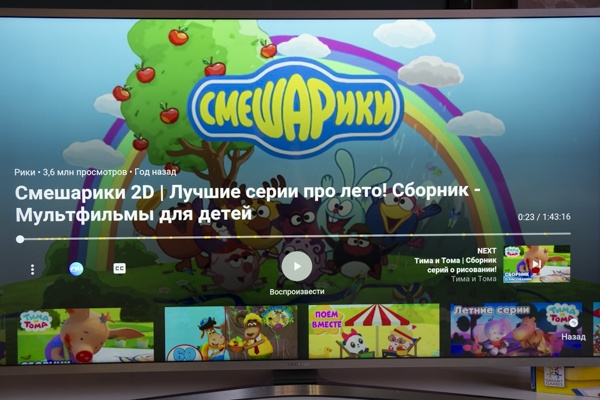
**Normalization results for pairs 7\_0.png\_7\_1.png from subset png\picture\_inside**

**7\_0.png: 7\_1.png: **

**Table 1 - Found homography parameters and normalization accuracy assessment**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Original:  img1: 0 img2: 0 | h11 | h12 | h13 | h21 | h22 | h23 | h31 | h32 | h33 | avg ErrPar (param) | avg ErrIM (pixel) | max ErrIM | avg ErrCPM (corner) | max ErrCPM | Expert rate |
| SIFT | 0,989 | 0,2 | 75,056 | -0,144 | 1,002 | 80,539 | 0,001 | 0 | 1 | 0 | 0,373 | 2,76 | ~ | ~ |  |
| SURF128 | 0,971 | 0,189 | 77,271 | -0,147 | 0,984 | 81,794 | 0,001 | 0 | 1 | 0 | 1,024 | 3,787 | ~ | ~ |  |
| SURF64 | 0,98 | 0,188 | 76,797 | -0,144 | 0,992 | 80,568 | 0,001 | 0 | 1 | 0 | 1,067 | 3,258 | ~ | ~ |  |
| ORB | 0,987 | 0,193 | 76,391 | -0,143 | 0,997 | 80,643 | 0,001 | 0 | 1 | 0 | 0,887 | 3,58 | ~ | ~ |  |
| ORB1000 | 1,031 | 0,235 | 69,496 | -0,135 | 1,069 | 73,26 | 0,001 | 0 | 1 | 0 | 0,873 | 2,953 | ~ | ~ |  |
| BRISK | 0,986 | 0,194 | 75,727 | -0,144 | 0,996 | 80,657 | 0,001 | 0 | 1 | 0 | 0,741 | 3 | ~ | ~ |  |
| KAZE | 0,979 | 0,196 | 75,97 | -0,147 | 0,996 | 81,199 | 0,001 | 0 | 1 | 0 | 0,795 | 3,557 | ~ | ~ |  |
| AKAZE | 0,982 | 0,194 | 76,357 | -0,146 | 0,993 | 81,389 | 0,001 | 0 | 1 | 0 | 0,749 | 3,551 | ~ | ~ |  |
| Original matrix |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

where h11, h12, h13, h21, h22, h23, h31, h32, h33 - parameters of found homography matrix H\* or of original one H;   
avgErrPar - average error of found parameters, the accuracy of found homography matrix parameters with a preliminary minimax normalization of found and original matrices;  
avgErrIM - average error of inlier coordinate matching;  
inliers - correct matches; outliers - false matches;  
maxErrIM – maximum error of inlier coordinate matching;  
avgErrCPM - average error of corner point matching;  
maxErrCPM - maximum error of corner point matching;  
expert rate - experts assessment of normalization accuracy with a 5-point scale: 0 - normalization failed, 1 - insufficient, 2 - satisfactory, 3 - good, 4 – excellent.

**Table 2 - Quantitative evaluation of descriptors, precision and recall estimation (with found overlap)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | NP1 | NP2 | NM | NI | DP1 | DP2 | OP1 | OP2 | NPO1 | NPO2 | NMO | DPO1 | DPO2 | Precision | RecallO1 | Comments |
| SIFT | 1643 | 990 | 509 | 446 | 0,0068 | 0,0041 | 99,6729 | 52,3392 | 1643 | 865 | 509 | 0,0069 | 0,0069 | 0,8762 | 0,2715 |  |
| SURF128 | 2020 | 1845 | 261 | 199 | 0,0084 | 0,0077 | 99,655 | 52,2312 | 2020 | 1518 | 261 | 0,0084 | 0,0121 | 0,7625 | 0,0985 |  |
| SURF64 | 2020 | 1845 | 339 | 264 | 0,0084 | 0,0077 | 99,6304 | 52,3329 | 2020 | 1521 | 339 | 0,0084 | 0,0121 | 0,7788 | 0,1307 |  |
| ORB | 7415 | 4708 | 1028 | 775 | 0,0309 | 0,0196 | 99,6625 | 52,1004 | 7415 | 4370 | 1028 | 0,031 | 0,0349 | 0,7539 | 0,1045 |  |
| ORB1000 | 1000 | 1000 | 162 | 122 | 0,0042 | 0,0042 | 99,6408 | 52,6333 | 1000 | 982 | 162 | 0,0042 | 0,0078 | 0,7531 | 0,122 |  |
| BRISK | 2955 | 1660 | 405 | 380 | 0,0123 | 0,0069 | 99,6658 | 52,3554 | 2955 | 1538 | 405 | 0,0124 | 0,0122 | 0,9383 | 0,1286 |  |
| KAZE | 1025 | 499 | 168 | 149 | 0,0043 | 0,0021 | 99,6504 | 52,4012 | 1025 | 457 | 168 | 0,0043 | 0,0036 | 0,8869 | 0,1454 |  |
| AKAZE | 1051 | 448 | 118 | 107 | 0,0044 | 0,0019 | 99,6604 | 52,1767 | 1051 | 422 | 118 | 0,0044 | 0,0034 | 0,9068 | 0,1018 |  |

where NP - number of found key points; NP1, NP2 - number of found key points for image1 and image2 respectively;  
NM - number of matches found with NNDR method, NM=NI+NO;  
NI - number of inliers found with RANSAC method;  
NO - number of outliers discarded with RANSAC method;   
DP - density of key points (per cent), DP= NP/(height x width) , height, width - vertical and horizontal image sizes respectively (pixels)  
DP1, DP2 - density of key points points for image1 and image2 respectively;  
OP1, OP2 - overlap percentage for image1 and image2 respectively;  
NPO1, NPO2 - number of found key points on overlap for image1 and image2 respectivelyy;  
NMO - number of matches on overlap found with NNDR method;  
DPO1, DPO2 - density of key points points on overlap for image1 and image2 respectively;   
OA - overlap area (pixels), OA1, OA2 - overlap area for image1 and image2 respectively;  
DPO1= NPO1/OA1; DPO2= NPO2/OA2;  
Precision = NI/ NM - the rate to evaluate the part of inliers to all found matches with NNDR method;  
RecallO1 = NI/ NPO1 - completeness of inlier retrieval relative to the number of all key points on overlap for image1. The rate illustrates usefulness of the found key points for normalization.

**Table 3 - Estimation of time costs**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | NP1 | NP2 | DesT1, sec | DesT2, sec | MatchT, sec | InlierT, sec | AvgDesT, ms | AvgMatchT, ms | AvgInlierT, ms | TotalNormT, sec |
| SIFT | 1643 | 990 | 0,054232 | 0,049151 | 0,017066 | 0,000555 | 0,041327 | 0,033528 | 0,001245 | 0,121005 |
| SURF128 | 2020 | 1845 | 0,080766 | 0,067856 | 0,030041 | 0,000548 | 0,03838 | 0,115098 | 0,002754 | 0,179211 |
| SURF64 | 2020 | 1845 | 0,067608 | 0,055676 | 0,01763 | 0,00059 | 0,031822 | 0,052006 | 0,002234 | 0,141504 |
| ORB | 7415 | 4708 | 0,018477 | 0,013633 | 0,099255 | 0,001031 | 0,002693 | 0,096551 | 0,00133 | 0,132395 |
| ORB1000 | 1000 | 1000 | 0,010021 | 0,009263 | 0,003565 | 0,000639 | 0,009641 | 0,022007 | 0,005237 | 0,023489 |
| BRISK | 2955 | 1660 | 0,041301 | 0,023679 | 0,014664 | 0,000526 | 0,01412 | 0,036207 | 0,001383 | 0,08017 |
| KAZE | 1025 | 499 | 0,125331 | 0,119171 | 0,005297 | 0,000489 | 0,180546 | 0,031532 | 0,00328 | 0,250288 |
| AKAZE | 1051 | 448 | 0,020004 | 0,014927 | 0,003135 | 0,000551 | 0,026175 | 0,026569 | 0,005148 | 0,038617 |

where DesT – descriptor creation time (time for key point detection and descriptor computation), DesT1, DesT2 – creation time of descriptors for image1 and image2 respectively;  
MatchT - retrieval time of matching found with NNDR method for the pair;  
InlierT – inlier retrieval time found with RANSAC method for the pair;  
AvgDesT – average time for one descriptor creation;  
AvgMatchT - average time for one match retrieval with NNDR method;  
AvgInlierT – average time for one inlier retrieval with RANSAC method;  
TotalNormT – total normalization time for the pair.