Experiment1

November 21, 2024

[1]:
```
import numpy as np
from numpy import genfromtxt

# Load signal
data = genfromtxt('ECG.csv', delimiter=',')

# Perform SVD
U1, S1, V1 = np.linalg.svd(data[:, 0:5], full_matrices=False)
print(S1)

# Perform SVD
U2, S2, V2 = np.linalg.svd(data[:, 6:11], full_matrices=False)
print(S2)
```

```
[4.39635131e-01 3.11031279e-01 6.62584161e-08 6.26867811e-08
 4.86262541e-08]
[1.20061665 0.76592543 0.34630379 0.21222007 0.13759651]
```

1 Answers

a) Explain the difference between singular values of the six first columns, and of the last 6 columns.

Looking at the values we get from the first SVD, one notices that the first two components are much larger than the other four, meaning that the data is essentially varying along two principal components. It shows that there are dependance between signals.

On the other hand, the values of the second SVD do not feature such a high contrast, therefore we cannot reduce the number of dimensions in this case. This show less meaningful dependance between the signals.

b) Computate of the effective rank with a threshold of 0.98.

[2]:
```
def effective_rank(singular_values, threshold=0.98):
    cumulative_energy = np.cumsum(singular_values**2) / np.
 ↪sum(singular_values**2)
    rank = np.searchsorted(cumulative_energy, threshold) + 1
    return rank
```

```python
# Compute effective rank for S1 and S2
rank_S1 = effective_rank(S1, 0.98)
rank_S2 = effective_rank(S2, 0.98)

print(f"Effective rank with threshold of 0.98 for S1: {rank_S1}")
print(f"Effective rank with threshold of 0.98 for S2: {rank_S2}")
```

```
Effective rank with threshold of 0.98 for S1: 2
Effective rank with threshold of 0.98 for S2: 4
```