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#Matematyka Konkretna

#Laboratorium 1

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#Warian 9

from matplotlib.image import imread
import matplotlib.pyplot as plt
import numpy as np
import os
plt.rcParams['figure.figsize'] = [16,8]

A = imread('9.webp')
X = np.mean(A, -1)

img = plt.imshow(X)
img.set_cmap('gray')
plt.axis('off')

U, S, VT = np.linalg.svd(X,full_matrices=False)
S = np.diag(S)

j=0
r=170
Xapprox = U[:, :r]@S[0:r, :r]@VT[:, :]
plt.figure(j+1)
j += 1
img = plt.imshow(Xapprox)
img.set_cmap('gray')
plt.axis('off')
plt.title('r='+str(r))
plt.show()

plt.figure(1)
plt.semilogy(np.diag(S))
plt.title('Singular Values')
plt.show()

```

r=170



```
plt.figure(1)
plt.semilogy(np.diag(S))
plt.title('Singular Values')
plt.show()

plt.figure(2)
cumulative_sum_ratio = np.cumsum(np.diag(S)) / np.sum(np.diag(S))
plt.plot(cumulative_sum_ratio)
plt.title('Singular Values: Cumulative Sum')
plt.show()
index_x = np.argmin(cumulative_sum_ratio <= 0.9)
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