|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Image name** | **Technique Name** | | | |
| **Arnold scrambling** | **Hilbert quantum image scrambling** | **Circular shifting and swapping operation** | **Hyperchaotic System and Fibonacci Q-Matrix** |
| Peppers | 9.6332 | 9.6623 | 10.7170 | 8.2202 |
| Lenna | 10.9247 | 10.8745 | 10.7650 | 8.6510 |
| Goldhill | 11.2271 | 12.2816 | 11.8415 | 9.0199 |
| Cameraman | 9.2693 | 9.4286 | 9.2019 | 8.3834 |
| Baboon | 11.7828 | 12.0582 | 12.0667 | 8.2447 |
| Flower | 8.1486 | 8.2380 | 12.1972 | 7.4758 |
| **Average PSNR** | **10.1643** | **10.4238** | **11.13155** | **8.3325** |

Comparative Results of different image scrambling on PSNR, MSE, NCC, AD, SC and MD parameters for different images.

(1). PSNR comparison

(2). MSE comparison

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Image name** | **Technique Name** | | | |
| **Arnold scrambling** | **Hilbert quantum image scrambling** | **Circular shifting and swapping operation** | **Hyperchaotic System and Fibonacci Q-Matrix** |
| Peppers | 407339016 | 404615676 | 317377541 | 563964853 |
| Lenna | 302555017 | 306075190 | 313885616 | 510711749 |
| Goldhill | 321258846 | 251998999 | 278878038 | 534037665 |
| Cameraman | 504234185 | 194431000 | 512118622 | 247340000 |
| Baboon | 202818022 | 190354203 | 189982691 | 458058865 |
| Flower | 592699569 | 585407784 | 233330419 | 665389943 |
| **Average MSE** | **388484109.2** | **322147142** | **307595487.8** | **496583845.8** |

(3). NCC comparison

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Image name** | **Technique Name** | | | |
| **Arnold scrambling** | **Hilbert quantum image scrambling** | **Circular shifting and swapping operation** | **Hyperchaotic System and Fibonacci Q-Matrix** |
| Peppers | 0.8225 | 0.8249 | 0.8626 | 0.7089 |
| Lenna | 0.8669 | 0.8670 | 0.8641 | 0.7263 |
| Goldhill | 0.8344 | 0.8713 | 0.8578 | 0.6572 |
| Cameraman | 0.7826 | 0.7919 | 0.7806 | 0.6935 |
| Baboon | 0.9034 | 0.9107 | 0.9112 | 0.7164 |
| Flower | 0.6981 | 0.7029 | 0.8816 | 0.6012 |
| **Average NCC** | **0.8180** | **0.8282** | **0.8597** | **0.6840** |

(4). AD comparison

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Image name** | **Technique Name** | | | |
| **Arnold scrambling** | **Hilbert quantum image scrambling** | **Circular shifting and swapping operation** | **Hyperchaotic System and Fibonacci Q-Matrix** |
| Peppers | -0.0259 | -0.0386 | -0.0011 | -6.3661 |
| Lenna | -0.0032 | -0.0024 | -0.0014 | -3.4187 |
| Goldhill | 0.0083 | -0.0008 | -0.0018 | -15.3452 |
| Cameraman | -0.1060 | -0.0446 | -0.0004 | -9.0377 |
| Baboon | 0.0204 | -0.0090 | -0.0004 | -5.5005 |
| Flower | 0.0051 | -0.0076 | -0.0004 | -24.6203 |
| **Average AD** | **-0.016883333** | **-0.017166667** | **-0.000916667** | **-10.71475** |

(5). SC comparison

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Image name** | **Technique Name** | | | |
| **Arnold scrambling** | **Hilbert quantum image scrambling** | **Circular shifting and swapping operation** | **Hyperchaotic System and Fibonacci Q-Matrix** |
| Peppers | 0.9944 | 0.9981 | 0.9996 | 0.8136 |
| Lenna | 0.9940 | 0.9983 | 0.9996 | 0.8108 |
| Goldhill | 0.9936 | 0.9986 | 0.9990 | 0.6884 |
| Cameraman | 0.9948 | 0.9992 | 0.9997 | 0.8213 |
| Baboon | 0.9942 | 0.9980 | 0.9989 | 0.7540 |
| Flower | 0.9933 | 0.9986 | 0.9997 | 0.6911 |
| **Average SC** | **0.9940** | **0.9985** | **0.9995** | **0.7632** |

(6). MD comparison

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Image name** | **Technique Name** | | | |
| **Arnold scrambling** | **Hilbert quantum image scrambling** | **Circular shifting and swapping operation** | **Hyperchaotic System and Fibonacci Q-Matrix** |
| Peppers | 229 | 227 | 206 | 231 |
| Lenna | 202 | 206 | 196 | 236 |
| Goldhill | 229 | 227 | 212 | 235 |
| Cameraman | 253 | 249 | 244 | 250 |
| Baboon | 184 | 195 | 193 | 197 |
| Flower | 223 | 217 | 210 | 239 |
| **Average MD** | **220** | **220.1667** | **210.1667** | **231.3334** |