

| Jaffe | | | | | | | | | | | | | | | | |
|---------------------|---------|----------|---------|---------|---------|---------|---------|----------------|---------|---------|---------|---------|---------|---------|---------|----------------|
| ACC | | | | | | | | | NMI | | | | | | | |
| Model | 10 | 20 | 30 | 40 | 50 | 60 | 70 | Avg. | 10 | 20 | 30 | 40 | 50 | 60 | 70 | Avg. |
| NMF | 91.3022 | 96.5305 | 88.3123 | 77.3165 | 76.7729 | 80.7512 | 80.3558 | 84.4773 | 89.4305 | 96.1704 | 91.344 | 86.13 | 80.2197 | 81.9974 | 82.6473 | 86.8485 |
| NMFOS | 94.4246 | 94.123 | 95.5643 | 93.6742 | 95.2192 | 94.1376 | 95.1345 | 94.6111 | 93.8734 | 96.3245 | 93.1372 | 94.5163 | 95.6910 | 95.1173 | 95.267 | 94.8467 |
| GRSNMF | 95.7746 | 96.4433 | 96.8634 | 96.7282 | 96.2093 | 96.8386 | 96.5305 | 96.4840 | 94.9638 | 97.4711 | 98.4382 | 96.5264 | 96.7909 | 96.7184 | 96.18 | 96.7270 |
| OGNMF | 95.8982 | 96.8372 | 96.1221 | 96.1221 | 96.1221 | 96.1221 | 96.1221 | 96.1923 | 94.5083 | 95.6776 | 97.3646 | 97.3646 | 97.3646 | 97.3646 | 97.3646 | 96.7156 |
| DGLCF | 73.017 | 70.7191 | 70.1507 | 76.9212 | 80.0346 | 82.5056 | 75.7845 | 75.5904 | 74.3467 | 73.4134 | 77.7806 | 82.8008 | 85.674 | 84.1468 | 82.7632 | 80.1322 |
| ERWNMF | 92.1917 | 96.2703 | 96.5043 | 96.8139 | 96.1221 | 99.2834 | 98.5915 | 96.5396 | 90.9622 | 97.4276 | 97.0091 | 98.2356 | 98.023 | 98.7461 | 98.8199 | 97.0319 |
| Our Proposed Method | 98.5915 | 98.12201 | 98.3568 | 98.5915 | 98.8263 | 98.5915 | 98.5915 | 98.5915 | 98.1289 | 97.3089 | 97.7551 | 98.1289 | 98.3869 | 98.1289 | 98.1289 | 97.9952 |

Table 1: Result comparison for Jaffe dataset.

| UMIST | | | | | | | | | | | | | | | | |
|---------------------|---------|---------|---------|---------|---------|---------|---------|----------------|---------|---------|---------|---------|---------|---------|---------|----------------|
| ACC | | | | | | | | | NMI | | | | | | | |
| Model | 10 | 20 | 30 | 40 | 50 | 60 | 70 | Avg. | 10 | 20 | 30 | 40 | 50 | 60 | 70 | Avg. |
| NMF | 36.9245 | 42.1785 | 39.6979 | 39.0023 | 40.5034 | 39.8993 | 40.2929 | 39.7855 | 54.4853 | 60.5149 | 58.4042 | 58.3597 | 58.9287 | 58.9688 | 60.9704 | 58.6617 |
| NMFOS | 41.4737 | 42.3341 | 42.0961 | 42.1053 | 42.5995 | 43.0023 | 42.4073 | 42.2883 | 59.1889 | 59.3173 | 60.3433 | 60.4556 | 60.5452 | 60.8884 | 62.4345 | 60.4533 |
| GRSNMF | 42.3707 | 43.3318 | 45.135 | 47.0572 | 45.373 | 44.0549 | 44.9062 | 44.6041 | 62.8512 | 63.6036 | 63.6368 | 64.177 | 63.8916 | 63.7218 | 64.292 | 63.7391 |
| OGNMF | 41.0618 | 40.476 | 42.3982 | 41.9863 | 43.1213 | 43.8535 | 44.3661 | 42.4662 | 59.8333 | 58.8503 | 61.1466 | 61.6052 | 62.5421 | 62.8544 | 63.0293 | 61.4087 |
| DGLCF | 33.5652 | 33.3547 | 37.73 | 35.4966 | 33.7941 | 32.5858 | 35.405 | 34.5616 | 47.9859 | 48.2975 | 48.251 | 48.0898 | 48.951 | 47.7277 | 49.9294 | 48.4618 |
| ERWNMF | 41.4096 | 41.8764 | 43.7162 | 44.1648 | 42.5538 | 43.2677 | 42.151 | 42.7342 | 59.5158 | 59.8676 | 62.0976 | 62.556 | 60.7727 | 61.1123 | 61.6295 | 61.0788 |
| Our Proposed Method | 61.6087 | 58.9304 | 59.7913 | 60.3043 | 61.7913 | 62.8348 | 61.7826 | 61.0062 | 77.7275 | 76.0505 | 76.0078 | 77.3597 | 77.2781 | 77.5699 | 77.2933 | 77.0410 |

Table 2: Result comparison for the UMIST dataset.

| Yale | | | | | | | | | | | | | | | | |
|---------------------|---------|---------|---------|---------|---------|---------|---------|----------------|---------|---------|---------|---------|---------|---------|---------|----------------|
| ACC | | | | | | | | | NMI | | | | | | | |
| Model | 10 | 20 | 30 | 40 | 50 | 60 | 70 | Avg. | 10 | 20 | 30 | 40 | 50 | 60 | 70 | Avg. |
| NMF | 37.7033 | 36.8421 | 40.5104 | 39.0431 | 37.6715 | 33.1738 | 37.799 | 37.5347 | 43.6138 | 43.882 | 45.5947 | 44.6185 | 43.7779 | 40.6329 | 43.0723 | 43.5989 |
| NMFOS | 38.9793 | 41.2121 | 42.5518 | 41.4354 | 41.0526 | 38.5327 | 37.9904 | 40.2506 | 45.0605 | 47.4628 | 47.1154 | 46.8797 | 48.176 | 45.1822 | 43.809 | 46.2408 |
| GRSNMF | 44.7847 | 43.9553 | 43.6045 | 42.7751 | 43.764 | 44.7847 | 42.0415 | 43.6728 | 47.9341 | 49.1106 | 47.3874 | 49.5373 | 49.7334 | 50.7019 | 48.322 | 48.961 |
| OGNMF | 43.2855 | 42.5518 | 44.7528 | 43.7959 | 43.5088 | 42.9984 | 43.2217 | 43.445 | 49.0137 | 47.7974 | 49.8562 | 49.1874 | 49.8102 | 49.4908 | 49.0513 | 49.1724 |
| DGLCF | 36.555 | 36.3955 | 39.0431 | 37.193 | 36.0128 | 35.5662 | 35.0239 | 36.5414 | 42.9426 | 43.2393 | 43.3305 | 42.8815 | 41.9039 | 42.5736 | 42.8606 | 42.8189 |
| ERWNMF | 40.1595 | 43.3174 | 41.4673 | 42.3923 | 41.1802 | 40.6699 | 40.5104 | 41.3853 | 45.326 | 47.6979 | 47.9218 | 46.7973 | 48.8528 | 46.8667 | 46.1275 | 47.0843 |
| Our Proposed Method | 42.0909 | 38.8788 | 39.0303 | 39.9091 | 43.4545 | 44.3636 | 38.8788 | 40.9437 | 46.7160 | 45.0028 | 49.2303 | 46.0949 | 49.2705 | 50.5812 | 45.8678 | 47.5376 |

Table 3: Result comparison for the Yale dataset.

| YaleB | | | | | | | | | | | | | | | | |
|---------------------|---------|---------|---------|---------|---------|---------|---------|----------------|---------|---------|---------|---------|---------|---------|---------|----------------|
| ACC | | | | | | | | | NMI | | | | | | | |
| Model | 10 | 20 | 30 | 40 | 50 | 60 | 70 | Avg. | 10 | 20 | 30 | 40 | 50 | 60 | 70 | Avg. |
| NMF | 8.3984 | 11.1826 | 13.6877 | 14.5118 | 15.0133 | 14.3636 | 14.9632 | 13.1601 | 11.9757 | 20.9943 | 24.794 | 27.6382 | 27.934 | 27.348 | 28.0233 | 24.1011 |
| NMFOS | 9.5888 | 12.3665 | 15.1507 | 15.1681 | 15.3839 | 16.1994 | 16.8491 | 14.3866 | 15.5176 | 22.9283 | 27.3337 | 27.7742 | 29.287 | 28.6928 | 30.7254 | 26.037 |
| GRSNMF | 9.4253 | 12.2117 | 14.3287 | 14.8847 | 15.5736 | 16.5111 | 16.5438 | 14.2113 | 15.2685 | 22.4669 | 26.6396 | 28.4205 | 29.2859 | 30.2029 | 29.8292 | 26.0162 |
| OGNMF | 9.0743 | 10.6789 | 12.7938 | 13.5307 | 14.1412 | 14.2807 | 14.453 | 12.7075 | 13.8294 | 17.9637 | 22.4881 | 23.0949 | 25.5198 | 26.681 | 27.3475 | 22.4178 |
| DGLCF | 9.7894 | 10.4849 | 10.5939 | 11.1128 | 10.5568 | 10.9798 | 11.3003 | 10.6883 | 13.9122 | 15.3585 | 15.3806 | 15.316 | 14.8175 | 14.9299 | 15.1162 | 14.9758 |
| ERWNMF | 9.6041 | 12.2291 | 14.5053 | 14.7931 | 15.6194 | 15.7808 | 16.5417 | 14.1534 | 15.467 | 21.5663 | 26.0157 | 27.2864 | 28.6635 | 29.3403 | 30.5162 | 25.5508 |
| Our Proposed Method | 26.1785 | 24.8592 | 23.8401 | 23.7945 | 23.2829 | 22.6988 | 23.4445 | 24.0141 | 38.3727 | 36.5534 | 36.1010 | 35.8204 | 35.7616 | 34.8840 | 35.2496 | 36.1061 |

Table 4: Result comparison for the YaleB dataset.