Track an Object in 3D Space

FP.1 Match 3D Objects

Implement the method
"matchBoundingBoxes", which takes as
input both the previous and the current data
frames and provides as output the ids of the
matched regions of interest (i.e. the boxID
property). Matches must be the ones with the
highest number of keypoint correspondences.

Code is at camFusion_Student.cpp (lines 351:391).

FP.2 Compute Lidar-based TTC

Compute the time-to-collision in second for all matched 3D objects using only Lidar measurements from the matched bounding boxes between current and previous frame.

computeTTCLidar function is at camFusion_Student.cpp (lines 321:348).

There are other helper functions called by computeTTCLidar as well.

FP.3 Associate Keypoint Correspondences with Bounding Boxes

Prepare the TTC computation based on camera measurements by associating keypoint correspondences to the bounding boxes which enclose them. All matches which satisfy this condition must be added to a vector in the respective bounding box.

clusterKptMatchesWithROI function is at camFusion_Student.cpp (lines 195:208).

FP.4 Compute Camera-based TTC

Compute the time-to-collision in second for all matched 3D objects using only keypoint correspondences from the matched bounding boxes between current and previous frame.

computeTTCCamera function is at camFusion_Student.cpp (lines 212:273).

FP.5 Performance Evaluation 1

Find examples where the TTC estimate of the Lidar sensor does not seem plausible. Describe your observations and provide a sound argumentation why you think this happened. Pls see the sheet named "TTC_Lidar"

in the enclosed Excel file named "TTCLidar_TTCCamera_Performances.xlsx"

Frame	Original Xmin values		Xmin values after removing noise			Xmin Diff. (After						Frame	Manually 6	estimated XI	min values			
(From/To)	Xmin prev.	Xmin curr.			TTC LIDAR	Xmin Diff. (Original)	noise removal)	hedey: In the pink highlighted cells, because of the relatively lower than normal difference between Xmin values (after noise removal), I doubt							Xmin curr.	ттс		
1-2	7.97	7.91	8.05	7.98	12.28	-0.06	0.06	the corresponsding f					1-2			#DIV/0!		
2-3	7.91	7.85	7.98	7.92	13.20	-0.06	0.06	inaccurate calculation was decelerating at			the precedir	ig vehicle	2-3			#DIV/0!		
3-4	7.85	7.79	7.92	7.87	17.12	-0.06	0.05	was decelerating at	a relatively s	teady rate.			3-4			#DIV/0!		
4-5	7.79	7.68	7.87	7.80	10.54	-0.11	0.07						4-5	7.80	7.76	19.40	These are the 3 exam	anles that I
5-6	7.68	7.64	7.80	7.77	26.80	-0.04	0.03						5-6	7.68	7.64	19.10	estimated manually.	
6-7	7.64	7.58	7.77	7.73	18.85	-0.06	0.04	hedey:					6-7	7.64	7.60	19.00	estillated manually.	
7-8	7.58	7.55	7.73	7.68	15.36	-0.03	0.05	Regarding the Green F					7-8			#DIV/0!		
8-9	7.55	7.47	7.68	7.61	10.87	-0.08	0.07	Xmin difference values, the noise removal helped to bring the TTC Lidar calculation to be more accurate and avoid the effect					8-9			#DIV/0!		
9-10	7.47	7.43	7.61	7.56	13.74	-0.04	0.06	of these abnormal diff		ccaracc and	avoid the ch	ccc	9-10			#DIV/0!		
10-11	7.43	7.39	7.56	7.47	8.49	-0.04	0.09						10-11			#DIV/0!		
11-12	7.39	7.20	7.47	7.41	13.00	-0.19	0.06						11-12			#DIV/0!		
12-13	7.20	7.27	7.41	7.33	9.65	0.07	0.08						12-13			#DIV/0!		
13-14	7.27	7.19	7.33	7.24	7.87	-0.08	0.09						13-14			#DIV/0!		
14-15	7.19	7.13	7.24	7.17	10.40	-0.06	0.07						14-15			#DIV/0!		
15-16	7.13	7.04	7.17	7.10	9.86	-0.09	0.07						15-16			#DIV/0!		
16-17	7.04	6.83	7.10	7.02	8.78	-0.21	0.08						16-17			#DIV/0!		
17-18	6.83	6.90	7.02	6.95	9.79	0.07	0.07						17-18			#DIV/0!		
18-19	6.90	6.81	6.95	6.87	8.48	-0.09	0.08						18-19			#DIV/0!		
					4.58													

FP.6 Performance Evaluation 2

CRITERIA

Run several detector / descriptor combinations and look at the differences in TTC estimation. Find out which methods perform best and also include several examples where camera-based TTC estimation is way off. As with Lidar, describe your observations again and also look into potential reasons.

MEETS SPECIFICATIONS

Pls see the sheet named "TTC_Camera"

in the enclosed Excel file named "TTCLidar_TTCCamera_Performances.xlsx"

Based on my findings, I see that FAST and SHITOMASI are the best performing detectors.

Together with AKAZE, they have the 10 lowest TTC standard deviation values.

In my opinion AKAZE/AKAZE is the most consistent detector/descriptor combination.

It gave the most consistent illustration of how the preceding vehicle is steadily decelerating from frame to frame.

ORB and HARRIS on the other hand gave unreliable results with lots of negative, inf, and nan TTC values.

etector	DDIGIC TO	er lore	FAST	DE ALC TALCATE TO		DDIOL	I DOUGE	BRISH		Louez	mmumic	mer.	ORB	DE AIC TAICUE	Louez	mmimic	DOLLE TOUR	AKAZE		A 700	- Inches	ш.
escriptor		IEF ORB		REAK AKAZE S					FREAK AKAZE					REAK AKAZE			BRIEF ORE				BIFT	L
-2	12.11	11.14	11.47	11.08 N/A	11.0			11.24		12.32		20.18	18.77 9.65	12.18 N/A	14.3		13.08	12.14	11.94 13.74	12.14	12.26	
-3	12.23	10.60	10.55	11.06 N/A	11.2			17.61		14.10		34.24		20.12 N/A	10.52		14.69	14.12		13.57		
-4	12.90	12.74	12.40	11.30 N/A	13.6			11.30		14.60		81.34	14.24 17.47	12.03 N/A	10.94		13.32	12.93	13.79	12.69	12.98 14.22	
-5	12.63	12.87	12.88	13.30 N/A	12.7		20.16	13.98		10.84		15.12		10.94 N/A	293.96	14.38	13.82	13.51	13.99	14.22		
i-6	16.97	15.05	15.12	15.77 NA	18.7			17.35 17.32		22.44		22.81	12.65	67.96 N/A	21.34		14.11	14.85	15.03 13.20	14.21	15.05 12.99	
-/	13.04	12.67	12.46	12.04 N/A	12.7		13.66			11.34		15.13	12.50	11.54 N/A	20.22		13.64	13.52		13.20	15.39	
-8	11.43 11.09	11.78 12.21	11.29	12.04 N/A 10.86 N/A	12.0 13.7		14.67 17.08	14.44 14.86		12.72		13.04 24.85	174.77 10.07	127.59 N/A 8.96 N/A	12.72		15.88	15.44 14.07	14.97	14.92	13.74	
1-9	11.09	12.21	11.53	11.11 N/A	12.0			14.86		14.62 15.50			13.09	8.96 N/A 13.33 N/A	8.80 11.60		14.18 13.29	12.86	12.88	13.30	13.74	
1-10 D-11	13.15	12.00	13.42	12.58 N/A	13.6			10.25		13.03		70.71 11.40	15.29	-272.52 N/A	10.00		11.64	11.62	11.79	11.60	13.96	
U-11 1-12	12.38	14.45	13.42	11.70 N/A	14.2			12.99		12.85		14.53	8.29	7.25 N/A			12.38	11.89	11.79	12.05	11.64	
	11.53	10.83	11.71	12.00 N/A	10.9		12.77	11.37		10.03		14.12	26.04		9.20	10.37	11.57	11.32	10.77	10.40	10.95	
2-13 3-14	11.53	11.79	12.44	11.56 N/A	12.3			11.03		12.65		13.04	26.04	47.57 N/A 6.62 N/A	-inf 9.45		9.94	9.98	10.77	11.08	10.95	
3-14 4-15	11.35	11.11	10.68	11.31 N/A	11.1			11.03		9.90		9.71	9.48	57.39 N/A	13.72		9.43	9.66	9.14	10.05	9.96	
4-10 5-16	10.77	10.52	9.90	10.21 N/A	10.7		10.25	11.16		9.90	8.73	8.94	9.63	8.61 N/A	11.28		9.43	9.43	9.14	9.68	9.52	
9-16 6-17	11.77	11.25	10.69	10.21 N/A	10.7			10.11		10.39		8.94	9.26	9.34 N/A	9.54		9.67	9.67	10.28	9.68	9.52	
7-18	9.14	7.49	9.29	7.15 N/A	7.8			9.21		8.94		11.18	6.66	11.32 N/A	17.23		9.09	8.83	8.71	8.87	8.99	-
8-19	11.28	9.47	11.01	10.18 N/A	10.6			9.72		11.36		11.37	18.52	7.52 N/A	7.83		8.96	8.87	8.59	8.74	8.73	
	11.20	3.47	ILUI	10. 10 TWA	10.0	3.32	3.30	3.72	10.33 NA	11.30	20.04	11.37	10.32	7.52 NM	7.00	0.77	0.30	0.07	0.00	0.74	0.73	
standard	1.50	1.67	1.35	1.62	2.1	5 2.89	3.02	2.66	3.61	2.93	7.82	20.09	37.36	74.84	64.83	2.08	2.17	2.07	2.04	1.94	2.07	
leviation	1.30	1.07	1.50	1.02	4.1	JI 2.03	3.02	2.00	3.01	2.33	7.02	20.03	37.30	74.04	04.03	2.00	2.1/	2.07	2.04	1.34	2.07	
Detector			HTOMAS	71		1		HARRI	C				SIFT			1						
Descriptor	BRISK IBF	IEF TORB		DEAK AKAZES	ner.	BRISK	BRIEF		FREAK JAKAZE	Tour	BRISK I	BRIEF		DE AIZ TAIZADE	Lour							
2																						
		12.05	10.101	10 OF NIA	10.0									REAK AKAZE								
-2	13.05	12.95	13.18	12.85 N/A	12.9	9 10.91	10.91	10.91	10.91 N/A	10.91	10.93	11.77	OOM	11.00 N/A	10.44							
-2 !-3	12.72	12.84	12.10	11.87 N/A	12.4	9 10.91 2 0.03	10.91 10.20	10.91 11.01	10.91 N/A 11.01 N/A	10.91 11.01	10.93 11.52	11.77 11.79	OOM OOM	11.00 N/A 12.25 N/A	10.44 11.62							
-2 -3 -4	12.72 12.88	12.84 11.00	12.10 10.35	11.87 N/A 10.09 N/A	12.4 10.0	9 10.91 2 0.03 5 -80.85	10.91 10.20 -11.47	10.91 11.01 -11.47	10.91 N/A 11.01 N/A 0.09 N/A	10.91 11.01 -80.85	10.93 11.52 13.54	11.77 11.79 15.09	DOM DOM	11.00 N/A 12.25 N/A 13.54 N/A	10.44 11.62 13.15							
-2 1-3 1-4 1-5	12.72 12.88 12.40	12.84 11.00 12.53	12.10 10.35 11.63	11.87 N/A 10.09 N/A 12.44 N/A	12.4 10.0 12.6	9 10.91 2 0.03 5 -80.85 7 11.77	10.91 10.20 -11.47 11.77	10.91 11.01 -11.47 11.77	10.91 N/A 11.01 N/A 0.09 N/A 12.51 N/A	10.91 11.01 -80.85	10.93 11.52 13.54 18.65	11.77 11.79 15.09 19.68	00M 00M 00M	11.00 N/A 12.25 N/A 13.54 N/A 19.93 N/A	10.44 11.62 13.15 16.35							
-2 -3 -4 -5 -6	12.72 12.88 12.40 12.35	12.84 11.00 12.53 10.98	12.10 10.35 11.63 11.92	11.87 N/A 10.09 N/A 12.44 N/A 11.45 N/A	12.4 10.0 12.6 12.2	9 10.91 2 0.03 5 -80.85 7 11.77	10.91 10.20 -11.47 11.77 12.88	10.91 11.01 -11.47 11.77 35.38	10.9 N/A 11.01 N/A 0.09 N/A 12.51 N/A 44.92 N/A	10.91 11.01 -80.85 11.77 13.64	10.93 11.52 13.54 18.65 14.17	11.77 11.79 15.09 19.68 14.21	00M 00M 00M 00M	11.00 N/A 12.25 N/A 13.54 N/A 19.93 N/A 13.56 N/A	10.44 11.62 13.15 16.35 12.50							
-2 -3 -4 -5 -6 -7	12.72 12.88 12.40 12.35 12.49	12.84 11.00 12.53 10.98 11.75	12.10 10.35 11.63 11.92 12.51	11.87 N/A 10.09 N/A 12.44 N/A 11.45 N/A 12.51 N/A	12.4 10.0 12.6 12.2 12.3	9 10.91 2 0.03 5 -80.85 7 11.77 8 -inf 0.29	10.91 10.20 -11.47 11.77 12.88 15.25	10.91 11.01 -11.47 11.77 35.38 13.62	10.91 N/A 11.01 N/A 0.09 N/A 12.51 N/A 44.92 N/A 14.20 N/A	10.91 11.01 -80.85 11.77 13.64 35.19	10.93 11.52 13.54 18.65 14.17 11.57	11.77 11.79 15.09 19.68 14.21 11.72	00M 00M 00M 00M 00M	11.00 N/A 12.25 N/A 13.54 N/A 19.93 N/A 13.56 N/A 11.98 N/A	10.44 11.62 13.15 16.35 12.50							
-2 -3 -4 -5 -6 -7 -8	12.72 12.88 12.40 12.35 12.49 12.47	12.84 11.00 12.53 10.98 11.75 16.50	12.10 10.35 11.63 11.92 12.51 11.75	11.87 N/A 10.09 N/A 12.44 N/A 11.45 N/A 12.51 N/A 12.23 N/A	12.4 10.0 12.6 12.2 12.3 12.3	9 10.91 2 0.03 5 -80.85 7 11.77 8 -inf 5 0.29 4 11.73	10.91 10.20 -11.47 11.77 12.88 15.25 14.27	10.91 11.01 -11.47 11.77 35.38 13.62 13.50	10.91 N/A 11.01 N/A 0.09 N/A 12.51 N/A 44.92 N/A 14.20 N/A 12.40 N/A	10.91 11.01 -80.85 11.77 13.64 35.19	10.93 11.52 13.54 18.65 14.17 11.57	11.77 11.79 15.09 19.68 14.21 11.72 12.70	OOM OOM OOM OOM OOM	11.00 N/A 12.25 N/A 13.54 N/A 19.93 N/A 13.56 N/A 11.98 N/A 13.94 N/A	10.44 11.62 13.15 16.35 12.50 10.76							
-2 -3 -4 -5 -6 -7 -8 -9	12.72 12.88 12.40 12.35 12.49 12.47 12.55	12.84 11.00 12.53 10.98 11.75 16.50 11.88	12.10 10.35 11.63 11.92 12.51 11.75 12.15	11.87 N/A 10.09 N/A 12.44 N/A 11.45 N/A 12.51 N/A 12.23 N/A 12.94 N/A	12.4 10.0 12.6 12.2 12.3 12.3	9 10.91 2 0.03 5 -80.85 7 11.77 8 -inf 0.29 4 11.73	10.91 10.20 -11.47 11.77 12.88 15.25 14.27 25.12	10.91 11.01 -11.47 11.77 35.38 13.62 13.50 25.12	10.91 N/A 11.01 N/A 0.09 N/A 12.51 N/A 44.92 N/A 14.20 N/A 12.40 N/A 12.92 N/A	10.91 11.01 -80.85 11.77 13.64 35.19 13.50 25.12	10.93 11.52 13.54 18.65 14.17 11.57 14.05	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14	OOM	11.00 N/A 12.25 N/A 13.54 N/A 19.93 N/A 13.56 N/A 11.98 N/A 13.94 N/A 11.18 N/A	10, 44 11, 62 13, 15 16, 35 12, 50 10, 76 12, 70 10, 84							
	12.72 12.88 12.40 12.35 12.49 12.47 12.55 10.48	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28	11.87 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.23 NA 12.24 NA 11.36 NA	12.4 10.0 12.6 12.2 12.3 12.3 12.1 11.9	9 10.91 2 0.03 5 -80.85 7 11.77 8 -inf 6 0.29 4 11.73 4 25.12 9 0.01	10.91 10.20 -11.47 11.77 12.88 15.25 14.27 25.12 3.90	10.91 11.01 -11.47 11.77 35.38 13.62 13.50 25.12 -nan(ind)	10.91 NA 11.01 NA 0.09 NA 12.51 NA 44.92 NA 14.20 NA 12.40 NA 12.92 NA -nan(ind) NA	10.91 11.01 -80.85 11.77 13.64 35.19 13.50 25.12 3.90	10.93 11.52 13.54 18.65 14.17 11.57 14.05 14.82 12.08	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14	00M 00M 00M 00M 00M 00M 00M	11:00 N/A 12:25 N/A 13:54 N/A 19:93 N/A 13:56 N/A 11:98 N/A 11:18 N/A 11:18 N/A 13:55 N/A	10.44 11.62 13.15 16.35 12.50 10.76 12.77 10.84							
0-11	12.72 12.88 12.40 12.35 12.49 12.47 12.55 10.48 13.53	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28 12.42	11.87 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.23 NA 12.84 NA 11.36 NA 11.36 NA	12.4 10.0 12.6 12.2 12.3 12.3 12.1 11.9	9 10.91 2 0.03 5 -80.85 7 11.77 8 -inf 0.29 4 11.73 4 25.12 9 0.01	10.91 10.20 -11.47 11.77 12.88 15.25 14.27 25.12 3.90 -inf	10.91 11.01 -11.47 11.77 35.38 13.62 13.50 25.12 -nan(ind) -inf	10.91 NA 11.01 NA 0.09 NA 12.51 NA 44.92 NA 14.20 NA 12.40 NA 12.92 NA -nan(ind) NA	10.91 11.01 -80.85 11.77 13.64 35.19 13.50 25.12 3.90	10.93 11.52 13.54 18.65 14.17 11.57 14.05 14.82 12.08	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14 12.25 10.22	00M 00M 00M 00M 00M 00M 00M 00M	11.00 N/A 12.25 N/A 13.54 N/A 19.93 N/A 13.56 N/A 11.98 N/A 13.94 N/A 11.18 N/A 13.55 N/A 8.01 N/A	10.44 11.62 13.15 16.35 12.50 10.76 12.70 10.84 10.85 9.77							
D-11 1-12	12.72 12.88 12.40 12.35 12.49 12.47 12.55 10.48 13.53 11.33	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64 12.17 11.79	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28 12.42 11.33	11.87 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.51 NA 12.23 NA 12.84 NA 11.36 NA 11.87 NA 10.69 NA	12.4 10.0 12.6 12.2 12.3 12.3 12.1 11.9 12.2	9 10.91 2 0.03 5 -80.85 7 11.77 8 -inf 5 0.29 4 11.73 4 25.12 9 0.01 3 -inf	10.91 10.20 -11.47 11.77 12.88 15.25 14.27 25.12 3.90 -inf	10.91 11.01 -11.47 11.77 35.38 13.62 13.50 25.12 -nan(ind) -inf	10.91 NA 11.01 NA 0.09 NA 12.51 NA 14.20 NA 14.20 NA 12.40 NA 12.92 NA -nan(ind) NA 0.05 NA	10.91 11.01 -80.85 11.77 13.64 35.19 13.50 25.12 3.90 -inf	10.93 11.52 13.54 18.65 14.17 11.57 14.05 14.82 12.08 10.66 12.76	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14 12.25 10.22	00M 00M 00M 00M 00M 00M 00M 00M 00M	11.00 N/A 12.25 N/A 13.54 N/A 19.93 N/A 13.56 N/A 11.98 N/A 11.98 N/A 13.94 N/A 13.18 N/A 13.55 N/A 8.01 N/A	10, 44 11,62 13, 15 16, 35 12, 50 10, 76 12, 70 10, 84 10, 85 9, 77 10, 46							
0-11 1-12 2-13	12.72 12.88 12.40 12.35 12.49 12.47 12.55 10.48 13.53 11.33 11.52	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28 12.42 11.33 10.46	11.87 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.23 NA 12.24 NA 11.36 NA 11.87 NA 10.69 NA 11.29 NA	12.4 10.0 12.6 12.2 12.3 12.3 12.1 11.9 12.2 12.2 10.8	9 10.91 2 0.03 5 -80.85 7 11.77 8 -inf 5 0.29 4 11.73 4 25.12 9 0.01 5 -inf 3 11.83	10.91 10.20 -11.47 11.77 12.88 15.25 14.27 25.12 3.90 -inf	10.91 11.01 -11.47 11.77 35.38 13.62 13.50 25.12 -nan(ind) -inf	10.91 NA 11.01 NA 0.09 NA 12.51 NA 44.92 NA 14.20 NA 12.20 NA 12.20 NA -nan(ind) NA -nan(ind) NA 0.05 NA 0.02 NA	10.91 11.01 -80.85 11.77 13.64 35.19 13.50 25.12 3.90 -inf	10.93 11.52 13.54 18.65 14.17 11.57 14.05 14.82 12.08 10.66 12.76 9.33	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14 12.25 10.22 10.66 8.99	00M	11.00 N/A 12.25 N/A 13.26 N/A 19.93 N/A 13.96 N/A 13.98 N/A 11.98 N/A 11.18 N/A 13.55 N/A 8.01 N/A 8.01 N/A 8.21 N/A	10.44 11.62 13.15 16.35 12.50 10.76 12.70 10.84 10.85 9.77 10.46							
D-11 1-12 2-13 3-14	12.72 12.88 12.40 12.35 12.49 12.47 12.55 10.48 13.53 11.33 11.52 12.24	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64 12.17 11.79 11.20 12.10	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28 12.42 11.33 10.46 12.65	11.87 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.51 NA 12.33 NA 12.44 NA 11.86 NA 11.87 NA 10.63 NA 11.29 NA 12.61 NA	12.4 10.0 12.6 12.2 12.3 12.3 12.1 11.9 12.2 12.2 10.8 11.7	9 10.91 2 0.03 3 -80.85 7 11.77 3 -inf 5 0.29 4 11.73 4 25.12 9 0.07 5 -inf 3 11.83	10.91 10.20 11.47 11.77 12.88 15.25 14.27 25.12 3.90 -inf 11.81 11.69	10.91 11.01 -11.47 11.77 35.38 13.62 13.50 25.12 -nan(ind) -inf 11.69 44.33	10.91 NA 11.01 NA 0.09 NA 12.51 NA 14.20 NA 14.20 NA 12.40 NA 12.92 NA -nan(ind) NA 0.05 NA 0.05 NA 11.69 NA 11.69 NA	10.91 11.01 -80.85 11.77 13.64 35.19 13.50 25.12 3.90 -inf 11.69 44.33	10.93 11.52 13.54 18.65 14.17 11.57 14.05 14.82 12.08 10.66 12.76 9.33 9.30	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14 12.25 10.22 10.66 8.99 8.70	00M	11.00 N/A 12.25 N/A 13.25 N/A 13.93 N/A 13.93 N/A 13.94 N/A 11.98 N/A 13.95 N/A 8.01 N/A 8.21 N/A 8.82 N/A	10.44 11.62 13.15 16.35 12.50 10.76 12.70 10.84 10.85 9.77 10.46							
0-11 1-12 2-13 3-14 4-15	12.72 12.88 12.40 12.35 12.49 12.47 12.55 10.48 13.53 11.33 11.52 12.24 10.57	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64 12.17 11.79 11.20 12.10 9.79	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28 12.42 11.33 10.46 12.65 10.02	11.87 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.23 NA 12.24 NA 11.36 NA 11.87 NA 10.69 NA 11.29 NA	12.4 10.0 12.6 12.2 12.3 12.1 11.9 12.2 10.8 11.7 9.2	10.91 2 0.03 5 -80.85 7 11.77 3 -inf 6 0.29 4 11.73 4 25.12 5 -inf 1 11.69 1 11.69	10.91 10.20 -11.47 11.77 12.88 15.25 14.27 25.12 3.90 -inf 11.81 11.69 44.33 5.66	10.91 11.01 -11.47 11.77 35.38 13.62 13.50 25.12 -nan(ind) -inf 11.81 11.69 44.33	10.91 NA 11.01 NA 0.03 NA 12.51 NA 44.92 NA 12.40 NA 12.40 NA 12.92 NA -nan(ind) NA 0.05 NA 16.90 NA 16.90 NA 16.90 NA 14.33 NA	10.91 11.07 -80.95 11.77 13.64 35.19 13.50 25.12 3.90 -inf 11.81 11.69 44.33 5.66	10.93 11.52 13.54 18.65 14.17 11.57 14.05 12.08 10.66 12.76 9.33 9.30	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14 12.25 10.22 10.66 8.99 8.70 9.03	OOM	11.00 NA 12.25 NA 13.54 NA 13.93 NA 13.96 NA 13.98 NA 13.94 NA 13.95 NA 13.95 NA 8.01 NA 8.01 NA 8.21 NA 8.82 NA 8.88 NA	10.44 11.63 13.15 16.35 12.55 12.75 10.84 10.85 9.77 10.46 10.65							
0-11 1-12 2-13 3-14 4-15 5-16	12.72 12.88 12.40 12.35 12.49 12.47 12.55 10.48 13.53 11.33 11.52 12.24 10.57 8.62	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64 12.17 11.79 11.20 12.10	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28 12.42 11.33 10.46 10.02 10.23	11.87 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.23 NA 12.23 NA 11.36 NA 11.67 NA 11.67 NA 12.51 NA 12.51 NA 12.51 NA	12.4 10.0 12.6 12.2 12.3 12.1 11.9 12.2 10.8 11.7 9.2	9 10.91 0.03 5 -80.95 7 11.77 3 -inf 5 0.29 4 11.73 4 25.12 3 0.01 5 -inf 11.89 6 -inf 12.14	10.91 10.20 -11.47 11.77 12.88 15.25 14.27 25.12 3.90 -inf 11.81 11.69 44.33 5.66	10.91 11.01 -11.47 11.77 35.38 13.62 25.12 -nan(ind) -inf 11.69 44.33 5.66 -14.78	10.91 NA 11.01 NA 0.09 NA 12.51 NA 14.92 NA 14.20 NA 12.40 NA 12.92 NA -nan(ind) NA 0.02 NA 0.02 NA 11.63 NA 14.33 NA 12.44 NA	10.91 11.07 +80.85 11.77 13.64 35.19 13.50 25.12 3.90 -inf 11.81 11.69 44.33 5.66 -16.03	10.93 11.52 13.54 18.65 14.17 11.57 14.05 14.05 12.08 10.66 12.76 9.33 9.30 9.60	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14 12.25 10.22 10.66 8.99 8.70 9.03 10.27	00M	11.00 NA 12.25 NA 13.54 NA 13.55 NA 13.65 NA 13.65 NA 11.88 NA 11.88 NA 11.80 NA 10.16 NA 8.01 NA 8.21 NA 8.82 NA 8.85 NA 8.87 NA	10.44 11.62 13.16 16.35 12.50 10.76 10.84 10.85 9.77 10.46 10.67 8.95 8.54							
0-11 1-12 2-13 3-14 4-15 5-16 6-17	12,72 12,88 12,40 12,35 12,49 12,47 12,55 10,48 13,53 11,33 11,52 12,24 10,57 8,62 9,98	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64 12.17 11.79 11.20 12.10 9.79 11.45 11.12	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28 12.42 11.33 10.46 12.65 10.02 10.02 10.23 7.59	11.97 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.23 NA 12.23 NA 11.87 NA 11.87 NA 11.29 NA 12.21 NA 12.21 NA 12.21 NA 12.21 NA 12.31 NA 12.51 NA 13.51 NA 13.51 NA 13.51 NA 13.51 NA 14.74 NA	12.4 10.0 12.6 12.2 12.3 12.1 11.9 12.2 12.2 10.8 11.7 9.2 12.0 9.3	9 10.91 0.03 5 -80.95 7 11.77 8 -inf 0.29 4 11.73 4 25.12 9 0.01 5 -inf 11.81 9 11.69 5 -inf 12.14	10.91 10.20 -11.47 11.77 12.88 15.25 14.27 25.12 3.90 -inf 11.69 44.33 5.66 -14.78	10.91 11.01 -11.47 11.77 35.38 13.62 25.12 -nan(ind) -inf 11.69 44.33 5.66 -14.78	10.91 NA 11.01 NA 0.03 NA 12.51 NA 14.92 NA 14.20 NA 12.92 NA 12.92 NA 10.05 NA 10.05 NA 11.63 NA 44.33 NA 44.33 NA 12.44 NA 12.64 NA 12.64 NA	10.91 11.07 -80.65 11.77 13.64 35.19 13.50 25.12 3.90 -inf 11.69 44.33 5.66 -16.03 7.29	10.93 11.52 13.54 18.65 14.17 11.57 14.02 12.08 10.66 12.76 9.33 9.30 9.64 9.60	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14 12.25 10.22 10.66 8.99 8.70 9.03 10.27 8.38	ODM	11.00 NA 12.25 NA 13.54 NA 13.54 NA 13.56 NA 13.96 NA 11.38 NA 11.38 NA 11.18 NA 8.01 NA 8.01 NA 8.21 NA 8.82 NA 8.86 NA 8.87 NA 8.83 NA	10.44 11.62 13.15 16.35 12.55 10.75 10.85 10.85 9.77 10.46 10.65 8.95 8.95 9.85 9.85							
D-11 1-12 2-13 3-14 4-15 5-16 6-17 7-18	12,72 12,88 12,40 12,35 12,49 12,47 12,55 10,48 13,53 11,33 11,52 12,24 10,57 8,62 9,98	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64 12.17 11.79 11.20 12.10 12.10 13.79 11.45 11.12	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28 11.28 11.33 10.46 12.65 10.02 10.23 7.59 8.67	11.87 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.51 NA 12.23 NA 13.56 NA 11.67 NA 10.69 NA 12.61 NA 12.61 NA 9.70 NA 9.70 NA 10.68 NA	12.4 10.0 12.6 12.2 12.3 12.3 12.1 11.9 12.2 12.2 10.8 11.7 9.2 12.0 9.3 9.0	9 10.91 0.03 5 -80.85 7 11.77 5 -0.29 4 11.73 4 25.12 9 0.01 5 -inf 11.69 5 -inf 1 1.214 0 -inf 6.66 5 1.10	10.91 10.20 -11.47 11.77 12.88 15.25 14.27 25.12 14.27 11.69 44.33 5.66 -14.78 6.76 12.58	10.91 11.01 -11.47 11.77 35.38 13.62 13.50 25.12 -nan(ind) -inf 11.69 44.33 5.66 -14.78 6.72 12.58	10.91 NA 1101 NA 0.09 NA 12.51 NA 4.92 NA 12.51 NA 12.40 NA 12.40 NA 12.40 NA 12.40 NA 12.40 NA 12.41 NA 14.31 NA 12.44 NA 12.44 NA 12.52 NA 12.54 NA 12.55 NA 12.55 NA	10.91 11.07 +80.95 11.77 13.64 35.19 13.90 25.12 3.90 -inf 11.89 44.33 5.66 44.33 5.66 -16.03 7.29	10.93 11.52 13.54 18.65 14.17 11.57 14.05 12.08 10.66 12.76 9.33 9.30 9.64 9.60 8.40	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14 12.25 10.22 10.66 8.99 9.70 9.03 10.27 8.38	OOM	11.00 INA 12.25 INA 12.25 INA 13.364 INA 13.365 INA 13.36 INA 13.34 INA 13.35 INA 10.16 INA 8.27 INA 8.28 INA 8.57 INA 8.53 INA 8.57 INA 8.58 INA	10.44 11.62 13.16 16.35 12.55 10.76 12.77 10.86 10.87 9.77 10.44 10.67 8.95 9.85 9.85 9.85							
0-11 1-12 2-13 3-14 4-15 5-16 6-17 7-18 8-19	12,72 12,88 12,40 12,35 12,49 12,47 12,55 10,48 13,53 11,33 11,52 12,24 10,57 8,62 9,98	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64 12.17 11.79 11.20 12.10 9.79 11.45 11.12	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28 12.42 11.33 10.46 12.65 10.02 10.02 10.23 7.59	11.97 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.23 NA 12.23 NA 11.87 NA 11.87 NA 11.29 NA 12.21 NA 12.21 NA 12.21 NA 12.21 NA 12.31 NA 12.51 NA 13.51 NA 13.51 NA 13.51 NA 13.51 NA 14.74 NA	12.4 10.0 12.6 12.2 12.3 12.3 12.1 11.9 12.2 12.2 10.8 11.7 9.2 12.0 9.3 9.0	9 10.91 0.03 5 -80.95 7 11.77 8 -inf 0.29 4 11.73 4 25.12 9 0.01 5 -inf 11.81 9 11.69 5 -inf 12.14	10.91 10.20 -11.47 11.77 12.88 15.25 14.27 25.12 3.90 -inf 11.69 44.33 5.66 -14.78	10.91 11.01 -11.47 11.77 35.38 13.62 13.50 25.12 -nan(ind) -inf 11.69 44.33 5.66 -14.78 6.72 12.58	10.91 NA 11.01 NA 0.03 NA 12.51 NA 14.92 NA 14.20 NA 12.92 NA 12.92 NA 10.05 NA 10.05 NA 11.63 NA 44.33 NA 44.33 NA 12.44 NA 12.64 NA 12.64 NA	10.91 11.07 -80.65 11.77 13.64 35.19 13.50 25.12 3.90 -inf 11.69 44.33 5.66 -16.03 7.29	10.93 11.52 13.54 18.65 14.17 11.57 14.02 12.08 10.66 12.76 9.33 9.30 9.64 9.60	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14 12.25 10.22 10.66 8.99 9.70 9.03 10.27 8.38	ODM	11.00 NA 12.25 NA 13.54 NA 13.54 NA 13.56 NA 13.96 NA 11.38 NA 11.38 NA 11.18 NA 8.01 NA 8.01 NA 8.21 NA 8.82 NA 8.86 NA 8.87 NA 8.83 NA	10.44 11.62 13.15 16.35 12.55 10.75 10.85 10.85 9.77 10.46 10.65 8.95 8.95 9.85 9.85							
-2 -2 -3 -4 -4 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5	12,72 12,88 12,40 12,35 12,49 12,47 12,55 10,48 13,53 11,33 11,52 12,24 10,57 8,62 9,98	12.84 11.00 12.53 10.98 11.75 16.50 11.88 11.64 12.17 11.79 11.20 12.10 12.10 13.79 11.45 11.12	12.10 10.35 11.63 11.92 12.51 11.75 12.15 11.28 11.28 11.33 10.46 12.65 10.02 10.23 7.59 8.67	11.87 NA 10.09 NA 12.44 NA 11.45 NA 12.51 NA 12.51 NA 12.23 NA 13.56 NA 11.67 NA 10.69 NA 12.61 NA 12.61 NA 9.70 NA 9.70 NA 10.68 NA	12.4 10.0 12.6 12.2 12.3 12.3 12.1 11.9 12.2 12.2 10.8 11.7 9.2 12.0 9.3 9.0	9 10.91 2 0.03 5 -80.85 7 11.77 8 -inf 0.29 4 25.12 9 0.01 3 11.89 11.89 11.71 12.14 14.25 15.25 16.66 17.71 17.71 18.71 19.	10.91 10.20 -11.47 11.77 12.88 55.25 14.27 25.12 3.90 -inf 11.61 44.33 5.66 -14.78 6.76 12.58	10.91 11.01 -11.47 11.77 35.38 13.62 13.50 25.12 -nan(ind) -inf 11.69 44.33 5.66 -14.78 6.72 12.58	10.91 NA 1001 NA 0.09 NA 4.452 NA 14.20 NA 12.51 NA 14.20 NA 12.40 NA 12.40 NA 12.40 NA 13.52 NA 16.51	10.91 11.07 +80.95 11.77 13.64 35.19 13.90 25.12 3.90 -inf 11.89 44.33 5.66 44.33 5.66 -16.03 7.29	10.93 11.52 13.54 18.55 14.17 11.57 14.05 14.92 10.66 12.76 9.33 9.30 9.64 9.60 8.40 8.40 8.45 8.78	11.77 11.79 15.09 19.68 14.21 11.72 12.70 15.14 12.25 10.22 10.66 8.99 9.70 9.03 10.27 8.38	OOM	11.00 INA 12.25 INA 12.25 INA 13.364 INA 13.365 INA 13.36 INA 13.34 INA 13.35 INA 10.16 INA 8.27 INA 8.28 INA 8.57 INA 8.53 INA 8.57 INA 8.58 INA	10.44 11.62 13.16 16.35 12.55 10.76 12.77 10.86 10.87 9.77 10.44 10.67 8.95 9.85 9.85 9.85							