

DIN SAE SPEC 91471:2023-05 (E)

Assessment methodology for automotive LiDAR sensors; Text in English

Inhalt	Seite
Foreword	5
Introduction.....	7
1 Scope.....	8
2 Normative references	8
3 Terms and definitions.....	8
4 Symbols and abbreviations.....	14
5 Overall methodology.....	16
6 Common specification of LiDAR sensors.....	17
6.1 Overview	17
6.2 Category: Device data.....	17
6.3 Category: Physical properties	18
6.4 Category: Installation specification.....	19
6.5 Category: Power supply.....	20
6.6 Category: Ingress protection	20
6.7 Category: Detection system.....	21
6.7.1 Transmitter	21
6.7.2 Receiver.....	22
6.8 Category: Basic detection properties.....	22
7 Assessment methodology	23
7.1 Overview	23
7.2 Evaluation metrics	23
7.2.1 Detection distance.....	23
7.2.2 Resolution.....	23
7.2.3 False-positive detection	24
7.2.4 Spatial error	25
7.2.5 Separability	26
7.3 Evaluation tools	27
7.4 Test scenarios.....	29
7.4.1 Overview	29
7.4.2 Multi-domain test.....	30
7.4.3 Angular separability.....	33
7.4.4 Radial separability 1	36
7.4.5 Radial separability 2	38
7.4.6 False alarm rate 1.....	40
7.4.7 False alarm rate 2.....	41
7.4.8 Cross-domain test.....	43
7.5 Documentation.....	46
Annex A (informative) Background to clustering	47
Bibliography	48

Figures

Figure 1 — True-positive and false-positive space	10
Figure 2 — Clustering	11
Figure 3 — Accuracy and precision	13
Figure 4 — Binary feature separability	14
Figure 5 — From environment perception to object data	17
Figure 6 — LiDAR point clouds for a) pedestrian target and b) vehicle target.....	17
Figure 7 — Representation of angular cluster density	24
Figure 8 — Representation of absolute angular deviations of false-positive clusters	25
Figure 9 — Schematic representation of Lambertian target of size 1 m × 1 m on target holder	28
Figure 10 — Sensor mounting platform with two rotation stages (azimuth and elevation).....	28
Figure 11 — Angular offsets for variation of sensor pose in azimuth and elevation.....	29
Figure 12 — Schematic representation of sensor and target for multi-domain test	30
Figure 13 — Differentiation of true-positive clusters and false-positive clusters	32
Figure 14 — Angular separability	34
Figure 15 — Angular separability test setup	34
Figure 16 — Radial separability test setup	36
Figure 17 — Radial separability test setup with see-through object between sensor and target.....	38
Figure 18 — False alarm rate 1 test setup	40
Figure 19 — False alarm rate 2 test setup	42
Figure 20 — Sensor aperture position within full width half maximum beam of light source	43
Figure 21 — 2-D representation of cross-domain test in angular plane.....	44
Figure 22 — Top-view of cross-domain test setup.....	45

Tables

Table 1 — Clustering map	11
Table 2 — Variations for multi-domain test	31
Table 3 — Variations for angular separability test.....	35
Table 4 — Variations for radial separability 1 test.....	37
Table 5 — Variations for radial separability 2 test.....	39