CS 6375: Machine Learning

Assignment 5

K-Means Clustering for Image Compression

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Koala.jpg (50 iterations for each)

|  |  |  |  |
| --- | --- | --- | --- |
| K Value | Size before compression (in KB) | Size after compression (in KB) | Ratio |
| 2 | 762.53 | 129.30 | 5.897 |
| 5 | 762.53 | 168.40 | 4.528 |
| 10 | 762.53 | 169.177 | 4.507 |
| 15 | 762.53 | 166.619 | 4.576 |
| 20 | 762.53 | 159.50 | 4.780 |

Original Image:

A close up of a koala

Description automatically generated

Compressed Images:

A close up of an animal

Description automatically generated A close up of an animal

Description automatically generated A koala bear

Description automatically generated

K=2 K = 5 K = 10

A koala bear looking at the camera

Description automatically generated A koala bear looking at the camera

Description automatically generated

K = 15 K = 20

Penguins.jpg (50 iterations)

|  |  |  |  |
| --- | --- | --- | --- |
| K Value | Size before compression (in KB) | Size after compression (in KB) | Ratio |
| 2 | 759.604 | 83.220 | 9.12 |
| 5 | 759.604 | 100.65 | 7.54 |
| 10 | 759.604 | 113.702 | 6.68 |
| 15 | 759.604 | 112.097 | 6.77 |
| 20 | 759.604 | 111.803 | 6.79 |

Original Image:

A penguin standing on a beach

Description automatically generated

Compressed Images:

A picture containing outdoor, sky, bird, animal

Description automatically generated A penguin standing on a beach

Description automatically generated A penguin standing on a beach

Description automatically generated

K=2 K = 5 K = 10

A penguin standing on a beach

Description automatically generated A penguin standing on a beach

Description automatically generated

K = 15 K = 20

Q. Is there a tradeoff between image quality and degree of compression?

Yes. ‘K’ represents the degree of compression. Smaller value of K means fewer clusters, and hence fewer colors to represent the image. Therefore, for smaller ‘K’ values, a lot of details in the image are compromised, which produces a lower image quality. Higher ‘K’ values show more colors due to a larger number of clusters, and hence produces a better-quality image. However, higher values of K take longer to execute.

Q. What would be a good value of K for each of the two images?

For the given images, Koala.jpg and Penguins.jpg, reasonably good images are seen when k lies between 15 and 20. The output file shows the reasonable compression ratio and most colors which are identifiable.

For Koala.jpg, k= 10 gives a compression ratio of 4.5, which is close to that for k=15 and 20. Hence k=10 would be a good choice for k, as it has almost the same compression ratio as of greater values of k.

For Penguins.jpg, k= 15 gives a compression ratio of 6.7, which is close to that for k=20. Hence k=15 would be a good choice for k, as it has almost the same compression ratio as of greater values of k.