

Practico Mentoría - Aprendizaje No Supervisado

El objetivo de este práctico es realizar [Clustering](#) sobre el Dataset de las Características de los jugadores.

De forma de juntar en los clusters a los jugadores con características similares, y en particular de este práctico analizar si estos clusters se corresponden con la posición en la que juegan estos jugadores.

Alumno: Flavio Olivier (Omega)

## Importaciones

```
In [1]: %load_ext autoreload  
        %autoreload 2  
  
        %matplotlib inline
```

```
In [2]: #paqueteria...

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import scipy as sp
import warnings

from sklearn.decomposition import PCA
from sklearn.cluster import KMeans
```

```
In [3]: warnings.filterwarnings('ignore')
sns.set_style("whitegrid")
```

```
In [4]: # Seteamos una semilla para Reproducibilidad
np.random.seed(1)
```

## Carga del Dataset

```
In [5]: #dataloader...  
  
path = 'https://raw.githubusercontent.com/diplodatos2019mentoría/Aprendizaje_No_Supervisado/master/'  
  
player_df = pd.read_csv(path + 'Datasets/football_player_full.csv', index_col = 'player_name')  
  
print("Shape 'player_df' = {}".format(player_df.shape))  
  
# Copy Dataframe  
player2_df = player_df.copy(deep = False)
```

```
In [6]: plottwo(df.sample(10))
```

Out[6]:	overall_rating	potential	crossing	finishing	heading_accuracy	short_passing	volleys	dribbling	curve	free_kick_accuracy	...	penalties	...
player_name													
Ariel Borysiuk	66.12	74.38	56.92	49.79	49.38	67.25	58.88	64.08	45.79	52.38	...	49.21	...
Sava Milladinovic Bento	58.00	64.43	51.07	44.86	42.93	58.14	46.21	58.29	50.64	52.86	...	49.50	...
Dusan Tadic	78.16	81.88	81.52	68.36	56.64	78.60	69.84	81.36	79.72	73.08	...	76.28	...
Samuel Souprayen	64.24	71.76	58.29	20.76	57.19	56.90	22.10	55.71	61.67	31.67	...	42.71	...
Daniele Croce	67.68	67.68	63.32	51.58	44.74	72.16	53.89	66.16	54.95	58.74	...	59.74	...
John Arne Riise	76.32	77.64	84.00	60.82	67.05	78.32	75.05	69.41	74.05	77.55	...	70.59	...

In [7]: player2\_df.dtypes

```
Out[7]: overall_rating      float64
          potential        float64
          crossing         float64
          finishing        float64
          heading_accuracy float64
          short_passing    float64
          volleys          float64
```

```

dribbling      float64
curve          float64
free_kick_accuracy float64
long_passing   float64
ball_control   float64
acceleration   float64
sprint_speed   float64
agility         float64
reactions       float64
balance         float64
shot_power     float64
jumping        float64

```

```
In [8]: # NO
player2_position_list = player2_df.position.tolist()
```

```
In [9]: player2_df = player2_df[[
    'overall_rating', 'potential', 'crossing', 'finishing', 'heading_accuracy',
    'short_passing', 'volleys', 'dribbling', 'curve', 'free_kick_accuracy',
    'long_passing', 'ball_control', 'acceleration', 'sprint_speed', 'agility',
    'reactions', 'balance', 'shot_power', 'jumping', 'stamina', 'strength',
    'long_shots', 'aggression', 'interceptions', 'positioning', 'vision',
    'penalties', 'marking', 'standing_tackle', 'sliding_tackle',
    'gk_diving', 'gk_handling', 'gk_kicking', 'gk_positioning', 'gk_reflexes',
]]]
```

```
In [10]: player2_df.dtypes
```

```

Out[10]: overall_rating      float64
potential           float64
crossing            float64
finishing           float64
heading_accuracy    float64
short_passing       float64
volleys             float64
dribbling           float64
curve               float64
free_kick_accuracy float64
long_passing        float64
ball_control        float64
acceleration        float64
sprint_speed        float64
agility              float64
reactions            float64
balance             float64
shot_power           float64
jumping              float64

```

```
In [11]: player2_df.sample(10)
```

```
Out[11]:
   overall_rating  potential  crossing  finishing  heading_accuracy  short_passing  volleys  dribbling  curve  free_kick_accuracy ... vision  penalties
player_name
Rolando Mandragora  60.93    73.13    47.87    44.33          48.07    69.33    41.67    60.07    49.67 ... 33.67 ... 65.07    31
Daniel Pinillos    59.71    66.14    59.57    32.14          48.14    48.29    33.14    52.29    57.57 ... 39.14 ... 43.86    46
Stopira            60.25    65.00    56.00    28.00          32.00    49.00    32.00    44.00    47.00 ... 42.00 ... 51.00    45
Kakha Kaladze     78.50    83.10    67.30    32.80          77.10    71.20    46.00    51.70    44.00 ... 48.30 ... 61.00    64
Sergi Darder      69.43    75.61    48.91    39.13          35.65    77.17    36.04    63.83    61.87 ... 54.26 ... 75.00    38
Zeljko Brkic      75.00    77.12    18.50    19.00          17.50    32.71    16.58    20.17    17.88 ... 18.42 ... 27.33    31
Stephen Elliott   66.50    70.93    52.79    67.14          65.64    59.79    61.14    64.21    52.00 ... 47.71 ... 64.93    63

```

## Aplicar Clustering sobre las features de los jugadores

Usar [K-Means](#) para el clustering.

Probar primero con 4 clusters, este numero se debe a cantidad de clases con respecto a la posicion de los jugadores:

- **GK**: Goalkeeper (Arquero)
- **DEF**: Defensor (Defensor)
- **MID**: Midfielder (Mediocampistas)
- **FW**: Forward (Delantero)

Luego de hacer clustering, ver cuantos elementos tiene cada cluster.

```
In [12]: # TODO
km_pred = KMeans(n_clusters = 4, random_state = 42).fit_predict(player2_df)
km_pred
```

```
Out[12]: array([0, 3, 2, ..., 0, 3, 2])
```

```
In [13]: #resultó algo así...
pd.concat([player2_df['position'].reset_index(), pd.DataFrame(km_pred, columns = ['clusternum']), auto = 1], axis = 1).set_index('player_name')
```

```
Out[13]:
```

player_name	position	cluster
Aaron Appindangoye	DEF	0
Aaron Cresswell	DEF	3
Aaron Doran	MID	2
Aaron Galindo	DEF	0
Aaron Hughes	DEF	0
Aaron Hunt	MID	2
Aaron Kuhl	MID	0
Aaron Lennon	MID	2
Aaron Lennox	GK	1
Aaron Meijers	MID	3

```
In [14]: #side by side...
from IPython.display import display_html

def siamesas(*args):
    html_str = ''
    spaciador = '<table style="min-width: 30px !important;"><tr style="min-width: 30px !important; background:none !important;">'
    for df in args:
        html_str += df.to_html() + spaciador

    display_html(html_str.replace('table', 'table style = "display:inline"'), raw = True)
```

```
In [15]: #clases originales...
#... y predichas.

siamesas(pd.DataFrame(player_df.position.value_counts()), pd.DataFrame(km_pred, columns = ['cluster']).cluster.value_counts())
```

position	cluster	
DEF	3664	2 3506
MID	3473	3 2877
FW	1919	0 2673
GK	869	1 869

### Evaluar resultados

Evaluar los resultados del clustering usando una medida como la [Pureza](#).

**Hint 1:** Puede que en los clusters haya confusión entre las distintas posiciones dentro del campo de juego, esto no está mal. Ya que hay que recordar que las posiciones están simplificadas.

**Hint 2:** Un indicador de mala calidad es que haya clusters muy chiquitos y uno muy grande, lo cual indica que en el espacio no se distinguen bien grupos separados y hay que usar otro espacio.

```
In [16]: #purity...
from sklearn import metrics

contingency_matrix = metrics.cluster.contingency_matrix(player_df['position'].values, km_pred)
print(contingency_matrix)
print()
print('Purity: {}'.format(contingency_matrix.max(axis = 1).sum() / contingency_matrix.sum()))

[[2417  0  0 1247]
 [ 3  0 1881 35]
 [ 0 869  0  0]
 [253  0 1625 1595]]
```

Purity: 0.6843324937027708

```
In [17]: #normalized mutual information or NMI...
from sklearn.metrics.cluster import normalized_mutual_info_score

print('NMI: {}'.format(normalized_mutual_info_score(player_df['position'].values, km_pred)))
```

NMI: 0.5629166802850829

```
In [18]: #rand index score...
from sklearn.metrics.cluster import adjusted_rand_score

print('Rand index: {}'.format(adjusted_rand_score(player_df['position'].values, km_pred)))
```

Rand index: 0.4033761167152728

### Diferentes numero de clusters

Usar diferentes numero de clusters, especialmente numeros altos, para observar las subdivisiones de las clases, y que clases se confunden mas.

**Nota:** Las posiciones asignadas a los jugadores son simplificadas, esto quiere decir que al hacer mas de 4 clusters podemos llegar a descubrir posiciones mas específicas dentro del campo de juego (por ejemplo: Defensor central, Lateral derecho/izquierdo, Mediocampista defensivo/ofensivo, etc.)

**Recordar:** Calcular la Pureza para analizar si tener una mayor cantidad de clusters da mejores resultados.

```
In [19]: #purezas...
for bucle in range(2, 10):
    km_pred = KMeans(n_clusters = bucle, random_state = 42).fit_predict(player2_df)
    contingency_matrix = metrics.cluster.contingency_matrix(player2_df['position'].values, km_pred)
    print('Purity para k={}: {}'.format(bucle, contingency_matrix.max(axis = 1).sum() / contingency_matrix.sum()))

Purity para k=2: 1.0
Purity para k=3: 0.8798992443324937
Purity para k=4: 0.6843324937027708
Purity para k=5: 0.5802518891687657
Purity para k=6: 0.4738539042821159
Purity para k=7: 0.469823677581864
Purity para k=8: 0.39476070528967255
Purity para k=9: 0.374911838790932
```

## Subconjunto de Features

Probar diferentes subconjunto de características del dataset para analizar si los resultados mejoran.

Por ejemplo, probar con el siguiente subconjunto de características:

- gk\_diving
- gk\_handling
- gk\_kicking
- gk\_positioning
- standing\_tackle
- sliding\_tackle
- short\_passing
- vision
- finishing
- volleys

Tambien probar con otros subconjuntos.

**Recordar:** Calcular la Pureza

```
In [20]: #subset...
player3_df = player2_df[['gk_diving', 'gk_handling', 'gk_kicking', 'gk_positioning', 'standing_tackle',
                           'sliding_tackle', 'short_passing', 'vision', 'finishing', 'volleys']]
player3_df.dtypes
```

```
Out[20]: gk_diving      float64
gk_handling     float64
gk_kicking      float64
gk_positioning   float64
standing_tackle float64
sliding_tackle   float64
short_passing    float64
vision          float64
finishing        float64
volleys          float64
dtype: object
```

```
In [21]: #ejecutamos KMeans...
k = 4
km_pred = KMeans(n_clusters = k, random_state = 42).fit_predict(player3_df)

contingency_matrix = metrics.cluster.contingency_matrix(player2_df['position'].values, km_pred)
print('Purity para k={}: {}'.format(k, contingency_matrix.max(axis = 1).sum() / contingency_matrix.sum()))
```

Purity para k=4: 0.7182871536523929

## Uso de Embedding

Aplicar el uso de embeddings, por ejemplo [PCA](#), para comparar que sucede en ese espacio en comparacion con lo que sucede en el espacio original.

```
In [22]: #embedding sobre data total...
from sklearn.preprocessing import StandardScaler

X = player2_df.values
y = player2_df['position'].values

#estandarizamos X...
X = StandardScaler().fit_transform(X)

#PCA...
pca = PCA(n_components = 2)
PrincipalComponents = pca.fit_transform(X)

#display(pd.DataFrame(PrincipalComponents, columns = ['PC_1', 'PC_2']))

#Kmeans sobre PCA...
km_pred = KMeans(n_clusters = 4, random_state = 42).fit_predict(PrincipalComponents)
```

```

contingency_matrix = metrics.cluster.contingency_matrix(player_df['position'].values, km_pred)
print(contingency_matrix)
print()
print('Purity: {}'.format(contingency_matrix.max(axis = 1).sum() / contingency_matrix.sum()))

[[ 5   0 2364 1295]
 [1844   0   32  43]
 [ 0 869   0   0]
 [1833   0 280 1360]]

Purity: 0.6962216624685138

```

mejora algunas décimas...

```

In [23]: #embedding sobre subset...
X = player3_df.values
y = player_df['position'].values

#estandarizamos X...
X = StandardScaler().fit_transform(X)

#PCA...
pca = PCA(n_components = 2)
PrincipalComponents = pca.fit_transform(X)

#display(pd.DataFrame(PrincipalComponents, columns = ['PC_1', 'PC_2']))

#Kmeans sobre PCA...
km_pred = KMeans(n_clusters = 4, random_state = 42).fit_predict(PrincipalComponents)

contingency_matrix = metrics.cluster.contingency_matrix(player_df['position'].values, km_pred)
print(contingency_matrix)
print()
print('Purity: {}'.format(contingency_matrix.max(axis = 1).sum() / contingency_matrix.sum()))

[[ 0 814   0 2850]
 [1871  48   0   0]
 [ 0   0 869   0]
 [1540 1780   0 153]]

Purity: 0.7425692695214106

```

mejora unos puntos...

```

In [24]: #aplicamos silhouette sobre el embedding del subset y observamos...
from sklearn.metrics import silhouette_samples, silhouette_score
import matplotlib.cm as cm

X = PrincipalComponents.copy()
range_n_clusters = 10
sse = {}
for n_clusters in range(2, range_n_clusters):
    # Create a subplot with 1 row and 2 columns
    fig, (ax1, ax2) = plt.subplots(1, 2)
    fig.set_size_inches(18, 7)

    # The 1st subplot is the silhouette plot
    # The silhouette coefficient can range from -1, 1 but in this example all
    # lie within [-0.1, 1]
    ax1.set_xlim([-0.1, 1])
    # The (n_clusters+1)*10 is for inserting blank space between silhouette
    # plots of individual clusters, to demarcate them clearly.
    ax1.set_ylim([0, len(X) + (n_clusters + 1) * 10])

    # Initialize the clusterer with n_clusters value and a random generator
    # seed of 10 for reproducibility.
    clusterer = KMeans(n_clusters = n_clusters, random_state = 42)
    cluster_labels = clusterer.fit_predict(X)
    sse[n_clusters] = clusterer.inertia_

    # The silhouette_score gives the average value for all the samples.
    # This gives a perspective into the density and separation of the formed
    # clusters
    silhouette_avg = silhouette_score(X, cluster_labels)
    print('Para n_clusters =', n_clusters, 'El silhouette_score promedio es :', silhouette_avg)

    # Compute the silhouette scores for each sample
    sample_silhouette_values = silhouette_samples(X, cluster_labels)

    y_lower = 10
    for i in range(n_clusters):
        # Aggregate the silhouette scores for samples belonging to
        # cluster i, and sort them
        ith_cluster_silhouette_values = \
            sample_silhouette_values[cluster_labels == i]

        ith_cluster_silhouette_values.sort()

        size_cluster_i = ith_cluster_silhouette_values.shape[0]
        y_upper = y_lower + size_cluster_i

        color = cm.nipy_spectral(float(i) / n_clusters)
        ax1.fill_betweenx(np.arange(y_lower, y_upper),
                         0, ith_cluster_silhouette_values,
                         facecolor = color, edgecolor = color, alpha = 0.7)

        # Label the silhouette plots with their cluster numbers at the middle
        ax1.text(-0.05, y_lower + 0.5 * size_cluster_i, str(i))

```

```

# Compute the new y_lower for next plot
y_lower = y_upper + 10 # 10 for the 0 samples

ax1.set_title('Visualizacion de los datos.', fontsize = 14)
ax1.set_xlabel('espacio de la primera caracteristica', fontsize = 14)
ax1.set_ylabel('espacio de la segunda caracteristica', fontsize = 14)

# The vertical line for average silhouette score of all the values
ax1.axvline(x = silhouette_avg, color = 'red', linestyle = '--')

ax1.set_yticks([]) # Clear the yaxis labels / ticks
ax1.set_xticks([-0.1, 0, 0.2, 0.4, 0.6, 0.8, 1])

# 2nd Plot showing the actual clusters formed
colors = cm.nipy_spectral(cluster_labels.astype(float) / n_clusters)
ax2.scatter(X[:, 0], X[:, 1], marker = '.', s = 30, lw = 0, alpha = 0.7,
            c = colors, edgecolor = 'k')

# Labeling the clusters
centers = clusterer.cluster_centers_
# Draw white circles at cluster centers
ax2.scatter(centers[:, 0], centers[:, 1], marker = 'o',
            c = 'white', alpha = 1, s = 200, edgecolor = 'k')

for i, c in enumerate(centers):
    ax2.scatter(c[0], c[1], marker = '%d' % i, alpha = 1,
                s = 50, edgecolor = 'k')

ax2.set_title('Visualizacion de los datos.', fontsize = 14)
ax2.set_xlabel('espacio de la primera caracteristica', fontsize = 14)
ax2.set_ylabel('espacio de la segunda caracteristica', fontsize = 14)

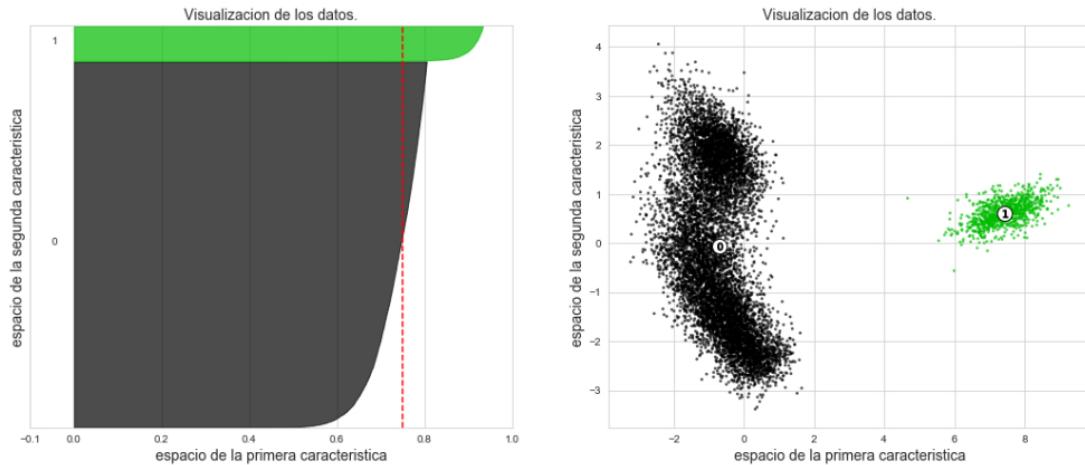
plt.suptitle((('Analisis de silueta para Kmedias ' +
               'con n_clusters = %d' % n_clusters),
               'fontsize = 14, fontweight = 'bold')
               '#plt.savefig("kmeans_%d" % n_clusters, dpi=300)

plt.show()

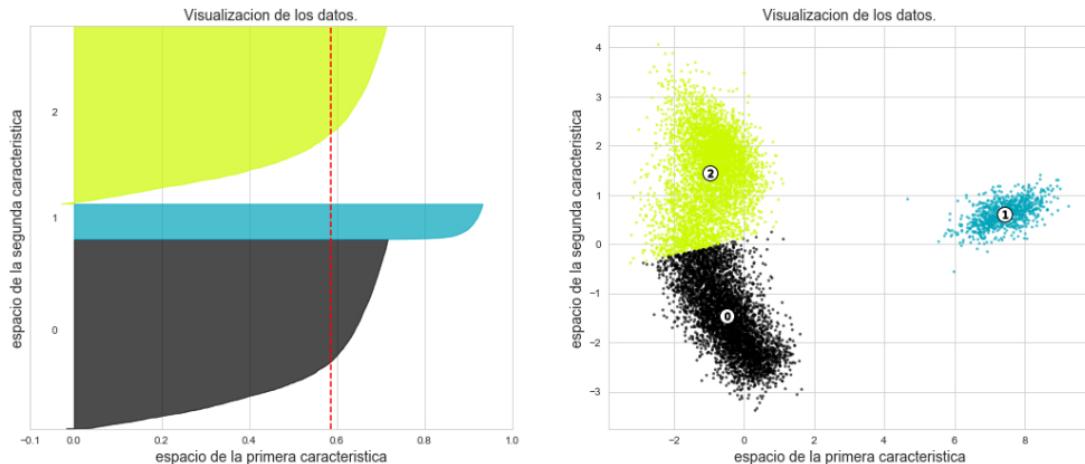
```

Para n\_clusters = 2 El silhouette\_score promedio es : 0.7496035117026996  
 Para n\_clusters = 3 El silhouette\_score promedio es : 0.5851505877728135  
 Para n\_clusters = 4 El silhouette\_score promedio es : 0.5174570129637844  
 Para n\_clusters = 5 El silhouette\_score promedio es : 0.4546350856569354  
 Para n\_clusters = 6 El silhouette\_score promedio es : 0.4253978573221953  
 Para n\_clusters = 7 El silhouette\_score promedio es : 0.39889557616069626  
 Para n\_clusters = 8 El silhouette\_score promedio es : 0.3894503538865469  
 Para n\_clusters = 9 El silhouette\_score promedio es : 0.39140187741250443

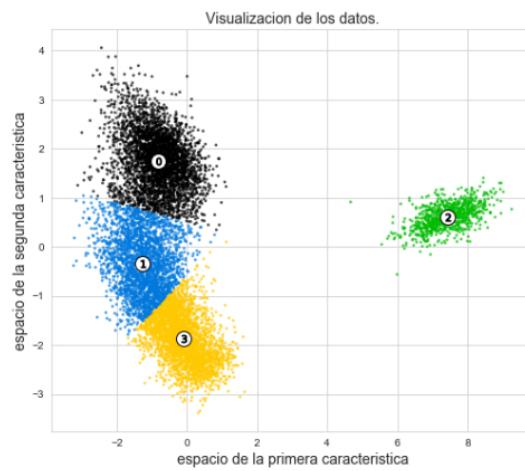
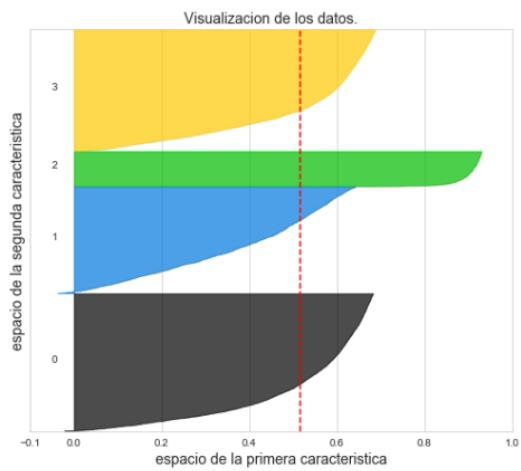
Analisis de silueta para Kmedias con n\_clusters = 2



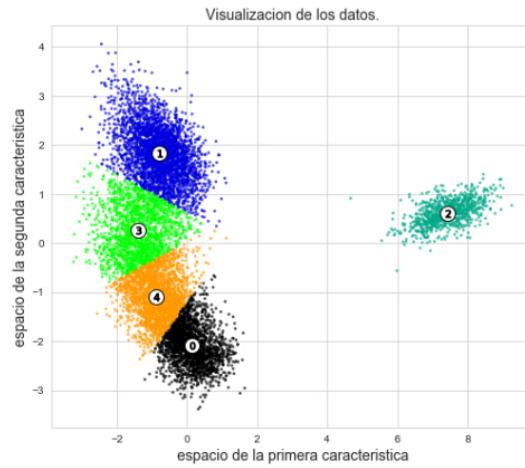
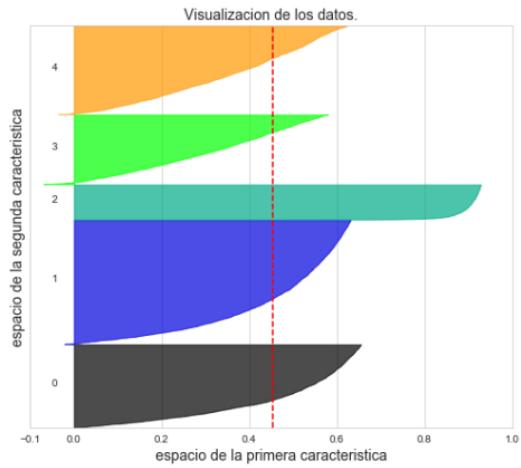
Analisis de silueta para Kmedias con n\_clusters = 3



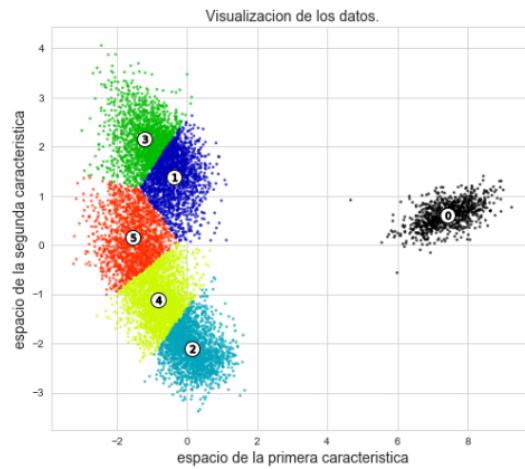
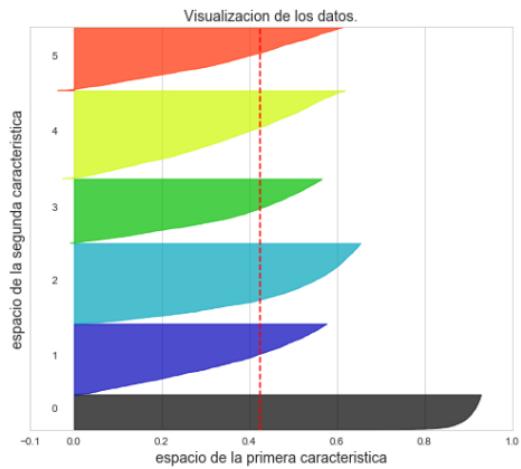
Analisis de silueta para Kmedias con n\_clusters = 4



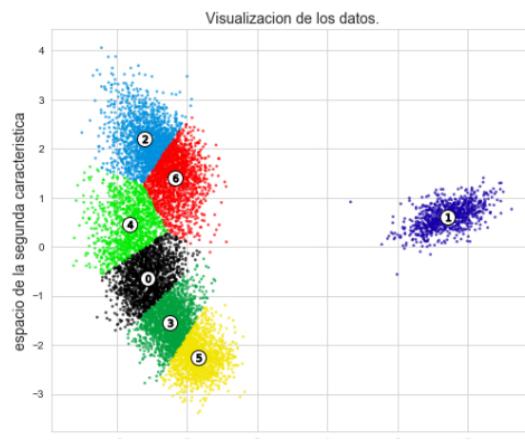
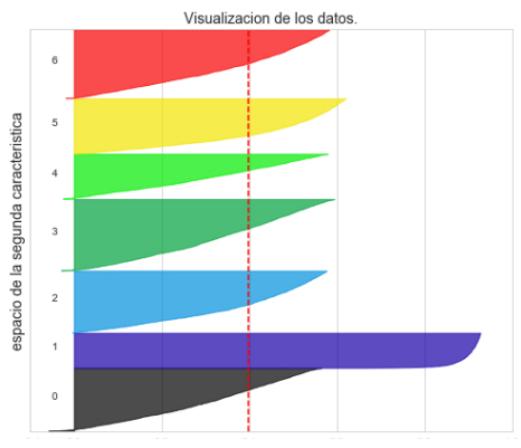
Analisis de silueta para Kmedios con n\_clusters = 5



Analisis de silueta para Kmedios con n\_clusters = 6

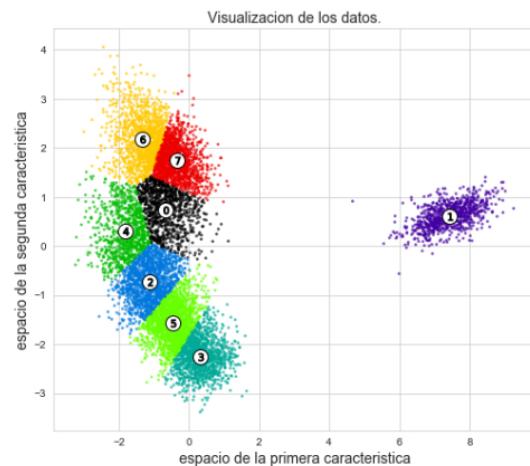
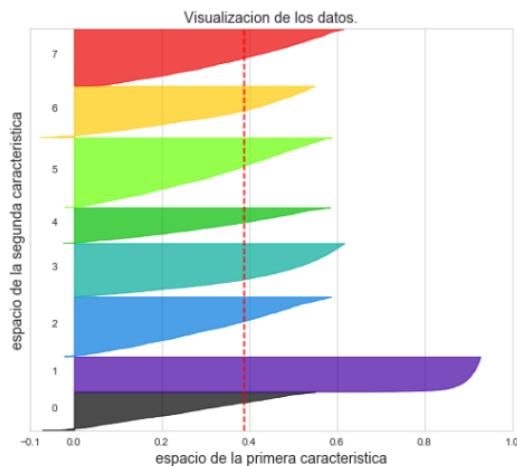


Analisis de silueta para Kmedios con n\_clusters = 7

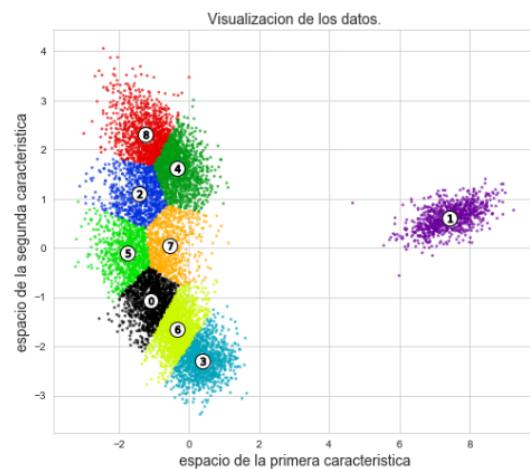
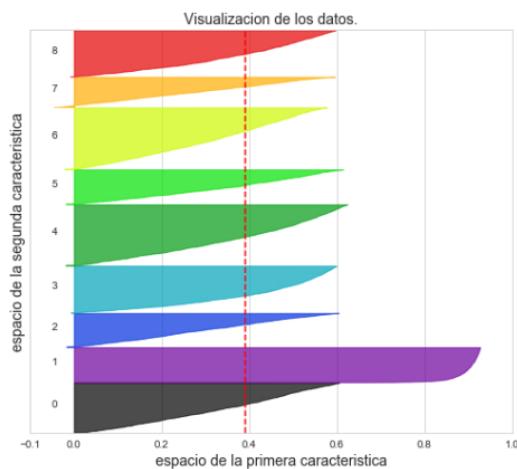




Analisis de silueta para Kmedias con n\_clusters = 8



Analisis de silueta para Kmedias con n\_clusters = 9



#### Comunicación de Resultados

Se pide que toda esta información no quede plasmada solamente en un Jupyter Notebook, sino que se diagrame una comunicación en formato textual o interactivo (Google Docs, PDF o Markdown por ejemplo).

La comunicación debe estar apuntada a un público técnico pero sin conocimiento del tema particular, como por ejemplo, sus compañeros de clase.

In [ ]: