Fusing Lidar And Video At The Lens For More Accurate Computer Vision

RGB View  Colorized Point Cloud
A Different Approach to Lidar And Sensor Fusion

- **Making ordinary ToF chips *extraordinary*: high accuracy 50M range**
  - Software and system IP vs. new chip design to achieve drastically lower cost
  - Development costs and speed similar to a software company

- **Solving critical Lidar+video system and data fusion challenges**
  - A single optical pathway removes issues of parallax, synchronization and calibration
  - A design that shares ~90% of the BOM of a typical video-only solution
  - Merged 3D+2D “enhanced RGB” data set works with existing 2D AI models

- **Our Vision: enable mass adoption of Lidar/video sensor fusion and related AI analytics**
Experienced Operators
And Technologists

Srinath Kalluri, Ph.D
CEO, Co-founder

Dr. Srinath Kalluri is former Head of R&D and Senior Director, Intel, and Lumentum. He has launched 25+ photonics products in mass production in Camera and Datacom markets over 20+ years of leading product development teams.

Ralph Spickermann, Ph.D.
CTO, Co-founder

Dr. Ralph Spickermann spent 20+ years at Lockheed Martin where he achieved the highest technical rank of senior fellow. While at Lockheed, he focused primarily on remote sensing lidar and optical communications.

Raghav Singh, Ph.D.
Director of Software

Dr. Raghavendra Singh was most recently a Senior Member of Technical Staff at IBM. He has 18+ years experience in video image processing and computational imaging.

David Friedman
CFO & Head of Sales

David Friedman is chairman-founder of Ayla Networks, an IoT platform. He is also a member of the board of directors of Venti Technologies, an autonomous vehicle company. Dave has spent the past 15 years building software/hardware start-ups.
Oyla Camera Produces Multiple Data Types
Oyla Software Blends to Fuel AI Models
Oyla in Action:
Traffic Monitoring
Oyla in Action: High Accuracy Safety Zone/Intrusion Detection

ALERT: Intruders in Zone
Oyla in Action:
Railway Platform Safety
Oyla in Action: High Accuracy Anomaly Detection

Gate opened 70 cm then back to only 20 cm then fully closed again
**Consuming Depth on Camera for Efficient CV**

**PROCESSING POINT CLOUDS IS EXPENSIVE**

Point Cloud → 3D CNNs → $$$

**LIDAR REQUIRES HIGH BANDWIDTH**

Lidar → Network → GPU, Server

**LATE FUSION IS HARD**

Standard H.264 Video + Metadata → Cv

**SOLUTION**

Oyla’s early fusion consumes depth on-camera for efficient computer vision
Use 3D Data to Enhance RGB and Add Spatial Metadata

- **YOLO on RGB**
- **YOLO on OYLA eRGB**

**eRGB** improves detection accuracy by 20% or more in challenging lighting conditions over RGB.

**Oyla e-RGB Image**

- Extract true physical characteristics from depth channel to augment RGB image
- Light fine-tuning of SOTA computer vision models

**2D CNN Models**

- Reuse efficient 2D convolutional neural network architectures (object detection, classification, etc.)

**Depth Maps**

- Rich data – color, texture, fine details
- Higher resolution
- Invariant to lighting
- Object size/scale information

**RGB Image**

- Rich data – color, texture, fine details
- Higher resolution

**Detection outputs + spatial metadata**

**Data streams produced by Oyla camera**

**Oyla Advantage:** Provide richer, more accurate meta-data, using known off-the-shelf detection models and methods.
Use 3D Data to Enhance RGB and Add Spatial Metadata

- **RGB Image**
  - Rich data – color, texture, fine details
  - Higher resolution

- **Depth Maps**
  - Extract true physical characteristics from depth channel to augment RGB image
  - Invariant to lighting
  - Object size/scale information

- **Oyla e-RGB Image**
  - 2D Change Detection Models
    - Reuse existing change detection algorithms (e.g. MOG2, GMM)

- **Detected changes (eRGB)**

eRGB reduces false positives by 80% in variable lighting conditions over RGB.
Use 3D Data to Enhance RGB and Add Spatial Metadata

- **RGB Image**
  - Rich data – color, texture, fine details
  - Higher resolution

- **Depth Maps**
  - Invariant to lighting
  - Object size/scale information

---

**Oyla e-RGB Image**

- Extract true physical characteristics from depth channel to augment RGB image
- Reuse existing change detection algorithms (e.g., MOG2, GMM)

---

**eRGB** reduces false positives by 80% in variable lighting conditions

**Detected changes**
- **eRGB grayscale**
- **Detected changes (eRGB)**
- **Detected changes (RGB)**

**Detection outputs + spatial metadata**

**Oyla Advantage:** Provide richer, more accurate meta-data, using known off-the-shelf detection models and methods
Uses of Metadata

- Filter event alerts
- Visualize
- SELECT from database entries
- Classify detections
- Filter events by 3D location, zone, size, distance from camera, distance between objects, etc.
Oyla “Software Defined” Lidar+Video Fusion
Unmatched for < 50M Range Applications

<table>
<thead>
<tr>
<th>Optics assemblies &amp; processing requirements</th>
<th>Oyla: 1 shared optics, 1 shared, low-cost MCU</th>
<th>Other Lidar: 2 separate optics, 1 or 2, High cost MCUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering required to fuse data from lidar and video sensors</td>
<td>None – fused at the shared optic</td>
<td>Significant/ongoing challenge</td>
</tr>
<tr>
<td>Compatibility with existing 2D AI models</td>
<td>Yes</td>
<td>No... requires new R&amp;D</td>
</tr>
<tr>
<td>Primary markets</td>
<td>Security, Industrial &amp; Transportation Safety, Robotics, Automotive</td>
<td>Automotive</td>
</tr>
<tr>
<td>Typical Design cycle</td>
<td>1 year</td>
<td>Years</td>
</tr>
</tbody>
</table>