3	0.2	2
3	4.6	3.1	1.5	0.2	2
4	5.0	3.6	1.4	0.2	0

```
# Print the labes of the existing clusters.
df1.yestimated.unique()
```

```
array([0, 2, 1], dtype=int32)
```

```
# Cluster centroides
ClustersC = km.cluster_centers_
ClustersC
```

```
array([[5.19375   , 3.63125   , 1.475     , 0.271875  ],
       [6.31458333, 2.89583333, 4.97395833, 1.703125  ],
       [4.73181818, 2.92727273, 1.77272727, 0.35      ]])
```

```
# Sum of squared error (sse) of the final model
km.inertia_
```

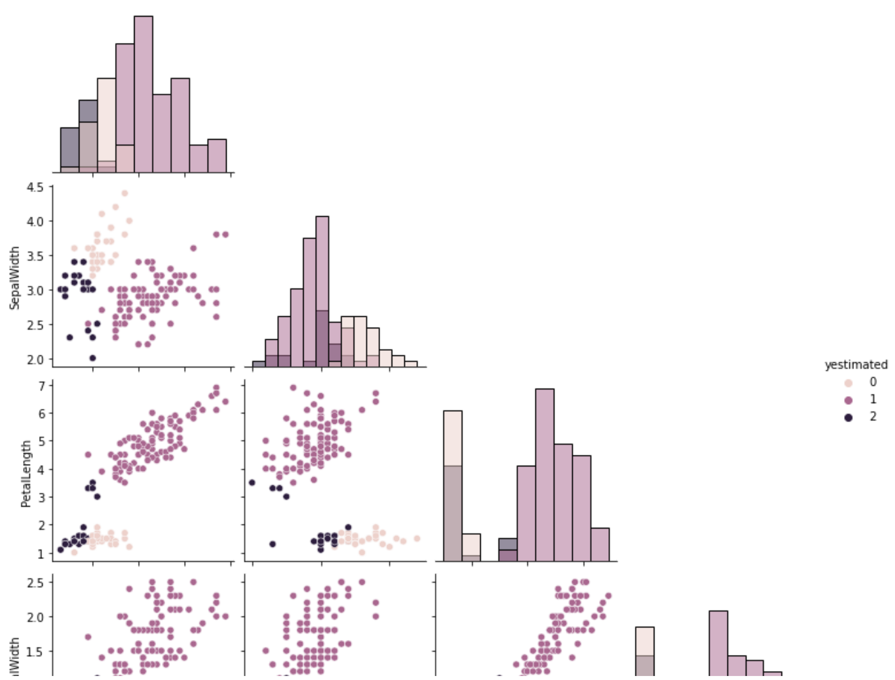
```
142.7540625
```

```
# The number of iterations required to converge
km.n_iter_
```

```
11
```

```
# Scatter plot of each cluster
sp2= sns.pairplot(data= df1, diag_kind="hist",corner=True,hue="yestimated")
sp2
```

```
<seaborn.axisgrid.PairGrid at 0x7fb2676b0a30>
```

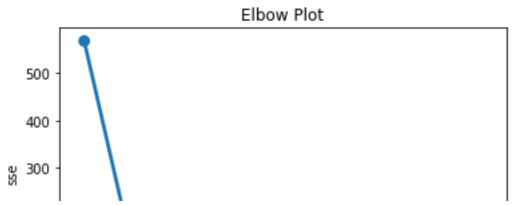


```
# Intialize a list to hold sum of squared error (sse)
sse = []

# Define values of k
k_rng= range(1,10)

# For each k
for k in k_rng:
  km = KMeans(n_clusters=k,n_init="auto")
  km.fit_predict(df1[["SepalLength","PetalLength"]])
  sse.append(km.inertia_)



#Base de datos para el elbow
ng= [1,2,3,4,5,6,7,8,9]
sse1 = pd.DataFrame({'Grupos': ng, 'sse':sse})
sse1
```

	Grupos	sse
0	1	566.493733
1	2	112.992072
2	3	53.809979
3	4	49.814874
4	5	25.634065
5	6	24.014102
6	7	18.884387
7	8	16.926267
8	9	13.438039

```
# Plot sse versus k
sp3 = sns.pointplot(data= sse1, x="Grupos", y="sse")
sp3.set_title("Elbow Plot")
```

```
Text(0.5, 1.0, 'Elbow Plot')
```



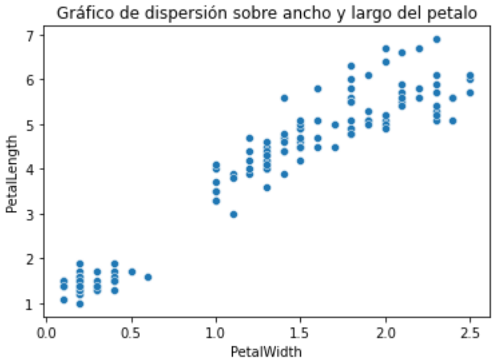
2. Do clustering with the iris flower dataset to form clusters using as features the two petal measurements: Drop out the other two features

```
df2 = df.loc[:,["PetalLength","PetalWidth"]]
df2.head()
```

	PetalLength	PetalWidth
0	1.4	0.2
1	1.4	0.2
2	1.3	0.2
3	1.5	0.2
4	1.4	0.2

```
# Pairplot: Scatterplot of all variables
sp4= sns.scatterplot(data=df2,y="PetalLength",x="PetalWidth")
sp4.set_title("Gráfico de dispersión sobre ancho y largo del petalo")
```

```
Text(0.5, 1.0, 'Gráfico de dispersión sobre ancho y largo del petalo')
```



```
# Define number of clusters
#Let's assume there are 2,3,4,5...? clusters/groups
K  = 3

#Creat the Kmeans box
km = KMeans(n_clusters = K, n_init='auto')

# Do K-means clustering (assing each point in the dataset to a cluster)
yestimated2 = km.fit_predict(df2)


# Print estimated cluster of each point in the dataset
yestimated2
```

```
array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 2, 2, 2, 2, 0, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 0, 2, 2, 2, 2, 2, 2, 0, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 0, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2], dtype=int32)
```

```
# Add a new column to the dataset with the cluster information
df2['yestimated'] = yestimated2
df2.head()
```

	PetalLength	PetalWidth	yestimated
0	1.4	0.2	1
1	1.4	0.2	1
2	1.3	0.2	1
3	1.5	0.2	1

```
# Print the labes of the existing clusters.
df2.yestimated.unique()
```

```
array([1, 0, 2], dtype=int32)
```

```
# Cluster centroides
ClustersC = km.cluster_centers_
ClustersC
```

```
array([[4.26923077, 1.34230769],
       [1.462     , 0.246     ],
       [5.59583333, 2.0375    ]])
```

```
# Sum of squared error (sse) of the final model
km.inertia_
```

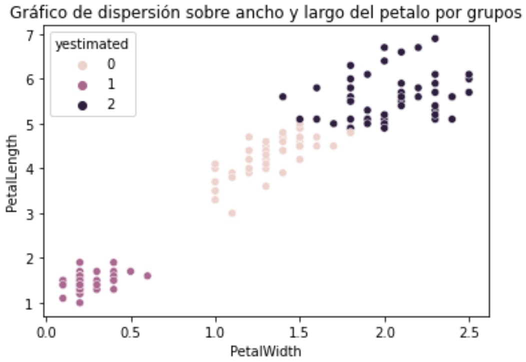
```
31.37135897435897
```

```
# The number of iterations required to converge
km.n_iter_
```

```
2
```

```
# Scatter plot of each cluster
sp5= sns.scatterplot(data=df2,y="PetalLength",x="PetalWidth",hue = 'yestimated')
sp5.set_title("Gráfico de dispersión sobre ancho y largo del petalo por grupos")
```

```
Text(0.5, 1.0, 'Gráfico de dispersión sobre ancho y largo del petalo por grupos')
```



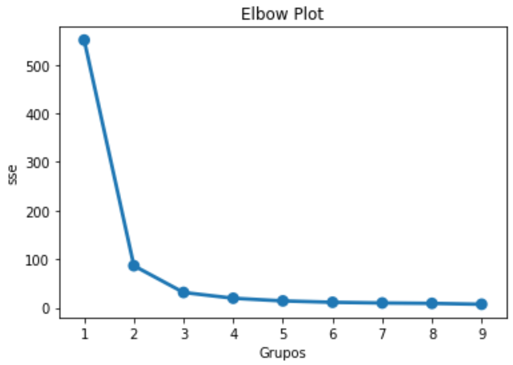
```
# Intialize a list to hold sum of squared error (sse)
sse2 = []

# Define values of k
k_rng= range(1,10)

# For each k
for k in k_rng:
  km = KMeans(n_clusters=k,n_init="auto")
  km.fit_predict(df2[["PetalLength","PetalWidth"]])
  sse2.append(km.inertia_)
```

```
#Base de datos para el elbow
sse2 = pd.DataFrame({'Grupos': ng, 'sse':sse2})
sse2
```

	Grupos	sse
0	1	550.895333
1	2	86.390220
2	3	31.371359
3	4	19.477123
4	5	13.983213
5	6	11.156897
6	7	9.741259

```
# Plot sse versus k
sp6 = sns.pointplot(data= sse2, x="Grupos", y="sse")
sp6.set_title("Elbow Plot")
```

```
Text(0.5, 1.0, 'Elbow Plot')
```



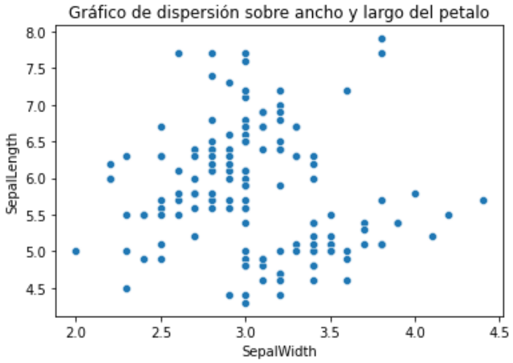
3. Do clustering with the iris flower dataset to form clusters using as features the two sepal measurements: Drop out the other two features

```
df3 = df.loc[:,["SepalLength","SepalWidth"]]
df3.head()
```

	SepalLength	SepalWidth
0	5.1	3.5
1	4.9	3.0
2	4.7	3.2
3	4.6	3.1
4	5.0	3.6

```
# Pairplot: Scatterplot of all variables
sp7= sns.scatterplot(data=df3,y="SepalLength",x="SepalWidth")
sp7.set_title("Gráfico de dispersión sobre ancho y largo del petalo")
```

```
Text(0.5, 1.0, 'Gráfico de dispersión sobre ancho y largo del petalo')
```



```
# Define number of clusters
#Let's assume there are 2,3,4,5...? clusters/groups
K  = 4
```

```
#Creat the Kmeans box
km = KMeans(n_clusters = K, n_init='auto')

# Do K-means clustering (assing each point in the dataset to a cluster)
yestimated3 = km.fit_predict(df3)


# Print estimated cluster of each point in the dataset
yestimated3
```

```
array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 0, 0, 0, 2, 0, 2, 0, 2, 0, 2, 2, 2, 2, 2, 2, 0,
       2, 2, 2, 2, 2, 2, 2, 2, 0, 0, 0, 0, 2, 2, 2, 2, 2, 2, 2, 2, 0, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 0, 2, 3, 0, 0, 3, 2, 3, 0, 3,
       0, 0, 0, 2, 2, 0, 0, 3, 3, 2, 0, 2, 3, 2, 0, 3, 2, 2, 0, 3, 3, 3,
       0, 2, 2, 3, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 2, 0, 0, 2], dtype=int32)
```

```
# Add a new column to the dataset with the cluster information
df3['yestimated'] = yestimated3
df3.head()
```

	SepalLength	SepalWidth	yestimated
0	5.1	3.5	1
1	4.9	3.0	1
2	4.7	3.2	1
3	4.6	3.1	1
4	5.0	3.6	1

```
# Print the labes of the existing clusters.
df3.yestimated.unique()
```

```
array([1, 0, 2, 3], dtype=int32)
```

```
# Cluster centroides
ClustersC = km.cluster_centers_
ClustersC
```

```
array([[6.58571429e+00, 3.05714286e+00, 1.00000000e+00],
       [5.00600000e+00, 3.42800000e+00, 2.00000000e+00],
       [5.77358491e+00, 2.69245283e+00, 9.99200722e-16],
       [7.47500000e+00, 3.12500000e+00, 1.00000000e+00]])
```

```
# Sum of squared error (sse) of the final model
km.inertia_
```

```
29.942571428571434
```

```
# The number of iterations required to converge
km.n_iter_
```

```
4
```

```
# Scatter plot of each cluster
sp8= sns.scatterplot(data=df3,y="SepalLength",x="SepalWidth",hue = 'yestimated')
sp8.set_title("Gráfico de dispersión sobre ancho y largo del sépalo por grupos")
```

```
Text(0.5, 1.0, 'Gráfico de dispersión sobre ancho y largo del sépalo por grupos')
```

Gráfico de dispersión sobre ancho y largo del sépalo por grupos

```
# Intialize a list to hold sum of squared error (sse)
sse3 = []

# Define values of k
k_rng= range(1,10)

# For each k
for k in k_rng:
  km = KMeans(n_clusters=k,n_init="auto")
  km.fit_predict(df3[["SepalLength","SepalWidth"]])
  sse3.append(km.inertia_)
```

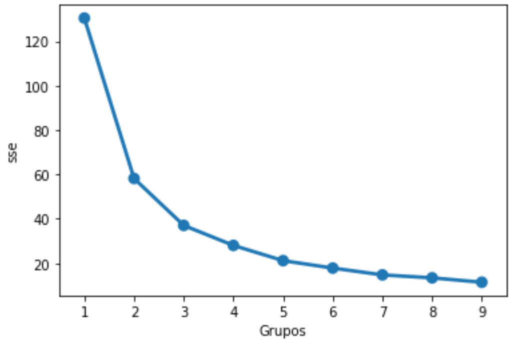
SepalWidth

```
#Base de datos para el elbow
sse3 = pd.DataFrame({'Grupos': ng, 'sse':sse3})
sse3
```

	Grupos	sse
0	1	130.475267
1	2	58.204093
2	3	37.050702
3	4	28.034982
4	5	21.171898
5	6	17.818369
6	7	14.753496
7	8	13.415184
8	9	11.438471

```
# Plot sse versus k
sp9 = sns.pointplot(data= sse3, x="Grupos", y="sse")
sp9.set_title("Elbow Plot")
```

```
Text(0.5, 1.0, 'Elbow Plot')
```



Elbow Plot

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