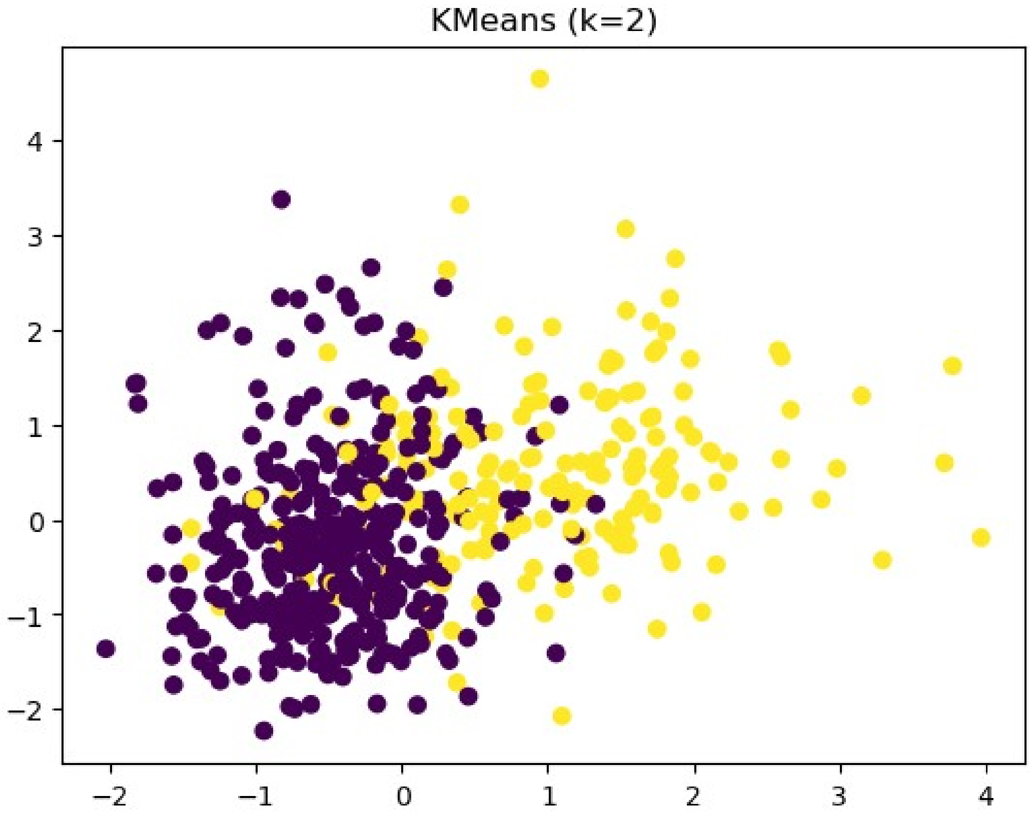
```python
import pandas as pd
#nazwy kolumn
column_names = [
    "ID", "Diagnosis",
    "radius1", "texture1", "perimeter1", "area1", "smoothness1",
"compactness1", "concavity1", "concave_points1",
    "symmetry1", "fractal_dimension1",
    "radius2", "texture2", "perimeter2", "area2", "smoothness2",
"compactness2", "concavity2", "concave_points2",
    "symmetry2", "fractal_dimension2",
    "radius3", "texture3", "perimeter3", "area3", "smoothness3",
"compactness3", "concavity3", "concave_points3",
    "symmetry3", "fractal_dimension3"
]

# Ścieżka do pliku CSV
sciezka = 'wdbc.csv'

# Wczytywanie pliku CSV do DataFrame
df = pd.read_csv(sciezka, header=None, names=column_names)

# Wyświetlenie pierwszych 5 wierszy
print(df.head())
```

```
         ID Diagnosis  radius1  texture1  perimeter1   area1
smoothness1  \
0    842302         M    17.99     10.38      122.80  1001.0
0.11840
1    842517         M    20.57     17.77      132.90  1326.0
0.08474
2  84300903         M    19.69     21.25      130.00  1203.0
0.10960
3  84348301         M    11.42     20.38       77.58   386.1
0.14250
4  84358402         M    20.29     14.34      135.10  1297.0
0.10030

   compactness1  concavity1  concave_points1  ...  radius3
texture3  \
0       0.27760      0.3001          0.14710  ...    25.38     17.33

1       0.07864      0.0869          0.07017  ...    24.99     23.41

2       0.15990      0.1974          0.12790  ...    23.57     25.53

3       0.28390      0.2414          0.10520  ...    14.91     26.50

4       0.13280      0.1980          0.10430  ...    22.54     16.67
```

```
   perimeter3   area3  smoothness3  compactness3  concavity3
concave_points3  \
0       184.60  2019.0       0.1622        0.6656      0.7119
0.2654
1       158.80  1956.0       0.1238        0.1866      0.2416
0.1860
2       152.50  1709.0       0.1444        0.4245      0.4504
0.2430
3        98.87   567.7       0.2098        0.8663      0.6869
0.2575
4       152.20  1575.0       0.1374        0.2050      0.4000
0.1625

   symmetry3  fractal_dimension3
0     0.4601             0.11890
1     0.2750             0.08902
2     0.3613             0.08758
3     0.6638             0.17300
4     0.2364             0.07678

[5 rows x 32 columns]
```

```python
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler
from sklearn.cluster import KMeans
from sklearn.metrics import silhouette_score

# Przygotowanie danych
X = df.drop(columns=["ID", "Diagnosis"])
X_scaled = StandardScaler().fit_transform(X)

# Testowanie różnych liczby skupień w KMeans
silhouette_scores = []
k_range = range(2, 11)

for k in k_range:
    kmeans = KMeans(n_clusters=k, random_state=0)
    labels = kmeans.fit_predict(X_scaled)
    score = silhouette_score(X_scaled, labels)
    silhouette_scores.append(score)
    print(f"Liczba skupień: {k}, Silhouette Score: {score:.2f}")

    plt.scatter(X_scaled[:, 0], X_scaled[:, 1], c=labels,
cmap='viridis')
    plt.title(f"KMeans (k={k})")
    plt.show()

# Wykres Silhouette Score vs liczba skupień
plt.plot(k_range, silhouette_scores, marker='o')
plt.title("Wpływ liczby skupień na Silhouette Score")
plt.xlabel("Liczba skupień (k)")
plt.ylabel("Silhouette Score")
plt.grid(True)
plt.show()
```

```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=3.
  warnings.warn(

Liczba skupień: 2, Silhouette Score: 0.34
```



```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
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  warnings.warn(

Liczba skupień: 3, Silhouette Score: 0.32
```
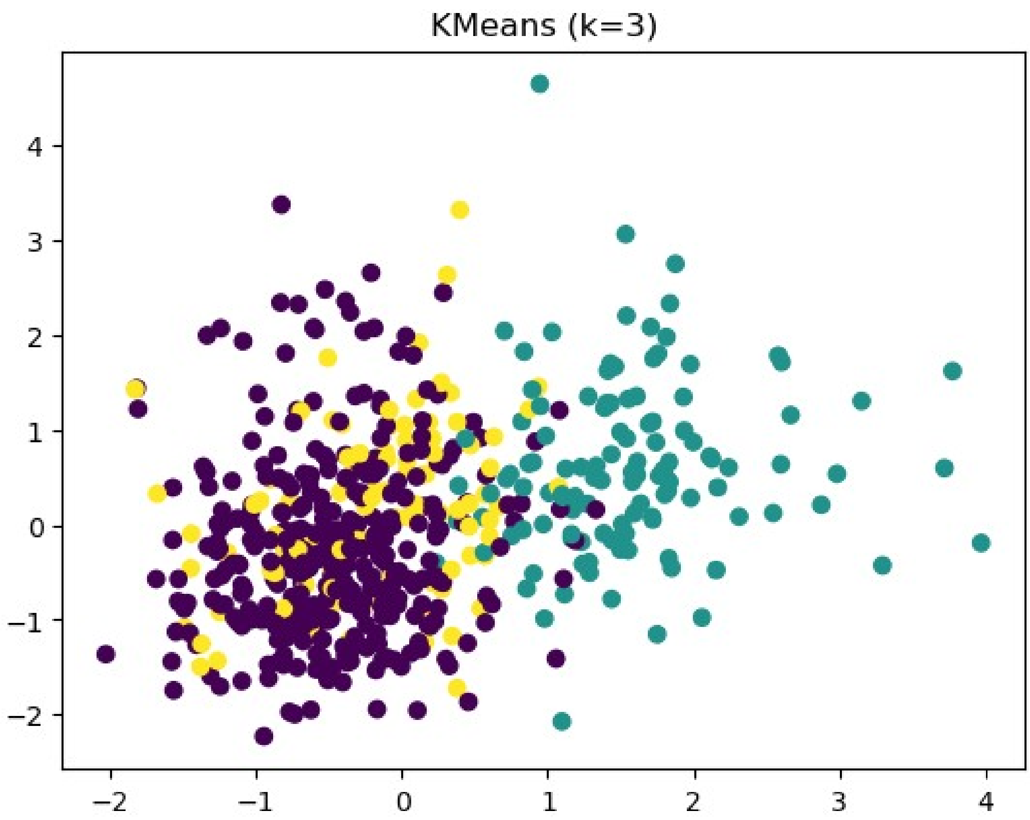
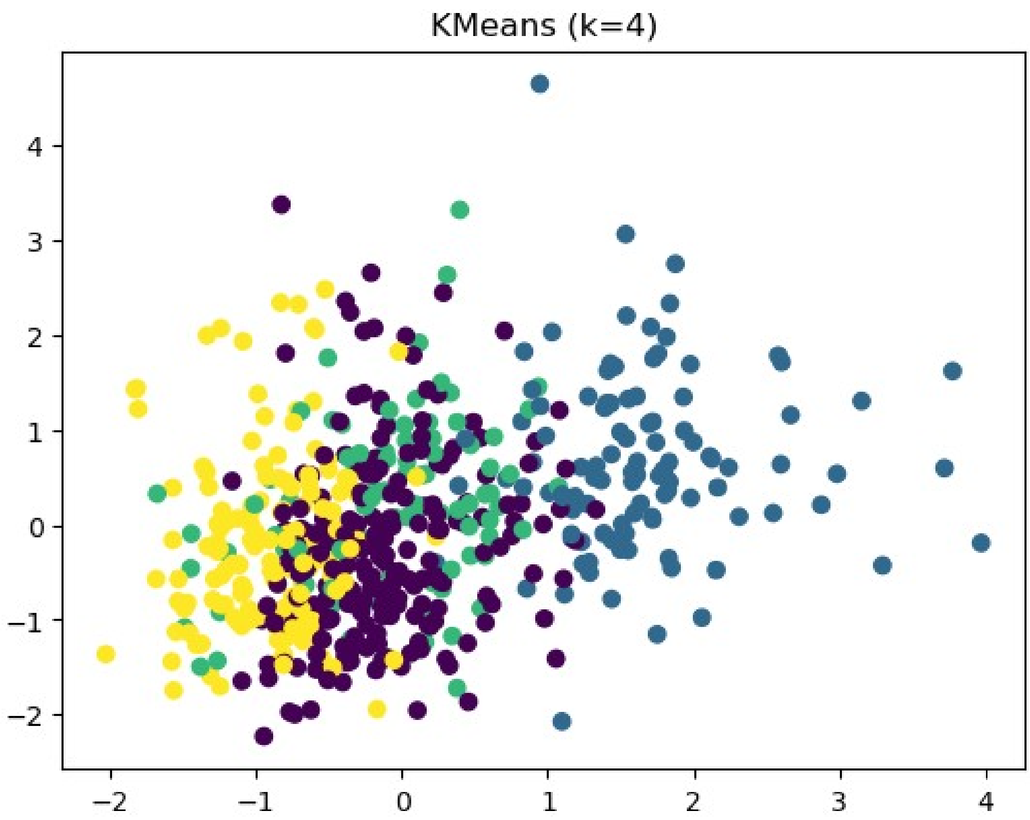
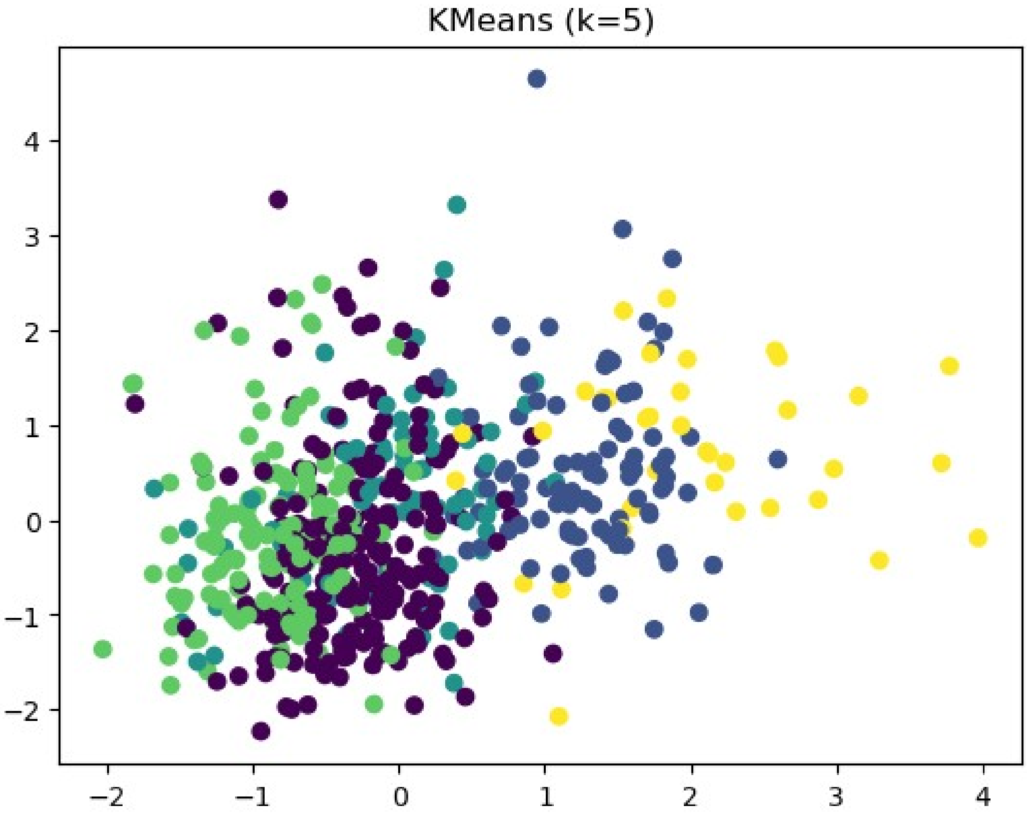



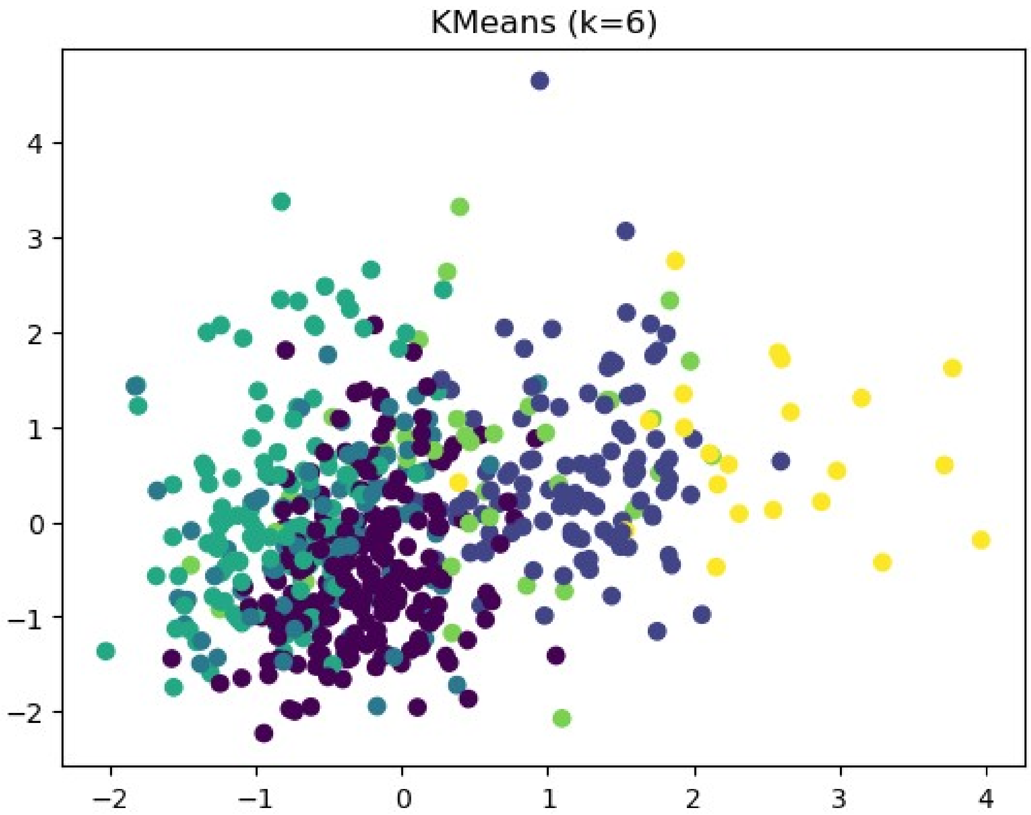
```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=3.
  warnings.warn(

Liczba skupień: 4, Silhouette Score: 0.16
```



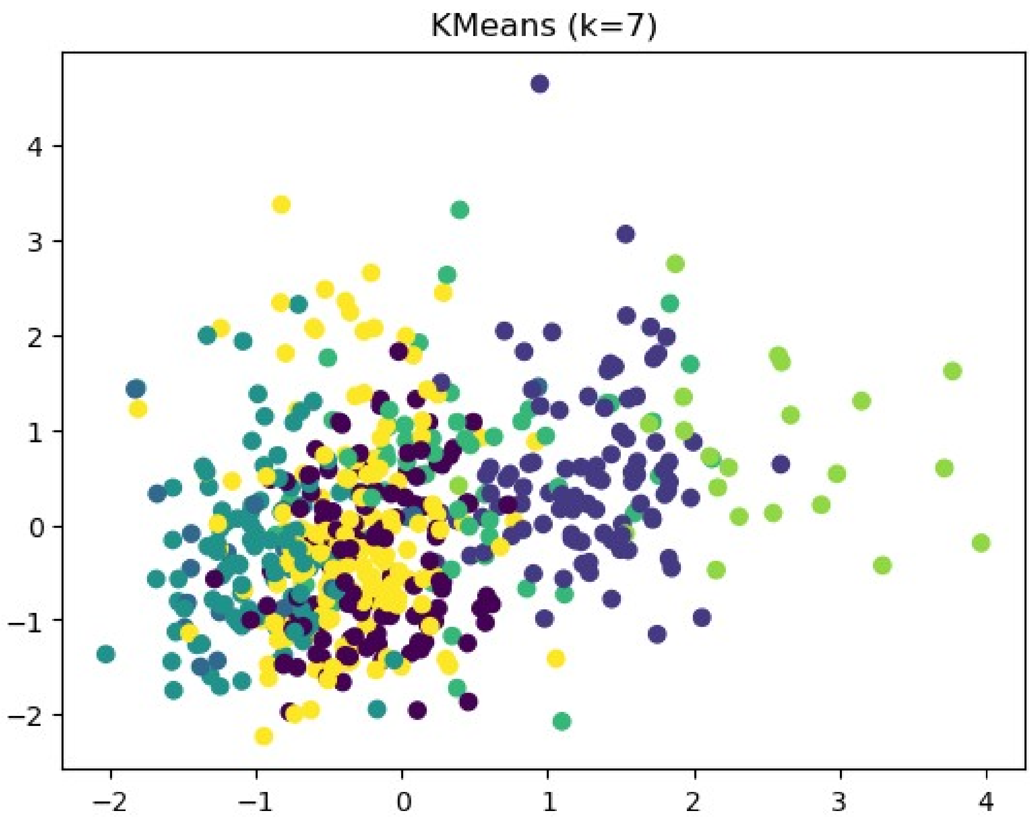
```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=3.
  warnings.warn(

Liczba skupień: 5, Silhouette Score: 0.17
```



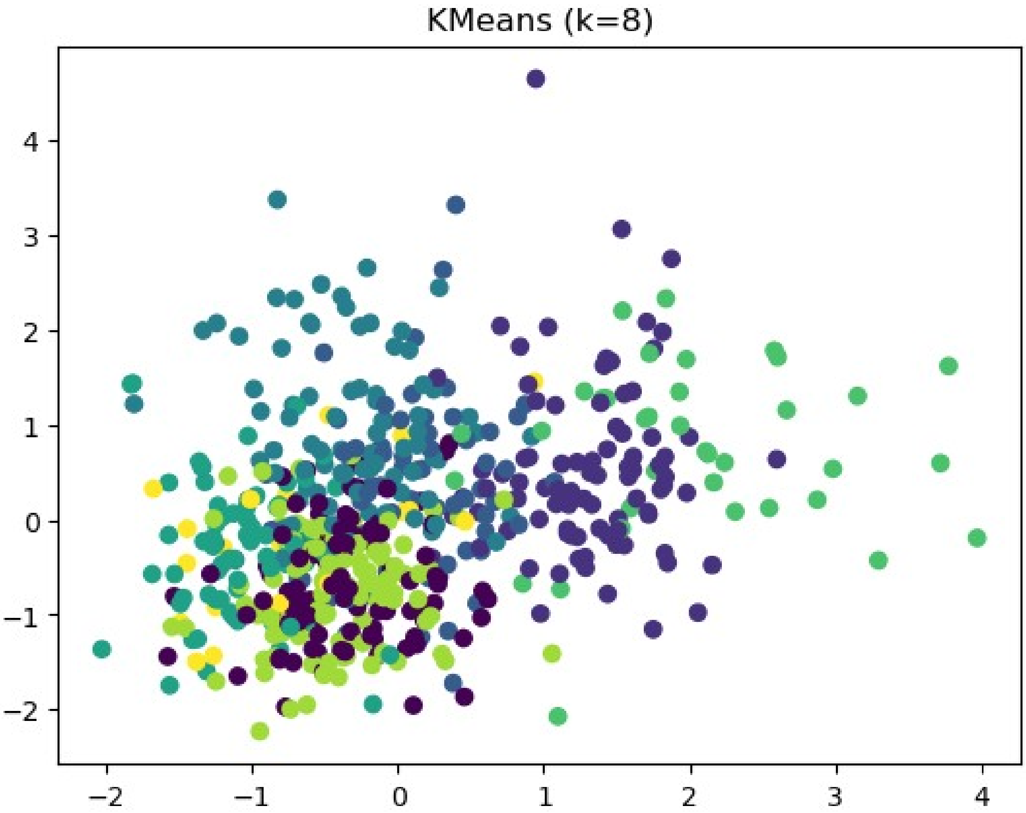
```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=3.
  warnings.warn(

Liczba skupień: 6, Silhouette Score: 0.16
```



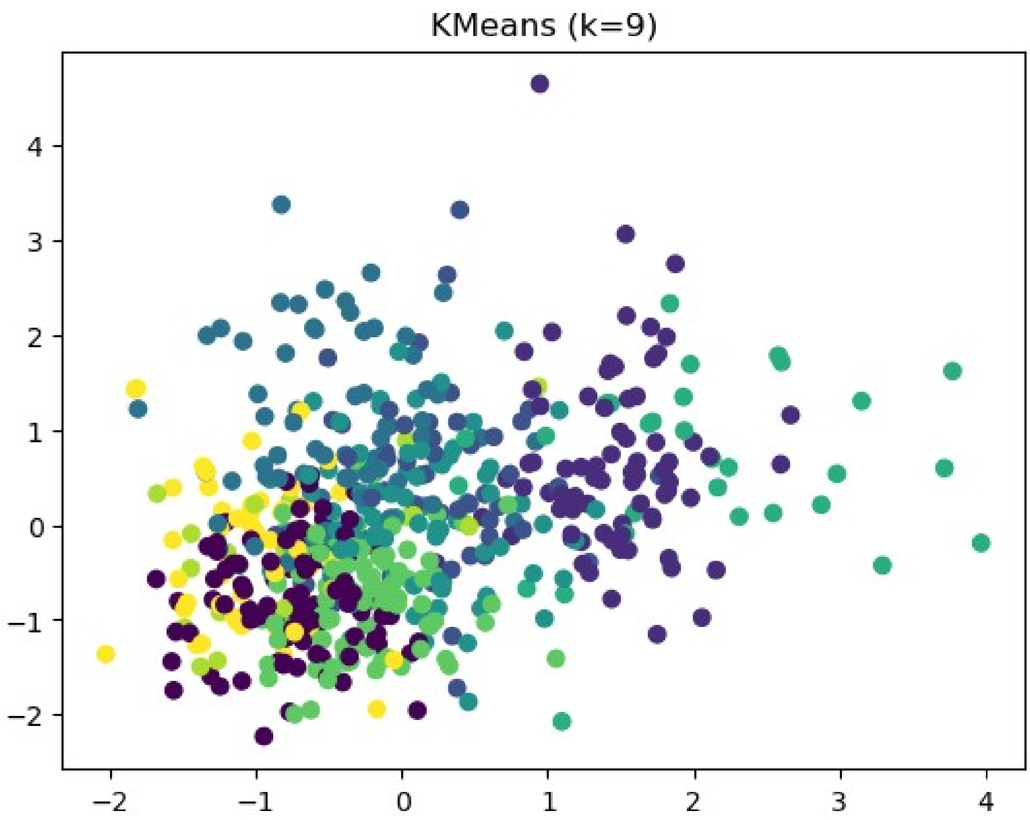
```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=3.
  warnings.warn(

Liczba skupień: 7, Silhouette Score: 0.14
```



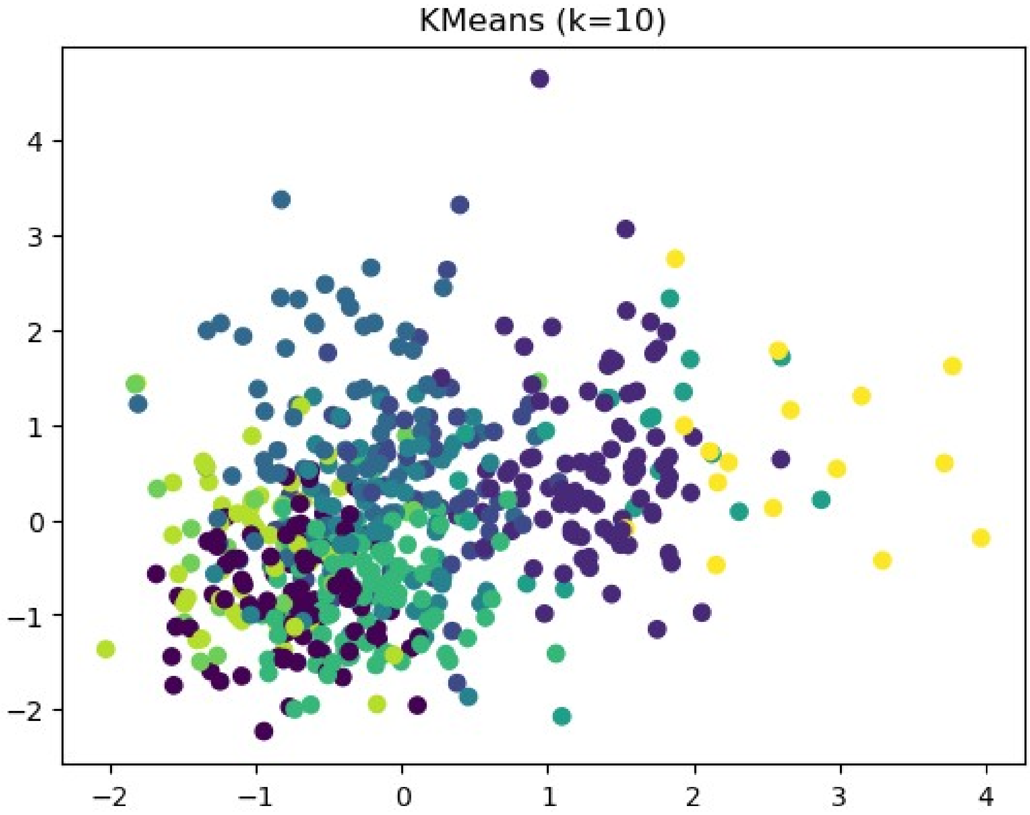
```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=3.
  warnings.warn(

Liczba skupień: 8, Silhouette Score: 0.13
```

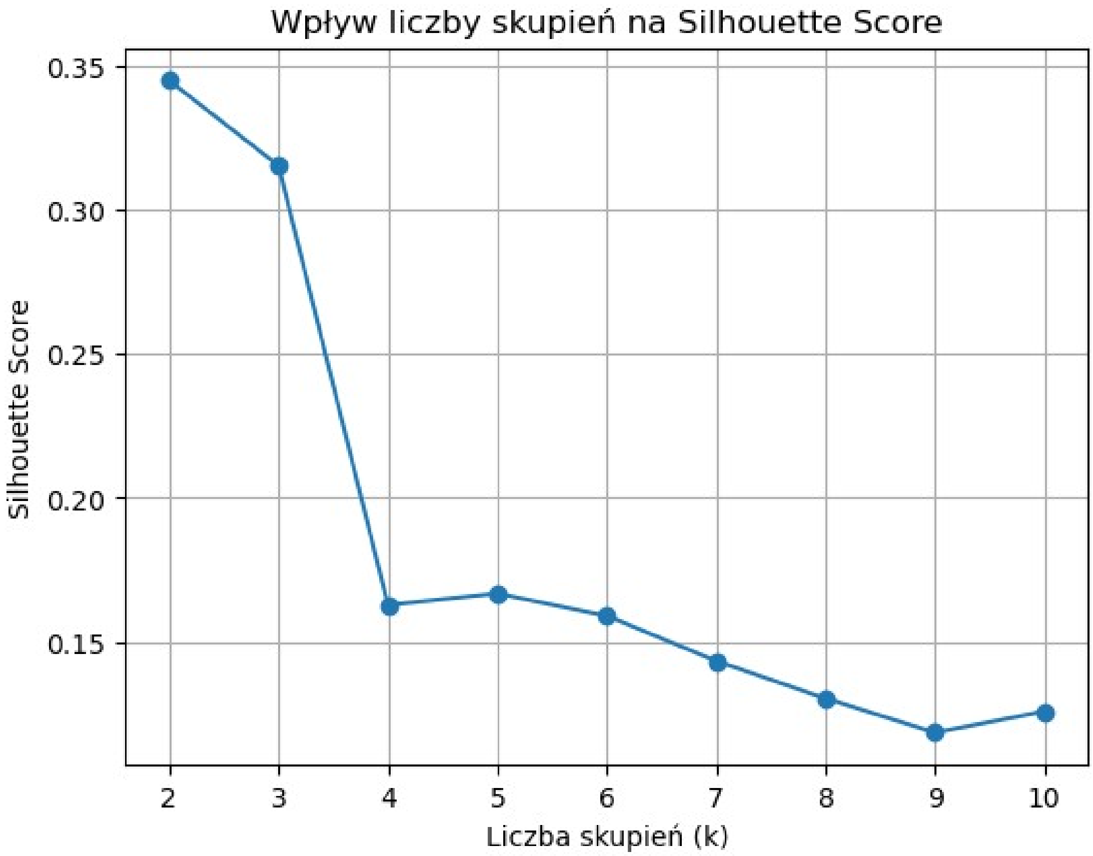


```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=3.
  warnings.warn(

Liczba skupień: 9, Silhouette Score: 0.12
```



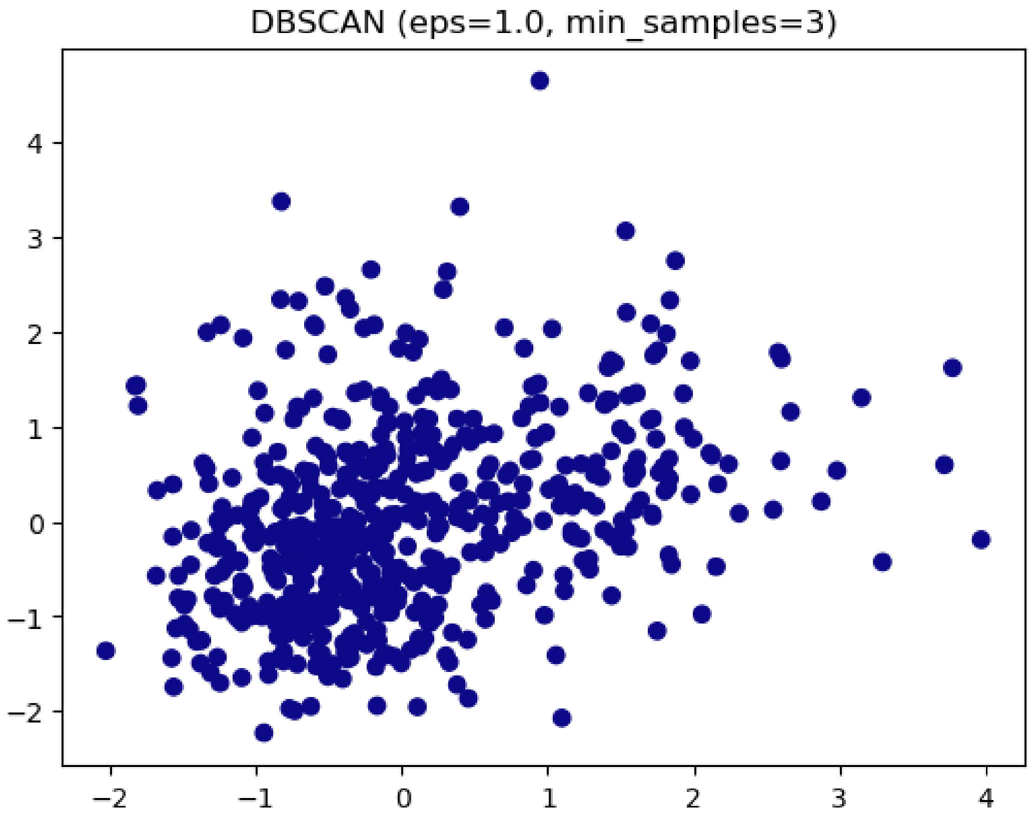
```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=3.
  warnings.warn(

Liczba skupień: 10, Silhouette Score: 0.13
```


KMeans (k=10)
4
3
2
1
0
−1
−2
−2
−1
0
1
2
3
4

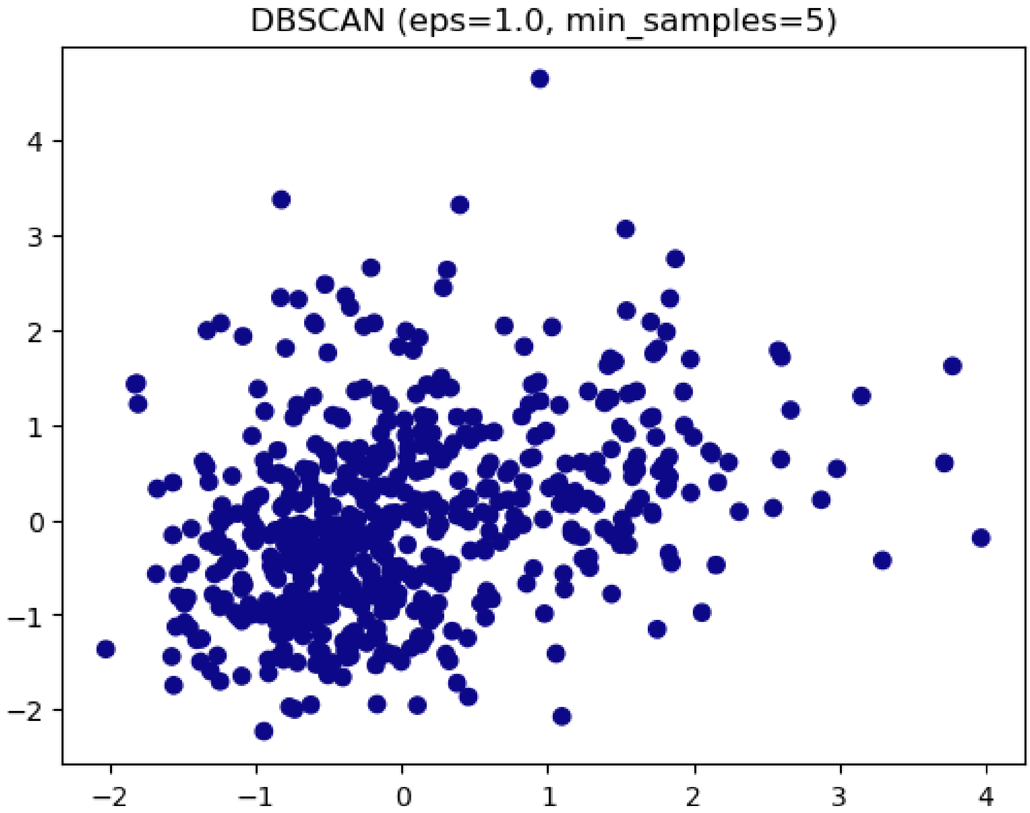


```
# --- Zadanie 2: DBSCAN ---
eps_values = [1.0, 2.0,3.0]
min_samples_values = [3, 5, 10]

for eps in eps_values:
    for min_samples in min_samples_values:
        dbscan = DBSCAN(eps=eps, min_samples=min_samples)
        labels = dbscan.fit_predict(X_scaled)
        n_clusters = len(set(labels)) - (1 if -1 in labels else 0)

        if n_clusters > 1:
            score = silhouette_score(X_scaled, labels)
            print(f"DBSCAN (eps={eps}, min_samples={min_samples}): 
Silhouette Score = {score:.2f}, klastry = {n_clusters}")
        else:
            print(f"DBSCAN (eps={eps}, min_samples={min_samples}): 
zbyt mało klastrów do obliczenia Silhouette")

        plt.scatter(X_scaled[:, 0], X_scaled[:, 1], c=labels, 
cmap='plasma')
        plt.title(f"DBSCAN (eps={eps}, min_samples={min_samples})")
        plt.show()
```

```
DBSCAN (eps=1.0, min_samples=3): zbyt mało klastrów do obliczenia
Silhouette
```

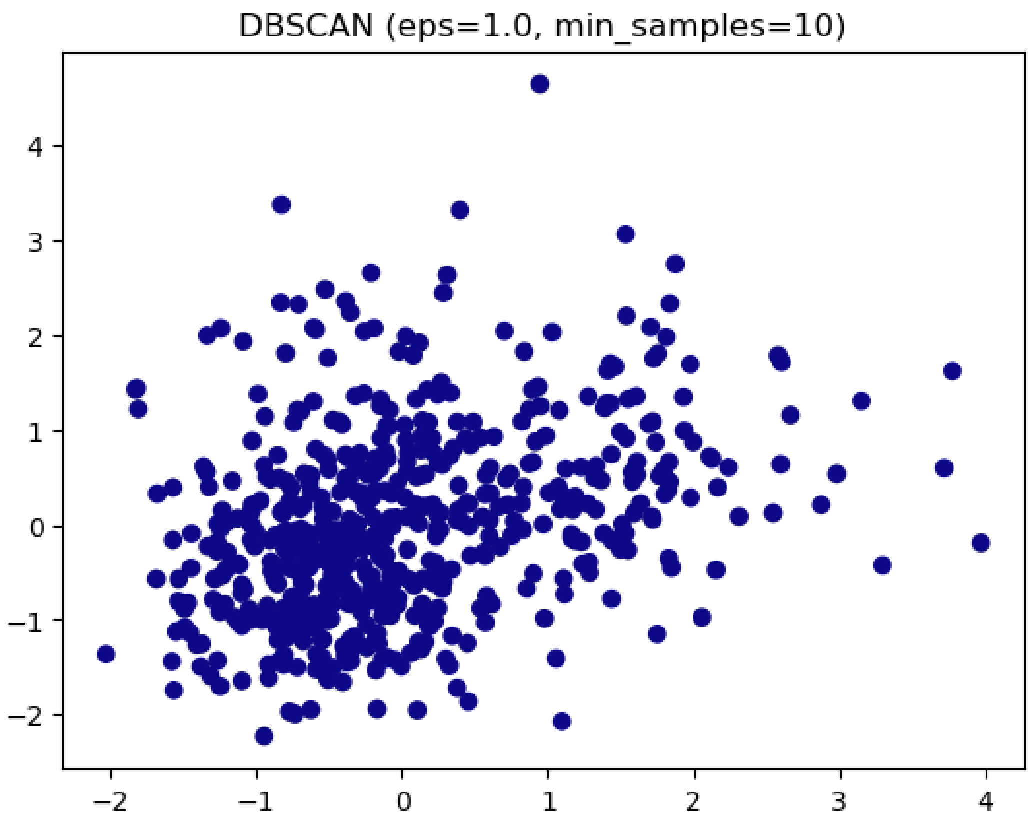


```
DBSCAN (eps=1.0, min_samples=5): zbyt mało klastrów do obliczenia
Silhouette
```

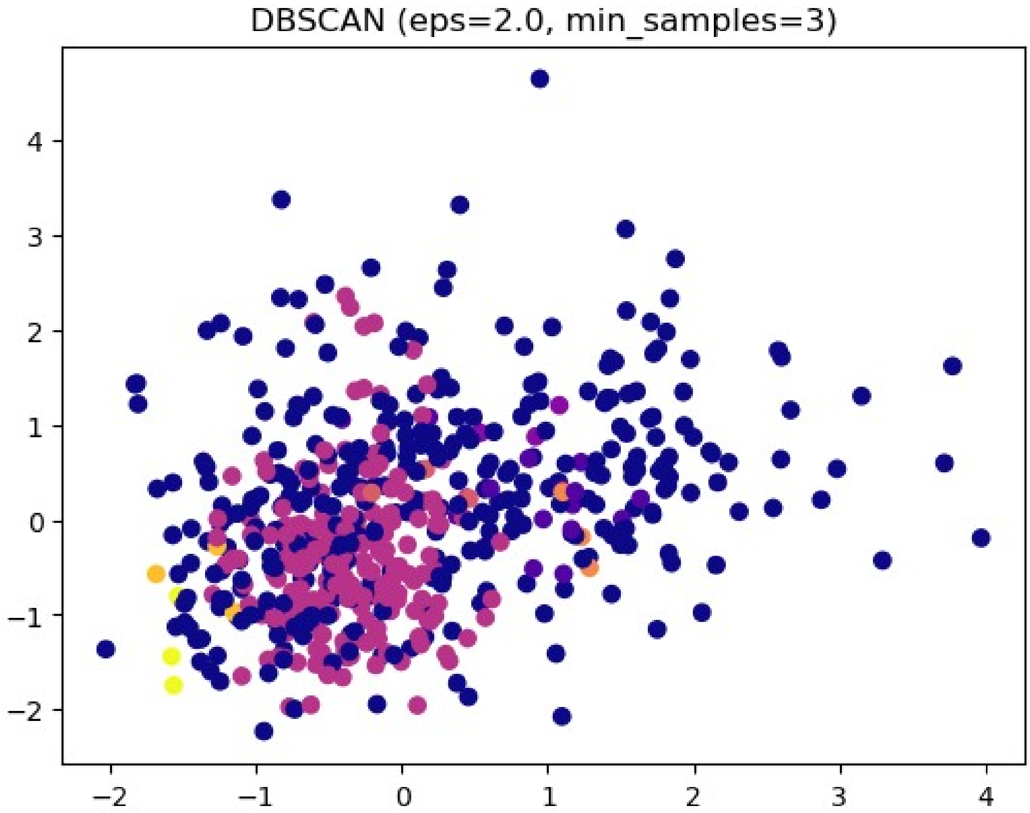


DBSCAN (eps=1.0, min_samples=5)

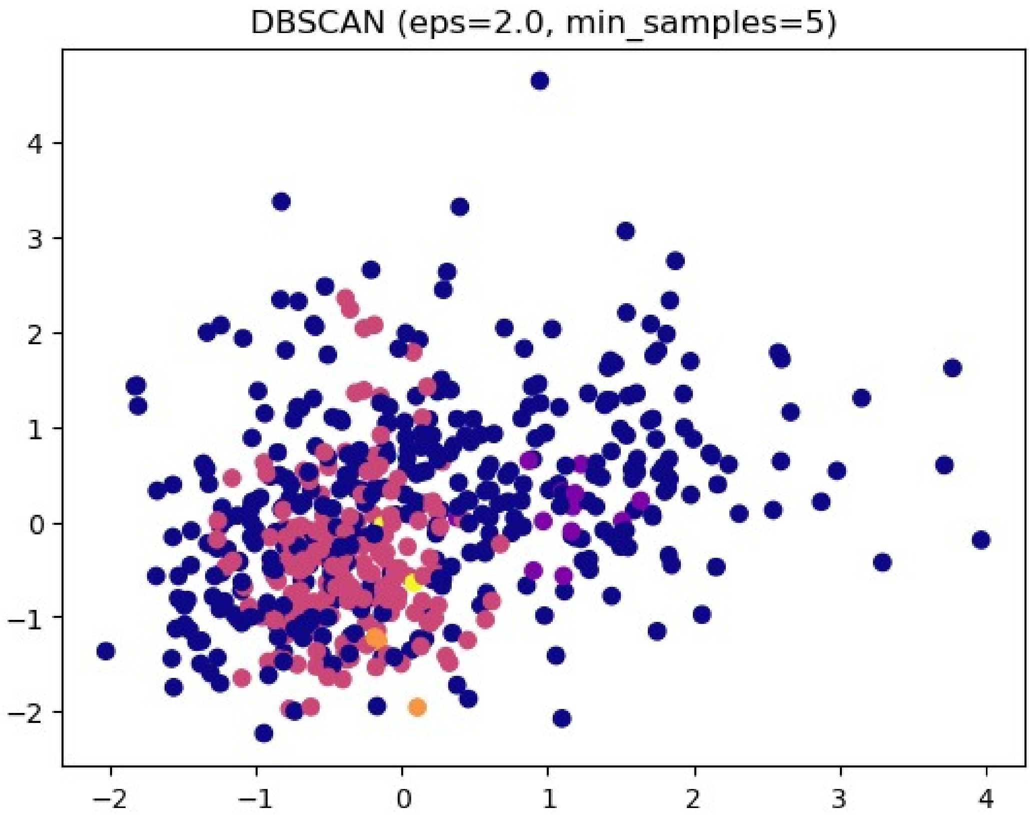
```
DBSCAN (eps=1.0, min_samples=10): zbyt mało klastrów do obliczenia
Silhouette
```



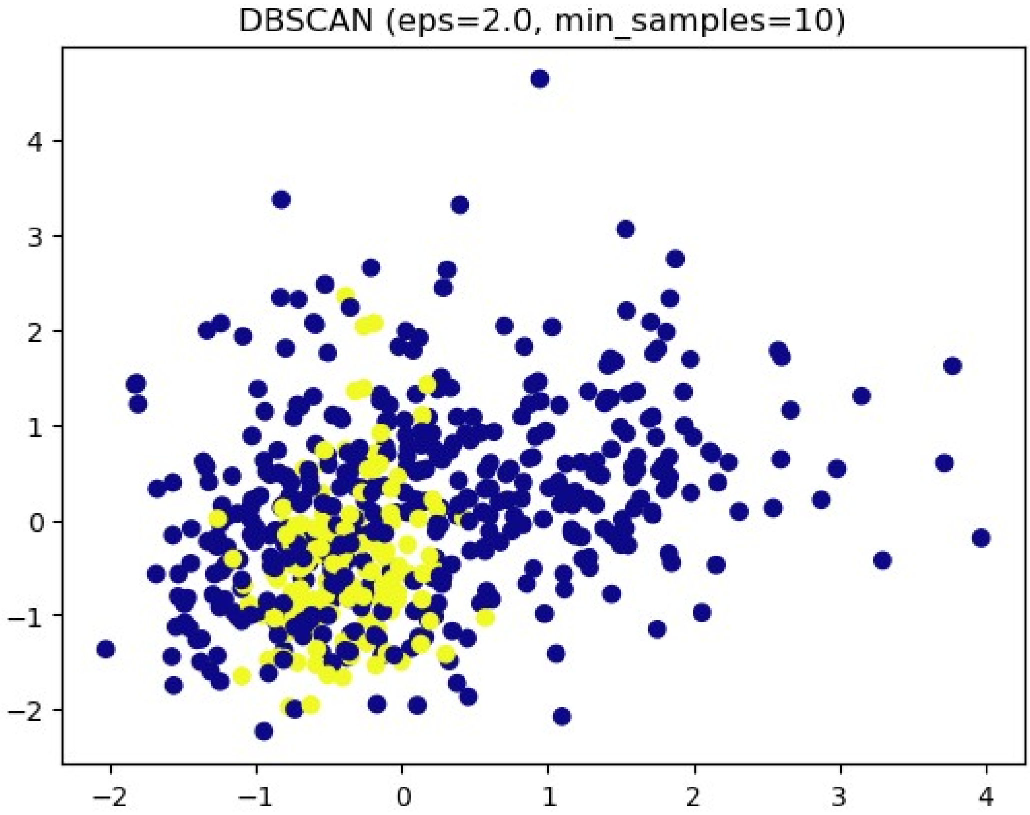
```
DBSCAN (eps=2.0, min_samples=3): Silhouette Score = -0.20, klastry = 7
```



```
DBSCAN (eps=2.0, min_samples=5): Silhouette Score = -0.20, klastry = 4
```

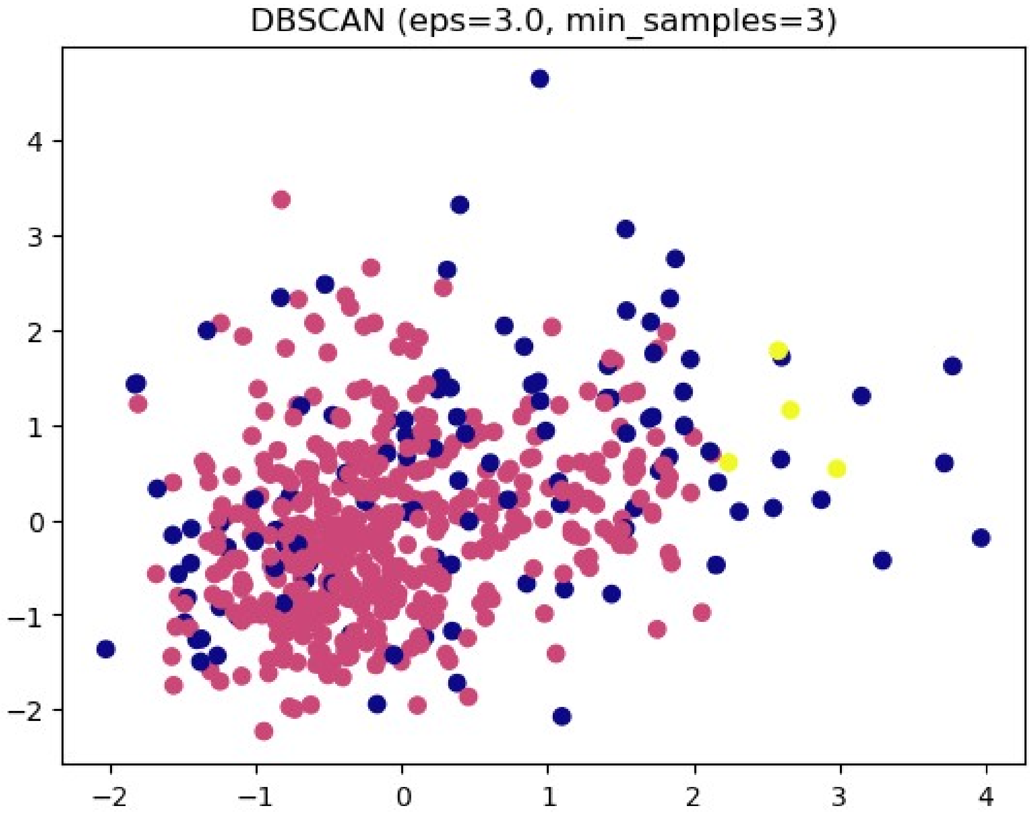


```
DBSCAN (eps=2.0, min_samples=10): zbyt mało klastrów do obliczenia
Silhouette
```

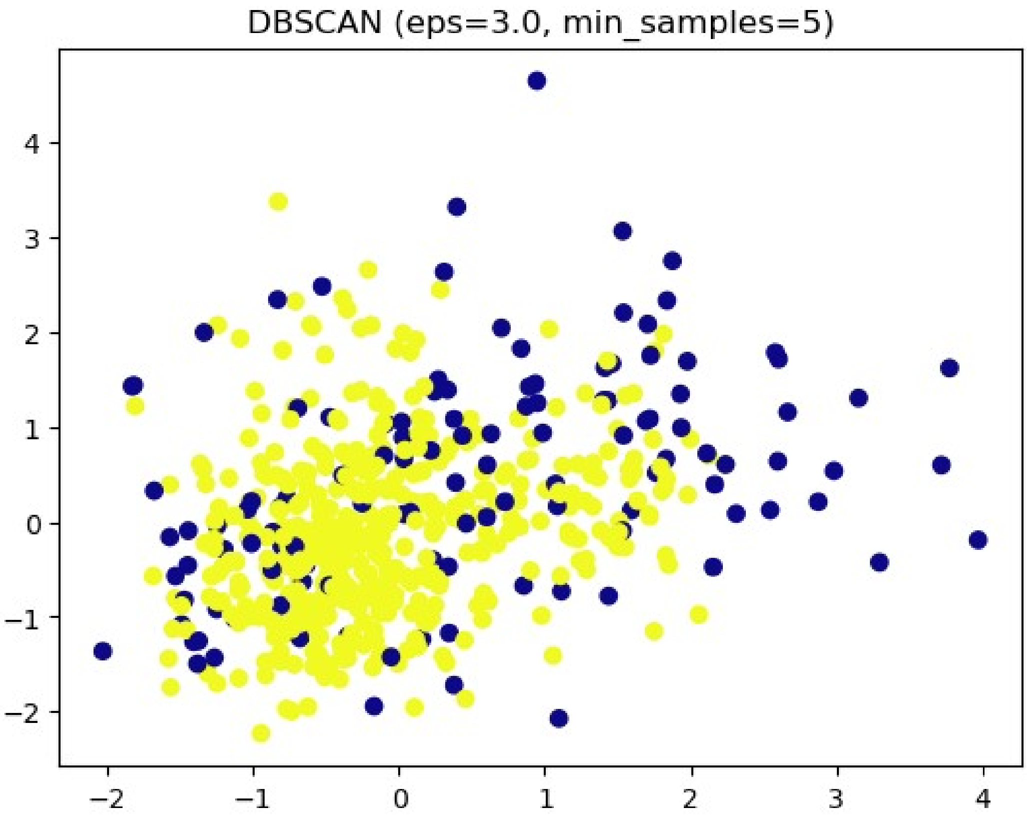


DBSCAN (eps=2.0, min_samples=10)

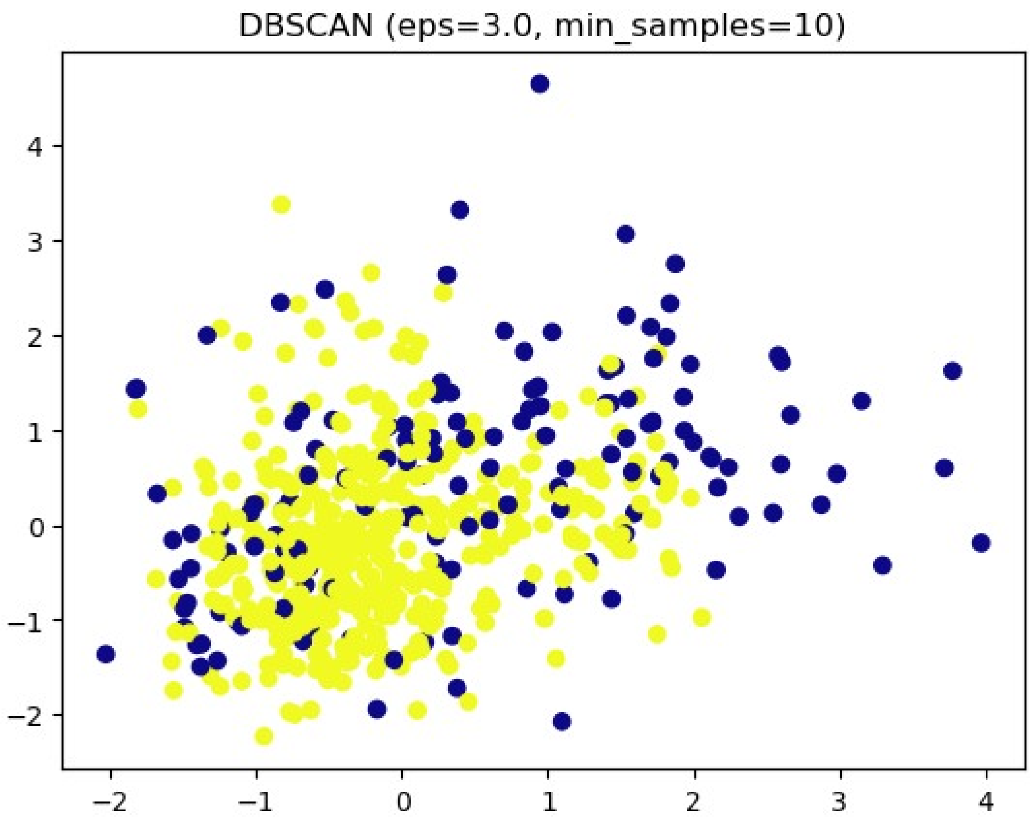
```
DBSCAN (eps=3.0, min_samples=3): Silhouette Score = 0.26, klastry = 2
```



```
DBSCAN (eps=3.0, min_samples=5): zbyt mało klastrów do obliczenia
Silhouette
```



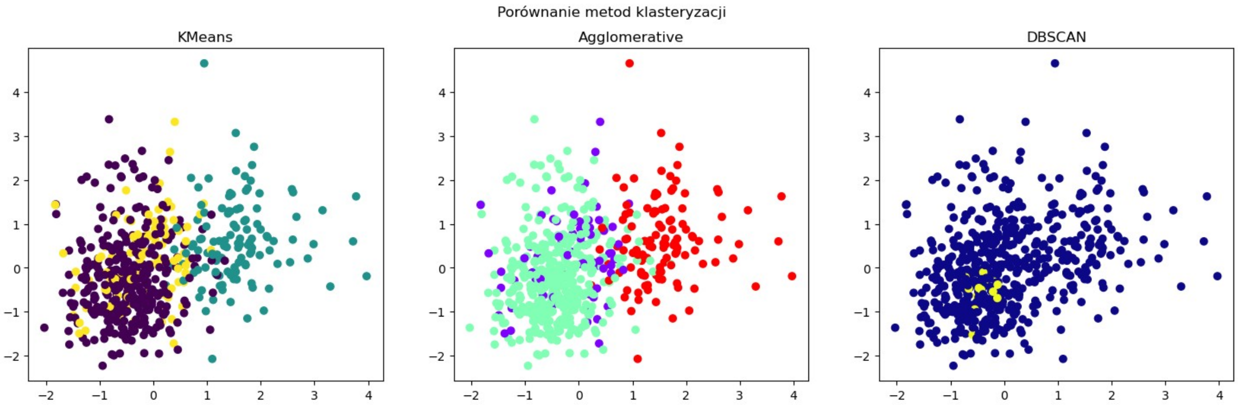
```
DBSCAN (eps=3.0, min_samples=10): zbyt mało klastrów do obliczenia
Silhouette
```



```
# --- Zadanie 3: Porównanie metod ---
# Wybór konkretnych konfiguracji
kmeans = KMeans(n_clusters=3, random_state=0)
kmeans_labels = kmeans.fit_predict(X_scaled)
kmeans_score = silhouette_score(X_scaled, kmeans_labels)

agg = AgglomerativeClustering(n_clusters=3)
agg_labels = agg.fit_predict(X_scaled)
agg_score = silhouette_score(X_scaled, agg_labels)

dbscan = DBSCAN(eps=1.5, min_samples=5)
dbscan_labels = dbscan.fit_predict(X_scaled)
dbscan_score = silhouette_score(X_scaled, dbscan_labels) if
len(set(dbscan_labels)) > 1 else -1

# Wyświetlenie wyników
print("\nPorównanie metod (Silhouette Score):")
print(f"- KMeans: {kmeans_score:.2f}")
print(f"- Agglomerative: {agg_score:.2f}")
print(f"- DBSCAN: {dbscan_score:.2f}")

fig, axs = plt.subplots(1, 3, figsize=(18, 5))
axs[0].scatter(X_scaled[:, 0], X_scaled[:, 1], c=kmeans_labels,
cmap='viridis')
```

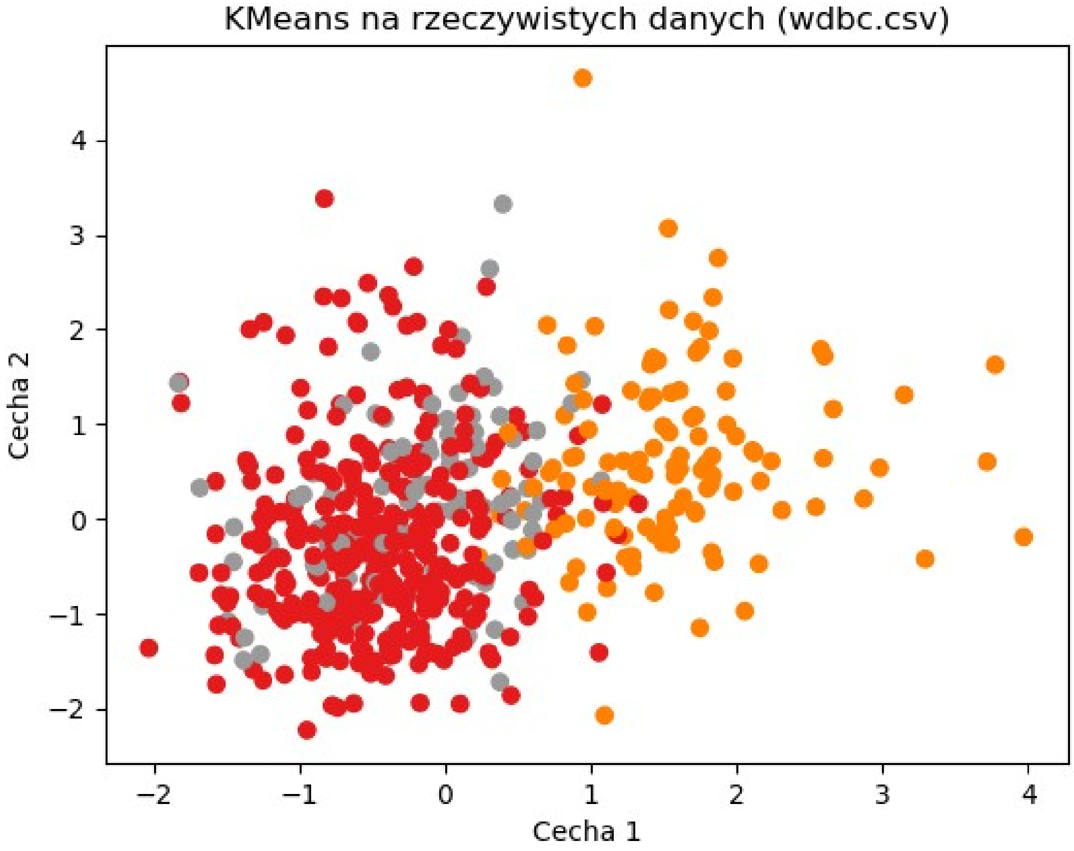
```
axs[0].set_title("KMeans")

axs[1].scatter(X_scaled[:, 0], X_scaled[:, 1], c=agg_labels,
cmap='rainbow')
axs[1].set_title("Agglomerative")

axs[2].scatter(X_scaled[:, 0], X_scaled[:, 1], c=dbscan_labels,
cmap='plasma')
axs[2].set_title("DBSCAN")

plt.suptitle("Porównanie metod klasteryzacji")
plt.show()
```

```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=3.
  warnings.warn(


Porównanie metod (Silhouette Score):
- KMeans: 0.32
- Agglomerative: 0.33
- DBSCAN: -0.22
```



```
# --- Zadanie 4: Zastosowanie KMeans do danych rzeczywistych
(oryginalny DataFrame) ---
kmeans_real = KMeans(n_clusters=3, random_state=0)
kmeans_real_labels = kmeans_real.fit_predict(X_scaled)
kmeans_real_score = silhouette_score(X_scaled, kmeans_real_labels)

plt.scatter(X_scaled[:, 0], X_scaled[:, 1], c=kmeans_real_labels,
cmap='Set1')
plt.title("KMeans na rzeczywistych danych (wdbc.csv)")
plt.xlabel("Cecha 1")
plt.ylabel("Cecha 2")
plt.show()

print(f"Silhouette Score (wdbc.csv, KMeans): {kmeans_real_score:.2f}")
```

```
C:\Users\48664\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=3.
  warnings.warn(
```



```
Silhouette Score (wdbc.csv, KMeans): 0.32
```