

1. Penguins.jpg(repeats 50 times)



$k = 2$



$k = 5$



$k = 10$



$k = 15$



$k = 20$

| % | K=2 | K=5 | K=10 | K=15 | K=20 |
|----------|--------|--------|--------|--------|--------|
| 1 | 10.929 | 13.993 | 15.004 | 15.036 | 14.713 |
| 2 | 10.927 | 13.828 | 14.933 | 14.761 | 14.919 |
| 3 | 10.929 | 13.519 | 15.176 | 14.823 | 14.681 |
| 4 | 10.927 | 13.402 | 15.003 | 14.764 | 14.681 |
| 5 | 10.927 | 13.997 | 15.194 | 14.864 | 14.622 |
| 6 | 10.927 | 13.931 | 15.222 | 15.029 | 14.631 |
| 7 | 10.929 | 13.606 | 15.238 | 14.765 | 14.751 |
| 8 | 10.929 | 14.160 | 14.922 | 14.769 | 14.641 |
| 9 | 10.929 | 13.906 | 14.983 | 14.743 | 14.741 |
| 10 | 10.927 | 13.606 | 15.217 | 14.743 | 14.666 |
| average | 10.928 | 13.727 | 15.089 | 14.830 | 14.705 |
| variance | near 0 | 0.021 | 0.015 | 0.012 | 0.007 |

2. Koala(repeats 50 times)



k = 2



k = 5



k = 10



k = 15



k = 20

| % | K=2 | K=5 | K=10 | K=15 | K=20 |
|----------|--------|--------|--------|--------|--------|
| 1 | 16.669 | 22.119 | 22.035 | 20.942 | 20.421 |
| 2 | 16.758 | 22.034 | 22.378 | 20.702 | 20.509 |
| 3 | 16.670 | 22.613 | 21.325 | 20.816 | 21.315 |
| 4 | 16.670 | 22.078 | 22.051 | 21.357 | 20.827 |
| 5 | 16.670 | 22.134 | 22.609 | 20.856 | 20.851 |
| 6 | 16.758 | 20.117 | 22.617 | 22.573 | 20.842 |
| 7 | 16.758 | 22.122 | 22.105 | 21.403 | 20.945 |
| 8 | 16.670 | 22.617 | 21.975 | 22.321 | 20.758 |
| 9 | 16.758 | 22.609 | 21.972 | 22.617 | 20.840 |
| 10 | 16.758 | 22.134 | 21.429 | 20.892 | 20.953 |
| average | 16.714 | 22.058 | 22.050 | 21.448 | 20.826 |
| variance | 0.002 | 0.471 | 0.167 | 0.528 | 0.054 |

Is there a tradeoff between image quality and degree of compression? What would be a good value of K for each of the two images?

There is a tradeoff between them.

For the penguin picture, from k = 2 to k = 10, the quality of the picture after compression gets better and better while its size is larger and larger. Then when k = 15 and k = 20, both two pictures have good quality and almost the same size. Certainly, k = 20 is the best choice.

For the koala picture, for k = 2 and k = 5, the quality of the picture after compression gets better and better while its size is larger and larger. But from k = 10 to k = 20, the quality is getting better while its size is smaller. Without doubt, we want to have the best quality and smallest size, which means k = 20 is what we want.