Project1

311512015 謝元碩

1. Kid blurred-noisy.tiff

|  |  |
| --- | --- |
| (a) original | (b) Laplacian |
| (c) Laplacian-sharpened | (d) Sobel-gradient |

|  |  |
| --- | --- |
| (e) smoothed gradient | (f) (e)‧(b) |
| (g) (a)+(f) | (h) power-law transformation of (g) |

|  |
| --- |
| Original histograms |
| Output histograms |

※From the histograms shown below, we can differentiate properties between original and final images. The histogram of original image is very smooth (smooth gray level), and that of final image is very sharp (some gray levels are enhanced).

2. Fruit blurred-noisy.tiff

|  |  |
| --- | --- |
| (a) original | (b) Laplacian |
| (c) Laplacian-sharpened | (d) Sobel-gradient |

|  |  |
| --- | --- |
| (e) smoothed gradient | (f) (e)‧(b) |
| (g) (a)+(f) | (h) power-law transformation of (g) |

|  |
| --- |
| Original histograms |
| Output histograms |

※From the histograms shown below, we can differentiate properties between original and final images. The histogram of original image is very smooth (smooth gray level), and that of final image is very sharp (some gray levels are enhanced).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *r* | p(r)  (kid original) | p(r)  (kid output) | p(r)  (fruit original) | p(r)  (fruit output) |
| 0 | 1 | 1 | 2 | 1 |
| 1 | 0 | 0 | 3 | 0 |
| 2 | 0 | 0 | 1 | 2 |
| 3 | 1 | 0 | 2 | 2 |
| 4 | 1 | 3 | 6 | 0 |
| 5 | 4 | 0 | 8 | 0 |
| 6 | 6 | 2 | 12 | 0 |
| 7 | 0 | 5 | 0 | 3 |
| 8 | 5 | 0 | 12 | 4 |
| 9 | 13 | 17 | 11 | 7 |
| 10 | 14 | 9 | 30 | 0 |
| 11 | 19 | 0 | 45 | 0 |
| 12 | 32 | 26 | 46 | 23 |
| 13 | 54 | 22 | 81 | 18 |
| 14 | 65 | 0 | 0 | 30 |
| 15 | 0 | 47 | 112 | 0 |
| 16 | 85 | 0 | 138 | 28 |
| 17 | 107 | 66 | 156 | 0 |
| 18 | 124 | 95 | 218 | 52 |
| 19 | 179 | 115 | 265 | 100 |
| 20 | 252 | 159 | 328 | 118 |
| 21 | 295 | 0 | 0 | 0 |
| 22 | 349 | 0 | 452 | 120 |
| 23 | 0 | 185 | 500 | 171 |
| 24 | 444 | 277 | 610 | 0 |
| 25 | 557 | 452 | 758 | 213 |
| 26 | 652 | 414 | 850 | 0 |
| 27 | 759 | 0 | 1021 | 307 |
| 28 | 922 | 442 | 0 | 477 |
| 29 | 1130 | 675 | 1208 | 475 |
| 30 | 0 | 0 | 1387 | 560 |
| 31 | 1320 | 681 | 1594 | 0 |
| 32 | 1458 | 1223 | 1879 | 779 |
| 33 | 1731 | 0 | 2061 | 0 |
| 34 | 1926 | 1040 | 2186 | 783 |
| 35 | 2205 | 1253 | 0 | 1348 |
| 36 | 2354 | 1350 | 2437 | 1078 |
| 37 | 2700 | 1759 | 2703 | 0 |
| 38 | 0 | 0 | 2923 | 1372 |
| 39 | 2886 | 1855 | 3180 | 1486 |
| 40 | 3344 | 0 | 3600 | 1800 |
| 41 | 3706 | 2861 | 3843 | 1959 |
| 42 | 3933 | 2231 | 0 | 0 |
| 43 | 4310 | 2631 | 4002 | 0 |
| 44 | 4478 | 0 | 4326 | 2908 |
| 45 | 4838 | 2795 | 4664 | 2401 |
| 46 | 0 | 3208 | 4711 | 2780 |
| 47 | 5013 | 3264 | 5134 | 0 |
| 48 | 5295 | 4432 | 5399 | 2861 |
| 49 | 5447 | 0 | 0 | 3391 |
| 50 | 5670 | 3714 | 5510 | 3483 |
| 51 | 5867 | 3921 | 5692 | 4638 |
| 52 | 5910 | 4276 | 5840 | 3923 |
| 53 | 6286 | 4505 | 6200 | 0 |
| 54 | 0 | 0 | 6416 | 4088 |
| 55 | 6205 | 0 | 6391 | 4468 |
| 56 | 6322 | 4701 | 0 | 4633 |
| 57 | 6351 | 5450 | 6501 | 0 |
| 58 | 6422 | 4553 | 6850 | 0 |
| 59 | 6359 | 4802 | 6705 | 4795 |
| 60 | 6225 | 0 | 7037 | 5889 |
| 61 | 0 | 4750 | 6965 | 4948 |
| 62 | 6133 | 5304 | 7267 | 5412 |
| 63 | 6123 | 5351 | 0 | 0 |
| 64 | 6112 | 4999 | 7151 | 5401 |
| 65 | 5709 | 4589 | 7330 | 5946 |
| 66 | 5411 | 0 | 7170 | 6654 |
| 67 | 5325 | 4751 | 7484 | 6063 |
| 68 | 5176 | 4316 | 7147 | 5780 |
| 69 | 0 | 4867 | 7424 | 0 |
| 70 | 4948 | 4775 | 0 | 6385 |
| 71 | 4844 | 4492 | 7423 | 5931 |
| 72 | 4663 | 0 | 7313 | 6520 |
| 73 | 4414 | 3922 | 7503 | 7105 |
| 74 | 4296 | 4216 | 7450 | 0 |
| 75 | 4102 | 3919 | 7496 | 6797 |
| 76 | 3914 | 4826 | 7336 | 6237 |
| 77 | 0 | 0 | 0 | 6851 |
| 78 | 3761 | 3619 | 7337 | 6615 |
| 79 | 3608 | 3924 | 7338 | 0 |
| 80 | 3411 | 3511 | 7474 | 8317 |
| 81 | 3242 | 3844 | 7359 | 6318 |
| 82 | 3182 | 3609 | 7391 | 6938 |
| 83 | 3159 | 0 | 7473 | 6668 |
| 84 | 0 | 4732 | 0 | 0 |
| 85 | 3104 | 3579 | 7386 | 7180 |
| 86 | 2980 | 3712 | 7205 | 6888 |
| 87 | 2851 | 3438 | 7261 | 8743 |
| 88 | 2885 | 0 | 7224 | 6903 |
| 89 | 2906 | 3761 | 7184 | 7366 |
| 90 | 2798 | 3461 | 7176 | 0 |
| 91 | 2828 | 4909 | 7306 | 7011 |
| 92 | 0 | 3598 | 0 | 7516 |
| 93 | 2935 | 3784 | 7084 | 7094 |
| 94 | 3022 | 0 | 7219 | 9019 |
| 95 | 2912 | 3536 | 7160 | 0 |
| 96 | 2982 | 3755 | 7218 | 7283 |
| 97 | 3086 | 3728 | 7079 | 7793 |
| 98 | 2976 | 5297 | 7121 | 7317 |
| 99 | 3041 | 0 | 0 | 7809 |
| 100 | 0 | 3785 | 6930 | 0 |
| 101 | 3134 | 3902 | 6992 | 7509 |
| 102 | 3178 | 3789 | 6971 | 9134 |
| 103 | 3224 | 3904 | 6885 | 7448 |
| 104 | 3262 | 5443 | 6812 | 7696 |
| 105 | 3278 | 0 | 6823 | 7179 |
| 106 | 3285 | 3977 | 0 | 0 |
| 107 | 3415 | 3786 | 6511 | 7602 |
| 108 | 0 | 3929 | 6627 | 9110 |
| 109 | 3299 | 3768 | 6599 | 7625 |
| 110 | 3355 | 0 | 6387 | 7135 |
| 111 | 3371 | 3978 | 6347 | 0 |
| 112 | 3506 | 5250 | 6298 | 7408 |
| 113 | 3375 | 3929 | 0 | 7057 |
| 114 | 3398 | 3696 | 6311 | 7440 |
| 115 | 0 | 3805 | 6097 | 8626 |
| 116 | 3323 | 0 | 6004 | 0 |
| 117 | 3369 | 3700 | 6065 | 7207 |
| 118 | 3310 | 5163 | 5732 | 6830 |
| 119 | 3252 | 3505 | 5895 | 7208 |
| 120 | 3248 | 7070 | 0 | 6805 |
| 121 | 3284 | 0 | 5639 | 8712 |
| 122 | 3214 | 3517 | 5725 | 0 |
| 123 | 0 | 3364 | 5473 | 6783 |
| 124 | 3126 | 4536 | 5468 | 13563 |
| 125 | 2945 | 3210 | 5396 | 7019 |
| 126 | 3134 | 3152 | 5495 | 6459 |
| 127 | 2940 | 0 | 0 | 0 |
| 128 | 2726 | 3035 | 5258 | 8739 |
| 129 | 2786 | 3048 | 5387 | 6503 |
| 130 | 2617 | 2981 | 5252 | 6588 |
| 131 | 0 | 4148 | 5260 | 6457 |
| 132 | 2636 | 2754 | 5294 | 0 |
| 133 | 2583 | 0 | 5232 | 6831 |
| 134 | 2509 | 2833 | 0 | 6197 |
| 135 | 2430 | 2651 | 5339 | 8493 |
| 136 | 2336 | 5245 | 5281 | 6569 |
| 137 | 2321 | 3763 | 5274 | 6853 |
| 138 | 2219 | 0 | 5300 | 0 |
| 139 | 0 | 2428 | 5384 | 6589 |
| 140 | 2211 | 2432 | 5282 | 13414 |
| 141 | 2092 | 2267 | 0 | 8902 |
| 142 | 2081 | 2463 | 5275 | 6378 |
| 143 | 2143 | 3217 | 5358 | 0 |
| 144 | 1951 | 0 | 5394 | 7021 |
| 145 | 1996 | 2254 | 5189 | 6603 |
| 146 | 0 | 2090 | 5216 | 7105 |
| 147 | 1989 | 2244 | 5389 | 8361 |
| 148 | 1905 | 2097 | 0 | 0 |
| 149 | 1773 | 0 | 5332 | 6801 |
| 150 | 1843 | 5100 | 5227 | 6639 |
| 151 | 1840 | 1994 | 5371 | 6982 |
| 152 | 1739 | 1987 | 5270 | 6393 |
| 153 | 1764 | 2043 | 5319 | 15329 |
| 154 | 0 | 1887 | 5212 | 0 |
| 155 | 1745 | 0 | 0 | 6870 |
| 156 | 1698 | 2970 | 5260 | 6533 |
| 157 | 1679 | 1827 | 5124 | 6919 |
| 158 | 1632 | 1899 | 5245 | 6255 |
| 159 | 1671 | 1781 | 5217 | 0 |
| 160 | 1664 | 0 | 5033 | 8079 |
| 161 | 1604 | 3556 | 5068 | 5950 |
| 162 | 0 | 2831 | 0 | 6434 |
| 163 | 1617 | 1740 | 5032 | 5934 |
| 164 | 1576 | 1707 | 5014 | 0 |
| 165 | 1565 | 1638 | 5196 | 11884 |
| 166 | 1531 | 0 | 5005 | 7125 |
| 167 | 1490 | 1770 | 4991 | 5211 |
| 168 | 1496 | 1596 | 4931 | 5397 |
| 169 | 0 | 4355 | 0 | 0 |
| 170 | 1506 | 1668 | 4743 | 5075 |
| 171 | 1525 | 0 | 4729 | 5152 |
| 172 | 1530 | 1618 | 4514 | 4687 |
| 173 | 1511 | 1711 | 4524 | 10351 |
| 174 | 1475 | 1616 | 4475 | 4429 |
| 175 | 1372 | 2539 | 4307 | 0 |
| 176 | 1333 | 1614 | 4205 | 4138 |
| 177 | 0 | 0 | 0 | 4214 |
| 178 | 1397 | 1694 | 4065 | 3891 |
| 179 | 1388 | 3347 | 3947 | 4707 |
| 180 | 1376 | 2695 | 3808 | 0 |
| 181 | 1347 | 1887 | 3757 | 3373 |
| 182 | 1369 | 0 | 3479 | 3488 |
| 183 | 1298 | 1813 | 3352 | 6440 |
| 184 | 1291 | 2000 | 0 | 3434 |
| 185 | 0 | 1901 | 3280 | 0 |
| 186 | 1329 | 4862 | 3161 | 2764 |
| 187 | 1297 | 2125 | 3004 | 2561 |
| 188 | 1252 | 0 | 2826 | 2510 |
| 189 | 1264 | 1985 | 2694 | 2262 |
| 190 | 1243 | 2138 | 2551 | 4679 |
| 191 | 1188 | 2136 | 0 | 0 |
| 192 | 1199 | 3046 | 2407 | 2004 |
| 193 | 0 | 4103 | 2307 | 1789 |
| 194 | 1271 | 0 | 2221 | 1724 |
| 195 | 1258 | 1921 | 2046 | 1524 |
| 196 | 1261 | 2056 | 1862 | 0 |
| 197 | 1218 | 1912 | 1865 | 1860 |
| 198 | 1334 | 2716 | 0 | 2692 |
| 199 | 1247 | 0 | 1712 | 1231 |
| 200 | 0 | 1732 | 1642 | 1125 |
| 201 | 1319 | 3473 | 1562 | 0 |
| 202 | 1310 | 1646 | 1399 | 1018 |
| 203 | 1315 | 1552 | 1332 | 1193 |
| 204 | 1459 | 2133 | 1364 | 815 |
| 205 | 1401 | 0 | 0 | 1446 |
| 206 | 1399 | 1332 | 1238 | 708 |
| 207 | 1366 | 1338 | 1048 | 0 |
| 208 | 0 | 2404 | 1013 | 587 |
| 209 | 1418 | 1091 | 885 | 691 |
| 210 | 1445 | 0 | 831 | 470 |
| 211 | 1497 | 1669 | 831 | 477 |
| 212 | 1420 | 978 | 0 | 0 |
| 213 | 1441 | 928 | 718 | 765 |
| 214 | 1494 | 1768 | 658 | 327 |
| 215 | 1382 | 1412 | 621 | 415 |
| 216 | 0 | 0 | 541 | 247 |
| 217 | 1465 | 791 | 518 | 0 |
| 218 | 1268 | 694 | 481 | 264 |
| 219 | 1234 | 723 | 0 | 416 |
| 220 | 1313 | 1249 | 383 | 251 |
| 221 | 1201 | 0 | 383 | 180 |
| 222 | 1173 | 1000 | 360 | 157 |
| 223 | 1038 | 523 | 296 | 0 |
| 224 | 0 | 485 | 266 | 123 |
| 225 | 908 | 458 | 214 | 227 |
| 226 | 996 | 1174 | 0 | 138 |
| 227 | 912 | 0 | 222 | 89 |
| 228 | 791 | 365 | 193 | 0 |
| 229 | 713 | 330 | 149 | 80 |
| 230 | 583 | 294 | 156 | 67 |
| 231 | 0 | 264 | 101 | 123 |
| 232 | 551 | 0 | 108 | 46 |
| 233 | 515 | 676 | 0 | 0 |
| 234 | 469 | 166 | 76 | 44 |
| 235 | 403 | 164 | 73 | 41 |
| 236 | 351 | 161 | 57 | 32 |
| 237 | 232 | 125 | 61 | 60 |
| 238 | 209 | 0 | 42 | 27 |
| 239 | 0 | 287 | 33 | 0 |
| 240 | 205 | 75 | 0 | 17 |
| 241 | 131 | 56 | 23 | 10 |
| 242 | 80 | 52 | 22 | 18 |
| 243 | 92 | 0 | 14 | 22 |
| 244 | 75 | 55 | 21 | 0 |
| 245 | 55 | 43 | 7 | 5 |
| 246 | 45 | 11 | 8 | 5 |
| 247 | 0 | 11 | 0 | 4 |
| 248 | 36 | 9 | 5 | 4 |
| 249 | 14 | 0 | 2 | 0 |
| 250 | 13 | 13 | 2 | 6 |
| 251 | 17 | 1 | 1 | 5 |
| 252 | 7 | 2 | 4 | 0 |
| 253 | 5 | 2 | 1 | 0 |
| 254 | 0 | 0 | 0 | 0 |
| 255 | 0 | 0 | 0 | 0 |

3.code

* Import cv2 to do image processing, and I always do a Gaussian blurring with kernel size 7 before doing Laplacian and Sobel gradient.
* For some processing, I use CV2\_64F data structure and “convertScaleAbs” to make the result more accurate.
* Use normalization functions to make gray levels more separate.
* Save every image in 200 dpi by using PIL library.
* Use cv2.calcHist to make the histograms.
* Import openpyxl to write data into an excel file.
* I separate python codes into two versions to do different image processing. Below are only codes of kid.py because fruit.py is same as kid.py.







