LeddarVision™ LVF-H

Comprehensive Front-View Premium ADAS L2/L2+ Highway Assist and 5-Star NCAP 2025/GSR 2022 Low-Level Fusion and Perception Software Stack

Product Overview

LVF-H is a comprehensive fusion and perception software stack supporting premium front view L2/L2+ ADAS highway assistance and 5-star NCAP 2025/GSR 2022 safety applications. LVF-H implements a premium stack handling sensors' interface, offline and online calibration and diagnostics, sensor synchronization, sensor fusion, object detection and classification, extended to include unclassified objects and events (e.g., cut-in), continuous tracking and stabilization, free space detection, road model, comprehensive traffic signs detection, highway traffic light detection, vehicle odometry interface, ego-motion localization and global localization with HD Map input. Stack further provides ability to fuse external sensors such as HD Map and V2X into a single and unified environmental model. Stack extends safety features support with detected objects trajectory prediction, perception decomposition, perception support to ODD analysis, sensor coverage and health monitoring. The complete stack extends perception, positioning and prediction features providing a comprehensive single and unified environmental model and API to premium L2/L2+ and highway assist ADAS applications.

Based on LeddarVision™ low-level fusion (LLF) and perception technology, it enables the premium L2/L2+ and highway assist ADAS offering at lower sensor and hardware cost. LLF technology optimally combines sensor modalities, pushing performance envelope far beyond legacy solutions and extending supported object detection fusion range over 200 m. LVF-H extends the front camera-based configuration to a 1V5R configuration having a single wide FoV (120°) 3 Mpx class front camera, one medium-range front radar and four short-range front and back corner radars. Front camera and medium-range radar extends the fusion range over 200 m and ACC support up to 160 km/h. The back short-range corner radars extend the support of GSR 2022 and 5-star NCAP 2025 to overtaking/reverse/doorin scenarios and the highway assist features support to lane change collision warning. LVF-H software stack is targeting low-cost ECU based on TI’s TDA4L plus a single Hailo-8 offering together over 30 TOPS of deep-learning acceleration to support the premium perception.

LVF-H superior object detection performance further extends to occluded VRUs and vehicles, providing early warning in NCAP tested scenarios (e.g., occluded cyclist tests). Superior object separation and longitudinal position measurement accuracy in highway scenarios lead to higher performing ACC implementation. Inherent sensor redundancy provides a more reliable operation in presence of degraded (e.g., dirty lens), failing (e.g., failing camera) or conflicting sensors (e.g., false alarms from radars in presence of guard rails’ multipath) and adverse scenarios and environments (e.g., dust, blinding light, etc.).

LVF-H product is part of a family of front-view products targeting entry- to premium-level ADAS. A comprehensive roadmap provides growing features support for different market segments. LVF-E companion product targets entry-level front-view ADAS, with lowest-cost 1V2R sensor configuration, having only a single wide FoV (120°) 1.2 Mpx class front camera and two short-range front corner radars to support GSR and five-star NCAP 2025 with comprehensive perception and positioning features.

LVF-H B-sample is planned for Q3 2023, targeting vehicle SOP in 2026.

Target Applications

- Economic premium L2/L2+ ADAS and highway assist applications
- Safety: GSR 2022 and 5-star NCAP 2025 (SA, VRU), including AEB C2C & VRU, LSS, SAS, ELK, LKA, BSD, TLR, TSR.
- Driving: L2/L2+ highway assist, including ACC (up to 160 km/h), LCA, TJA, HWA. Including semi auto-lane change support.
Hardware Platform
- Sensor configuration: 1V5R
- Front camera: 3 Mpx 120° FoV
- Front radar: One medium-range radar (Continental ARS510 or similar)
- Corner radars: Four short-range corner radars (Continental SRR520 or similar)
- SoC/memory: TI TDA4L, 8 GB
- DL accelerator: Hailo-8
- ECU: TBD

Software Stack Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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<tbody>
<tr>
<td>Fusion</td>
<td>Radar-camera low-level fusion</td>
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<td>Offline, online radar to camera calibration and diagnostics</td>
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<td>Perception</td>
<td>Dynamic and static 3D object detection and classification, including vehicles</td>
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<td>and VRUs extended to L/R lanes</td>
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<td>Road model: L/C/R lanes based on lane lines detection (solid, dashed, color),</td>
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<td>traffic islands and road edges detection</td>
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<td>Speed traffic signs detection (SAS/ISA support)</td>
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<td>Object continuous tracking and stabilization, 15 FPS output</td>
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<td>Premium perception</td>
<td>Unclassified object detection</td>
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<td>Event detection (e.g., cut-in)</td>
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<td>Free space detection</td>
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<td>Traffic signs and highway traffic light detection</td>
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<td></td>
<td>Fuses external sensors such as HD Map and V2X into a single and unified</td>
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<tr>
<td></td>
<td>environmental model</td>
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<td>Premium prediction</td>
<td>Detected objects trajectory prediction</td>
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<td>Positioning</td>
<td>Ego-motion, GPS, IMU and vehicle dynamics-based odometry (wheels)</td>
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<td>Premium positioning</td>
<td>Global localization with HD Map input</td>
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<td>Premium safety</td>
<td>Global scene attributes detection for ODD analysis support</td>
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<td>Sensor coverage and health monitoring</td>
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## Perception decomposition

**Supported ODDs**
- Weather/illumination: day/low light/night with streetlights, light rain
- Road topography and conditions: highway, poor road marking visibility, high lane curvatures. Highway special lanes, including entrance, exits, toll, service and ramps.
- ODD extended to cover 5-star NCAP 2025 test scenarios

**Environmental model**
- Objects (3D, classification), free space, road model, ego-motion data in vehicle coordinates (in global coordinates – TBD) and diagnostics (TBD)

**Operating system**
- Linux

**Interfaces**
- Sensors: ROS2
- Vehicle odometry: CAN
- GPS, IMU: CAN
- Environmental model: ROS2, ECAL

## Perception Key Performance Indicators (KPIs)

### Object detection
- Vehicles (CIPV): Typ. range >200 m
- Vehicles (rear end): Typ. range >200 m
- VRUs (ego-path): Typ. range 60 m
- Ultra-low FPR on objects in danger zone (within 2.5 sec TTC) to support safety features in danger zone with perception decomposition

### Object measurements
- Vehicle (rear-end) accuracy: typ. std longitudinal (1.5 m), lateral (0.5 m), orientation (2 deg) @ 150 m
- Vehicle (CIPV) 3D bounding box accuracy: typ. std length (0.5 m), width (0.2 m), height (0.3 m) @ 150 m

### Road model
- CIPV assignment to ego-lane up to 200 m with recall 95%, precision 99%

### Traffic signs detection
- Numerical type signs with recall >95%, precision >99%

### Traffic light detection
- TBD

### Global positioning accuracy
- Ego-vehicle position <0.1m, heading <0.2°

### NCAP 2025 test scenarios
- Perception shall support gaining >90% score of SA and VRU relevant tests

## LVF-H Features Roadmap Schedule

- TDA4L+ Hailo-8 platform: 2023
- ROS2 support: 2023
- TSR for SAS/ISA support: 2023
- Extended road model: 2023
- Extended object detection: 2023 (extended to L/R lanes to support 5-star NCAP overtaking/reverse/dooring scenarios)
- Extended ODD: 2024
- Comprehensive TSR/TLR: 2024
- Premium perception: 2024
- Premium positioning: 2024
- Premium safety: 2024
Certifications
- ASPICE: developed according to ASPICE L2, targeted by Q3 2024.
- ASIL-B certification targeted.

Availability
- A-sample: Available since Q2 2022
- B-sample: Q3 2023
- C-sample: 2024
- Target vehicles: SOP 2026