Table I Mathematical representation for GLCM features

|  |  |
| --- | --- |
| Feature | Mathematical Representations |
| Auto Correlation |  |
| Contrast |  |
| Correlation |  |
| Dissimilarity |  |
| Homogeneity |  |
| Energy |  |
| Entropy |  |
| Variance |  |
| Normalize IDM |  |

Table II Mathematical representation for Statistical Texture Features

|  |  |
| --- | --- |
| Feature | Mathematical Representation |
| Mean |  |
| Standard Deviation |  |
| Kurtosis |  |
| Skewness |  |

Table -III GLCM Features Extracted from Melanoma Skin Lesion (ISIC\_0000013)

|  |  |
| --- | --- |
| Feature | Value |
| Auto correlation | 21.85659 |
| Contrast | 0.310915 |
| Correlation | 0.984737 |
| Dissimilarity | 0.078171 |
| Energy | 0.399349 |
| Entropy | 1.233506 |
| Homogeneity | 0.976595 |
| Variance | 21.90483 |
| Normalized Inverse Different Moment | 0.996746 |

Table -IV Statistical Texture Features obtained for Melanoma Skin Lesion (ISIC\_0000013) Using Scatter Wavelet Transform

|  |  |
| --- | --- |
| Feature | Value |
| Mean | 0.27939 |
| Standard Deviation | 0.074581 |
| Smoothness Index | 0.349813 |
| Skewness | 3.816392 |
| Kurtosis | 12.70318 |

|  |  |
| --- | --- |
| Feature | Value |
| Area | 123891 |
| Perimeter | 6152 |
| Form Factor | 0.0411 |
| Major Axis Length | 636.3517 |
| Minor Axis Length | 607.9734 |

Table -V Shape Features obtained for Melanoma Skin Lesion (ISIC\_0000013) Using Scatter Wavelet Transform

Table -VI GLCM Feature Values Extracted from various Skin Lesion

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Feature | BCC  ISIC\_0025513 | Melanoma  ISIC\_0000013 | Nevus  ISIC\_0000000 | SK  ISIC\_0001104 | SCC  ISIC\_0011593 |
| Auto correlation | 25.37 | 21.85 | 24.12 | 25.38 | 22.54 |
| Contrast | 0.385 | 0.310 | 0.369 | 0.308 | 0.261 |
| Correlation | 0.979 | 0.984 | 0.980 | 0.985 | 0.987 |
| Dissimilarity | 0.107 | 0.078 | 0.101 | 0.075 | 0.057 |
| Energy | 0.313 | 0.399 | 0.312 | 0.354 | 0.501 |
| Entropy | 1.554 | 1.233 | 1.597 | 1.376 | 0.913 |
| Homogeneity | 0.966 | 0.976 | 0.967 | 0.978 | 0.985 |
| Variance | 25.444 | 21.904 | 24.193 | 25.414 | 22.569 |
| N I D M | 0.995 | 0.996 | 0.996 | 0.996 | 0.997 |

Table -VII Shape Features extracted from various Skin Lesions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Feature | BCC  ISIC\_0025513 | Melanoma  ISIC\_0000013 | Nevus  ISIC\_0000000 | SK  ISIC\_0001104 | SCC ISIC\_0011593 |
| Area | 147203 | 123891 | 141693 | 139295 | 97705 |
| Perimeter | 7445 | 6152 | 6802 | 7549 | 5422 |
| Form Factor | 0.033 | 0.041 | 0.035 | 0.030 | 0.041 |
| Major Axis Length | 610.898 | 636.351 | 602.294 | 643.614 | 718.595 |
| Minor Axis Length | 583.028 | 607.973 | 598.297 | 590.424 | 680.411 |

Table -VIII Texture Features obtained using Scattered Wavelet for various Skin Lesions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Feature | BCC  ISIC\_0025513 | Melanoma  ISIC\_0000013 | Nevus  ISIC\_0000000 | SK  ISIC\_0001104 | SCC  ISIC\_0011593 |
| Mean | 0.378 | 0.279 | 0.398 | 0.759 | 0.681 |
| Standard Deviation | 0.067 | 0.745 | 0.698 | 0.692 | 0.916 |
| Smoothness Index | 0.012 | 0.349 | 0.056 | 0.089 | 0.084 |
| Skewness | 3.256 | 3.816 | 3.942 | 3.894 | 2.957 |
| Kurtosis | 13.763 | 12.703 | 12.981 | 12.939 | 12.562 |

Table IX Dataset used in proposed work

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Classification | No of Training Images | No of Test Images | Batch Size | No of Epochs |
| Melanoma Recognition | 900 | 379 | 6 | 150 |
| Melanoma VS Nevus | 1854 | 551 | 36 | 50 |
| S K vs S C C | 517 | 129 | 10 | 50 |
| Melanoma VS SK | 2070 | 518 | 40 | 50 |
| Melanoma VS BCC | 2201 | 551 | 44 | 50 |
| Nevus VS BCC | 584 | 137 | 11 | 50 |

|  |  |  |
| --- | --- | --- |
| Author | Method | Accuracy (%) |
| Nudrat Nida et al., [26]  (2019) | RCNN+ FCM | 94.08% |
| Tomas Majtner et al.,[27]  (2016) | Deep Learning + hand Crafted Features | 82.6% |
| Zhen Yu et.al., [28 ]  (2017) | Pretrained DRNN on Imagenet | 86.81% |
| Yu, Lequan, et al.,[14]  (2017) | Deep CNN with FCRN | 85.5% |
| **Proposed Work** | **CNN with hand crafted features** | **98.13%** |

Table X Comparison of Proposed Work for Melanoma Recognition with Existing Work

Table XI Comparison of Proposed Work for the classification of different Skin Lesions with Existing Work

|  |  |  |
| --- | --- | --- |
| Author | Method | Accuracy (%) |
| Khalid M. Hosny et al.,[29]  (2019) | Transfer learning with  pretrained AlexNet | 94.71% |
| Bakkouri I et al.,[30] | CNN with weights from pre-trained network | Skin Lesion classification Average accuracy of 97.40% |
| **Proposed Work** | **CNN with Hand Crafted Features** | **Melanoma Vs Nevus -93.14%**  **SK Vs SCC 95.64%**  **Melanoma Vs SK 98.45%**  **Melanoma Vs BCC 96.01%**  **Nevus Vs BCC-98.67%** |