

SELF DRIVING CARS

CAMERA PROJECT

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OUTPUT FOR MULTIPLE DETECTORS AND DESCRIPTORS

Detector Type: FAST Descriptor Type: BRISK Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 12.6908 65.9071 11.9 11.5751 12.5032 12.8854 12.3202 11.8075
12.3008 12.4292 8.23412 12.1861

Detector Type: FAST Descriptor Type: BRIEF Matcher Type: MAT_BF Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 11.0575 20.3488 11.8658 12.0847 12.6222 13.9549 11.4787
11.5341 11.8956 11.8304 7.95281 10.8444

Detector Type: FAST Descriptor Type: ORB Matcher Type: MAT_BF Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 11.3112 16.7984 11.8818 11.9761 13.497 13.6355 11.9945 11.6123
11.2436 12.1331 9.61277 11.9975

Detector Type: FAST Descriptor Type: FREAK Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 11.6421 32.2568 11.9033 11.9904 13.8722 13.0192 12.2294

11.4823 10.9945 12.0872 9.67806 12.5539

Detector Type: FAST Descriptor Type: SIFT Matcher Type: MAT_BF Descriptor Family: DES_HOG Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 11.6923 20.6686 12.1074 12.377 13.8027 13.4364 11.9536

11.6295 11.3035 11.26 7.92013 11.1303

Detector Type: SHITOMASI Descriptor Type: BRISK Matcher Type: MAT_BF Descriptor Family: DES_BINARY Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 13.6541 12.9056 12.9475 12.6199 12.7019 12.0008 11.7642

11.7376 9.97271 10.4477 11.8438 9.88916

Detector Type: SHITOMASI Descriptor Type: BRIEF Matcher Type: MAT_BF Descriptor Family: DES_BINARY Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 13.8833 12.1368 16.3066 12.08 12.9491 12.0062 11.4169

11.4484 11.7504 11.5476 10.3568 8.26497

Detector Type: SHITOMASI Descriptor Type: ORB Matcher Type: MAT_BF

Descriptor Family: DES_BINARY Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 13.0336 12.1848 12.4947 12.2022 13.6174 11.3317 11.5615

11.5384 10.6027 11.2036 11.1681 8.61917

Detector Type: SHITOMASI Descriptor Type: FREAK Matcher Type: MAT_BF

Descriptor Family: DES_BINARY Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 13.6884 12.3866 13.0387 12.8674 13.8461 11.4072 12.0287

11.6524 10.2993 10.9372 11.3514 7.75279

Detector Type: SHITOMASI Descriptor Type: SIFT Matcher Type: MAT_BF

Descriptor Family: DES_HOG Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 13.6475 12.1074 12.6612 12.0847 13.2001 11.7502 11.8792

11.4218 11.6886 10.7624 11.3514 10.0254

Detector Type: HARRIS Descriptor Type: BRISK Matcher Type: MAT_BF

Descriptor Family: DES_BINARY Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 8.81335 35.3833 12.2792 13.5704 -inf 11.6702 11.6948 12.1403

-13.6263 6.92571 12.5848 -inf

Detector Type: HARRIS Descriptor Type: BRIEF Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 8.81335 19.4967 13.497 13.5704 -inf 11.6702 11.9536 5.6061
-inf 7.21241 12.6612 -inf

Detector Type: HARRIS Descriptor Type: ORB Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 9.74953 34.1473 13.712 13.5704 -inf 11.4377 11.9536 6.06984
-14.7808 6.7641 12.5848 -inf

Detector Type: HARRIS Descriptor Type: FREAK Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 8.81335 39.584 13.2002 12.9162 20.5862 11.8135 11.8228 nan
-inf 6.87135 nan nan

Detector Type: HARRIS Descriptor Type: SIFT Matcher Type: MAT_BF
Descriptor Family: DES_HOG Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 8.81335 19.4967 12.9162 12.9162 -13.4405 11.6702 11.9536
5.66097 -inf 7.21241 12.5848 -inf

Detector Type: BRISK Descriptor Type: BRISK Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 13.8834 26.9537 16.5209 15.5102 12.5703 13.0222 11.8362
12.8134 12.425 11.5659 9.55475 11.2957

Detector Type: BRISK Descriptor Type: BRIEF Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 11.9678 17.995 14.9567 18.7451 10.7038 13.5752 13.4665
11.0794 11.1267 12.1146 11.1487 10.2657

Detector Type: BRISK Descriptor Type: ORB Matcher Type: MAT_BF Descriptor
Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 13.709 19.5717 15.9052 16.1001 11.4778 13.7339 11.214 12.8134
11.2406 11.6922 10.0559 12.1936

Detector Type: BRISK Descriptor Type: FREAK Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 12.4708 22.0377 14.8201 17.0632 13.1664 13.7091 11.326
11.3058 13.3252 10.7419 9.55454 11.4499

Detector Type: BRISK Descriptor Type: SIFT Matcher Type: MAT_BF Descriptor Family: DES_HOG Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 13.7021 30.2501 14.6652 16.2874 13.5371 14.1945 11.5109
10.4534 12.4658 12.0393 10.4889 12.576

Detector Type: ORB Descriptor Type: BRISK Matcher Type: MAT_BF Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 13.3282 98.5803 13.1844 10.9105 13.146 8.29125 -inf 9.78295
11.3884 15.2827 14.3156 27.4934

Detector Type: ORB Descriptor Type: BRIEF Matcher Type: MAT_BF Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 19.4581 25.9716 47.9156 -inf 33.1427 15.0858 14.2597 9.99925
8.88172 10.9531 12.2682 17.6604

Detector Type: ORB Descriptor Type: ORB Matcher Type: MAT_BF Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 156.084 23.9732 -inf 10.4367 23.5366 9.2983 -inf 13.5239
25.3155 13.3523 15.7683 27.4756

Detector Type: ORB Descriptor Type: FREAK Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 11.9371 -inf -inf 8.95665 -inf 8.46717 24.6245 37.1591 8.67502
9.37082 9.93894 8.14326

Detector Type: ORB Descriptor Type: SIFT Matcher Type: MAT_BF Descriptor
Family: DES_HOG Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 11.5099 -inf -inf 10.7914 11.3956 9.20223 -inf 26.0899 30.204
10.4631 18.7821 14.2111

Detector Type: AKAZE Descriptor Type: BRISK Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 11.8685 14.2471 16.2202 13.5471 11.8592 12.6418 10.3562
9.74176 9.96887 10.1207 9.14663 8.873

Detector Type: AKAZE Descriptor Type: BRIEF Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 12.9382 14.72 15.7893 14.2401 11.5709 12.2983 11.4823
9.98208 9.48053 9.90061 9.28967 8.96428

Detector Type: AKAZE Descriptor Type: ORB Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 11.8397 15.1147 15.3297 13.9909 11.4732 12.4319 11.1953
10.3644 10.0763 9.85408 9.17787 9.24847

Detector Type: AKAZE Descriptor Type: FREAK Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 11.8907 15.7248 15.6959 13.6614 11.4261 12.2713 10.9742
9.99328 9.92231 10.3759 9.2409 8.69306

Detector Type: AKAZE Descriptor Type: AKAZE Matcher Type: MAT_BF
Descriptor Family: DES_BINARY Selector Type: SEL_KNN
lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537
10.9678 8.09422 3.17535 -9.99424 8.30978
camera outputs: 12.0279 16.1532 15.5226 14.4738 11.6429 12.537 11.0717
10.9116 10.1601 10.0008 9.25992 9.02542

Detector Type: AKAZE Descriptor Type: SIFT Matcher Type: MAT_BF
Descriptor Family: DES_HOG Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 12.2062 15.8662 15.5632 14.1263 11.5935 12.3819 10.9645

10.5999 9.92231 10.2177 9.26089 8.78348

Detector Type: SIFT Descriptor Type: BRISK Matcher Type: MAT_BF Descriptor

Family: DES_BINARY Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 12.4055 15.2698 14.7319 15.9024 11.0724 13.0329 10.7274

9.3534 9.51227 8.74034 9.05558 9.37991

Detector Type: SIFT Descriptor Type: BRIEF Matcher Type: MAT_BF Descriptor

Family: DES_BINARY Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 11.8653 13.3937 14.6573 15.9459 11.0246 12.8359 10.5086

10.6285 9.79929 8.73299 8.99481 8.96523

Detector Type: SIFT Descriptor Type: SIFT Matcher Type: MAT_BF Descriptor

Family: DES_HOG Selector Type: SEL_KNN

lidar outputs: 12.9722 16.2511 34.3404 9.34376 18.0318 3.83244 -10.8537

10.9678 8.09422 3.17535 -9.99424 8.30978

camera outputs: 11.183 14.5962 14.0533 15.7467 10.6289 11.2389 11.3523

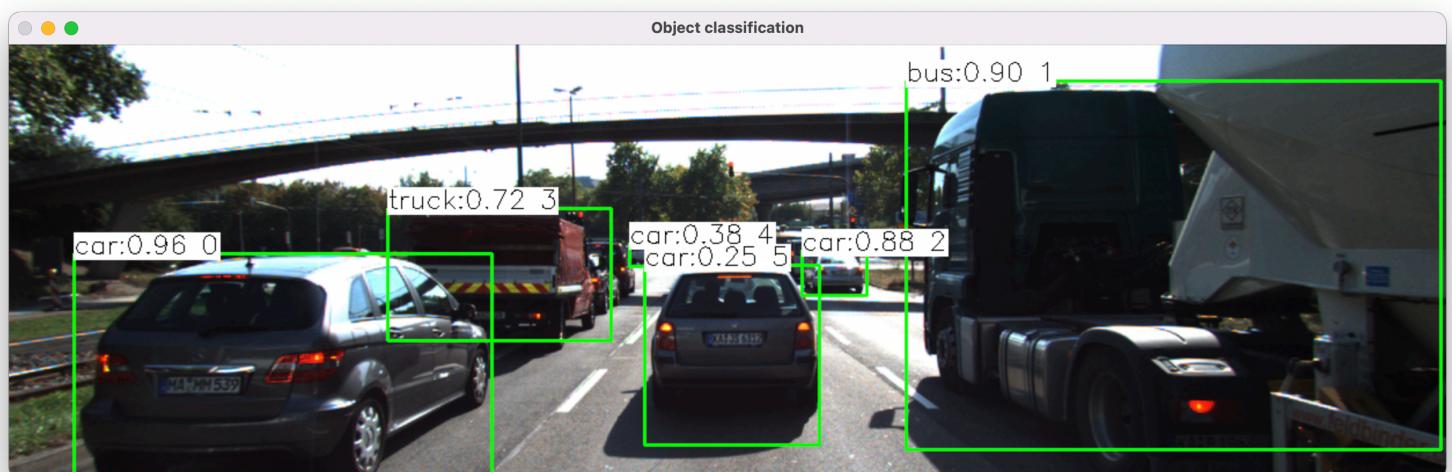
10.9938 10.3647 9.84815 8.72429 8.89146

COMMENTS

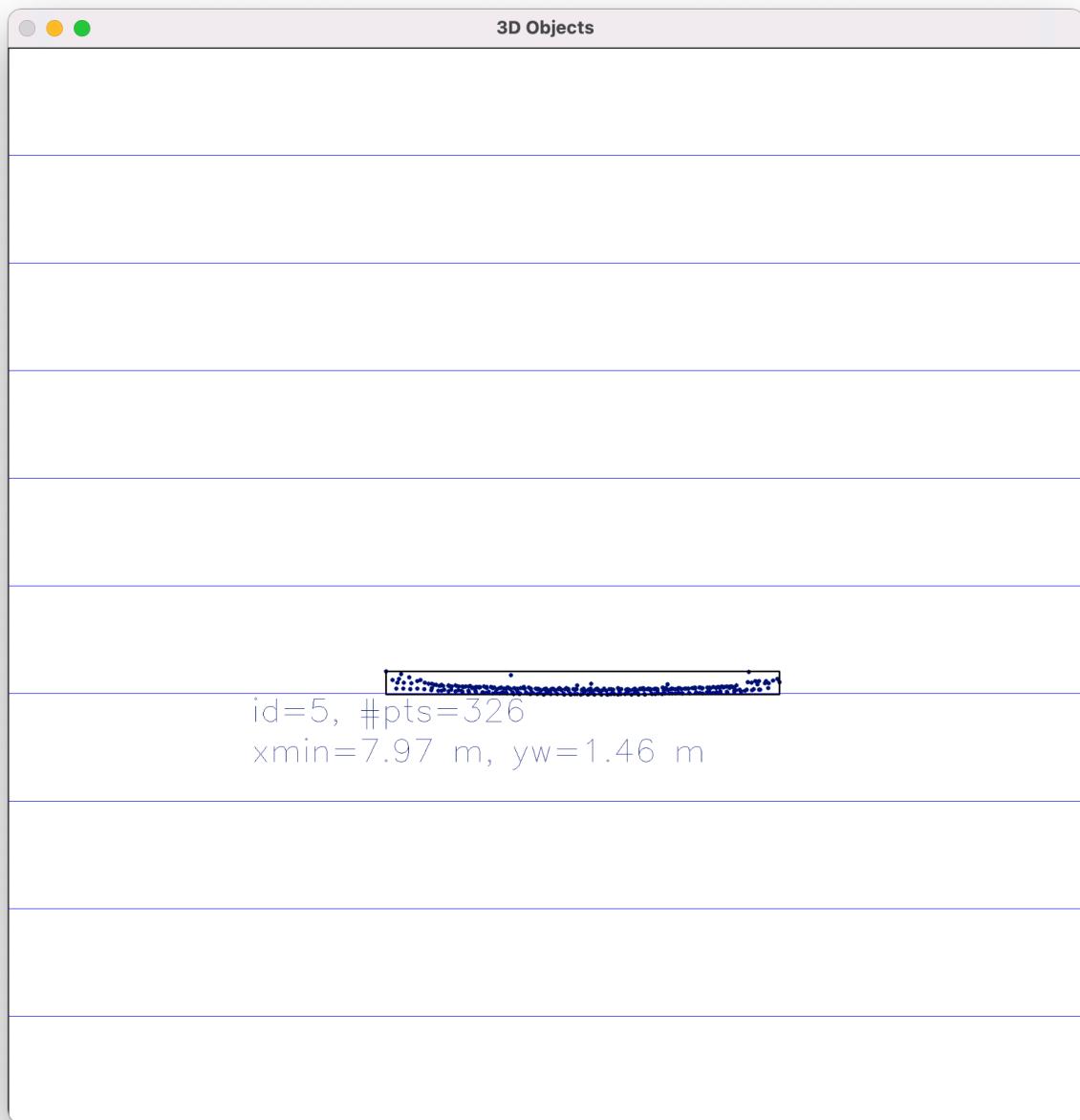
When using FAST detector and SIFT descriptor it was observed that the lidar output was poor relative to the camera and that is due to the presence of some random outliers in the lidar data.

OUTPUT IMAGES

YOLO output:



TOPVIEW of lidar points:



Lidar TTC and Camera TTC:

