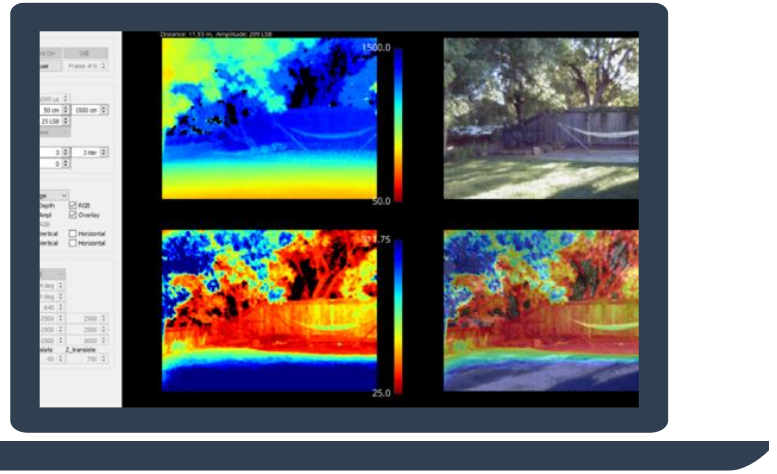
Fusing Lidar And Video At The Lens For More Accurate Computer Vision

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

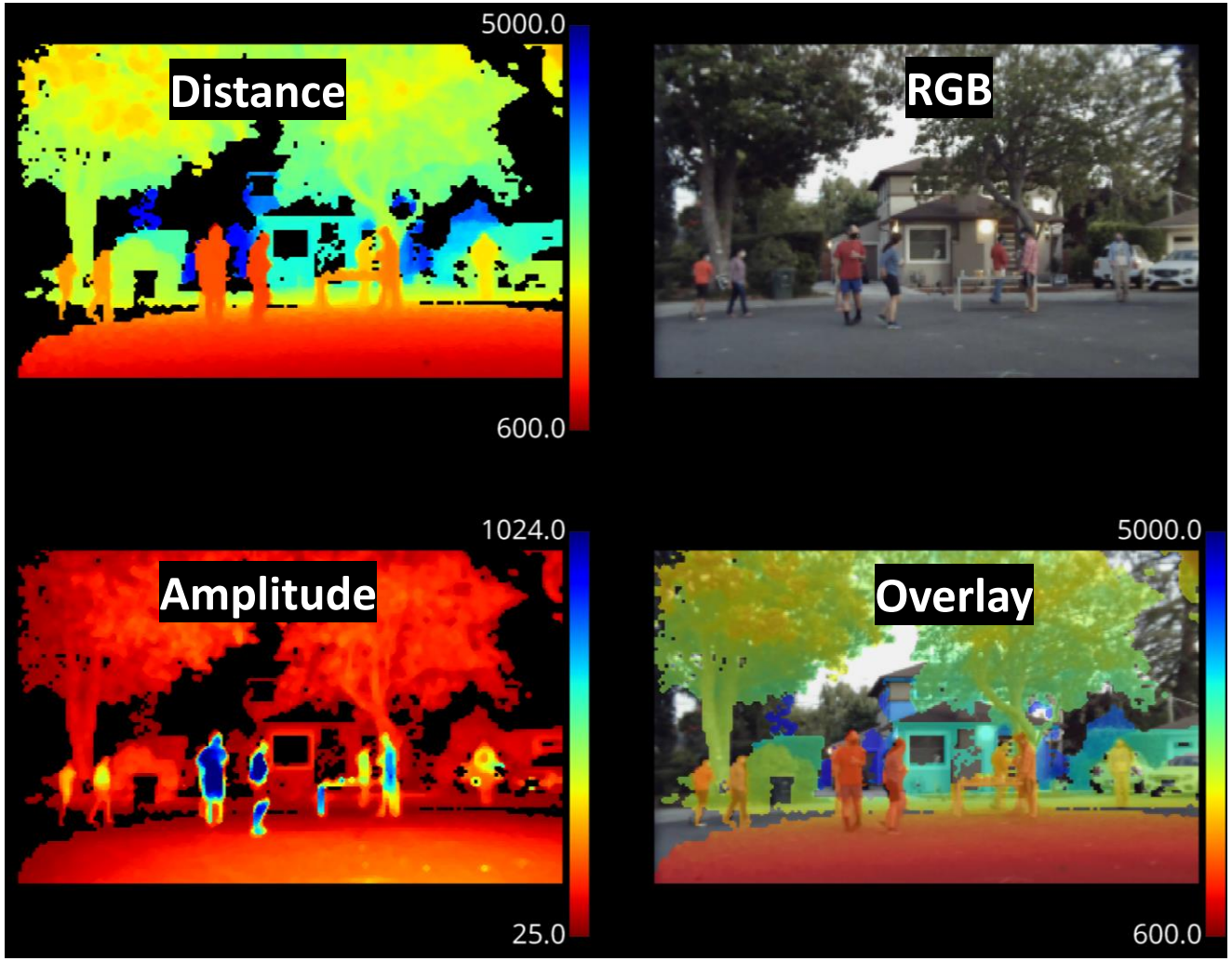
Dr. Raghavendra Singh was most recently a Senior Member of Technical Staff at IBM. He has 18+ years experience in video image processing and computational imaging.

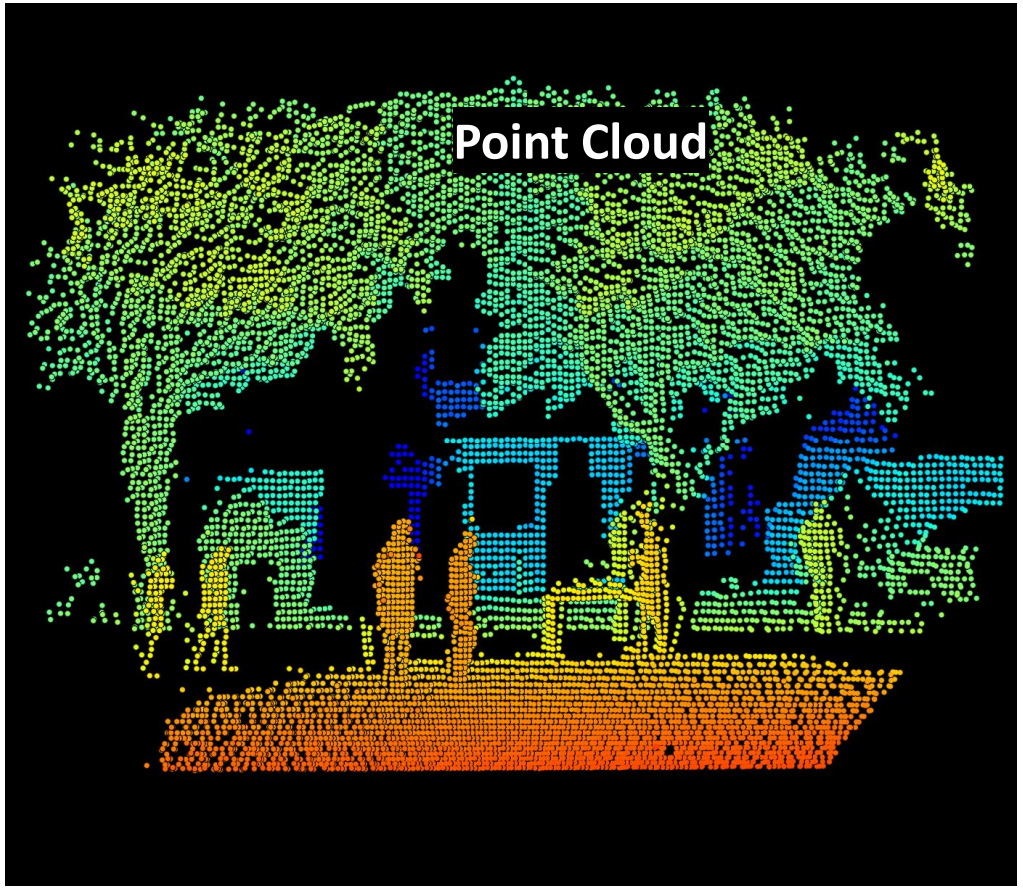
David Friedman

CFO & Head of Sales

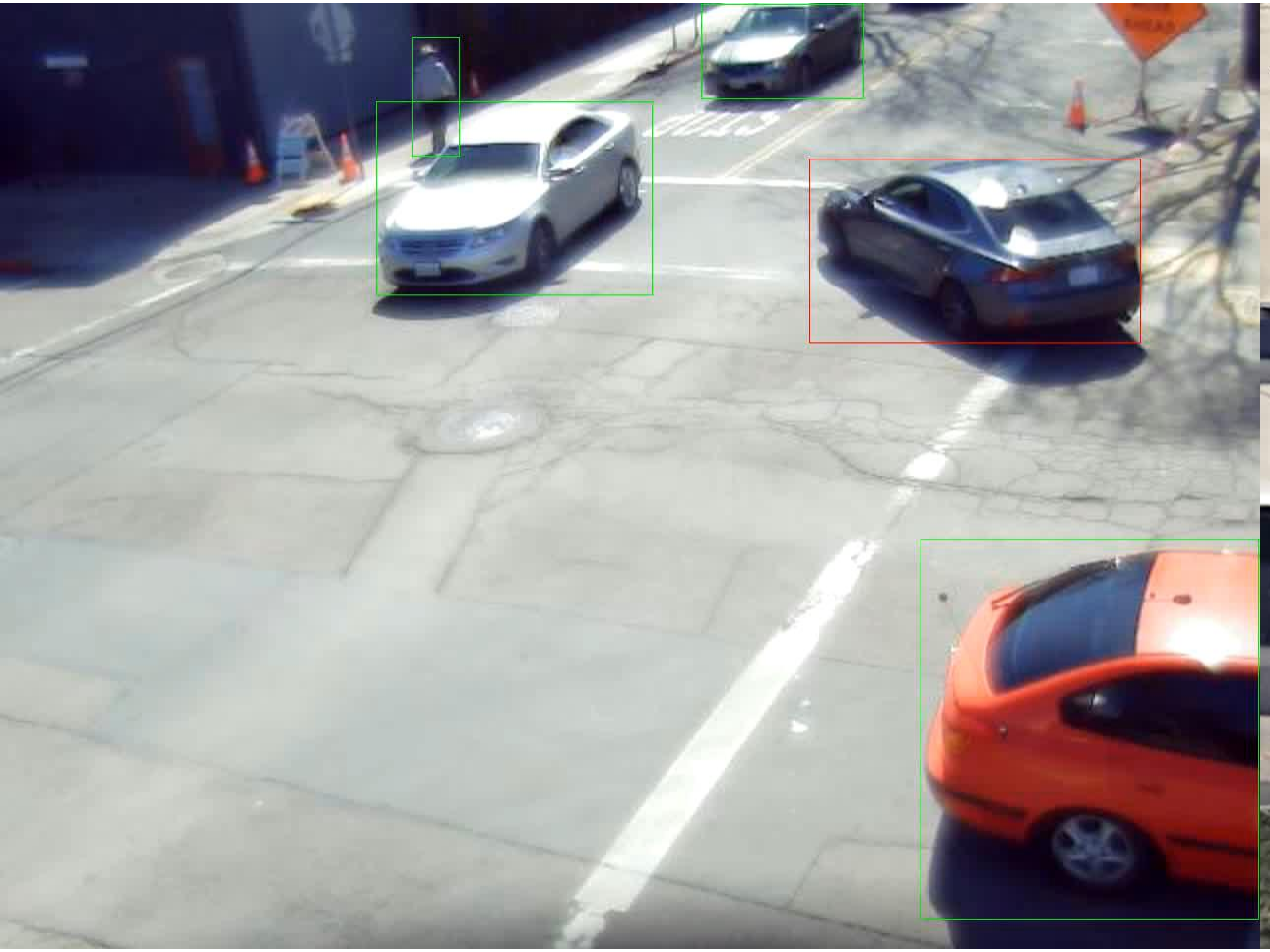
David Friedman is chairman/founder of Ayla Networks, an IoT platform. He is also a member of the board of directors of Venti Technologies, an autonomous vehicle company. Dave has spent the past 15 years building software/hardware start-ups.

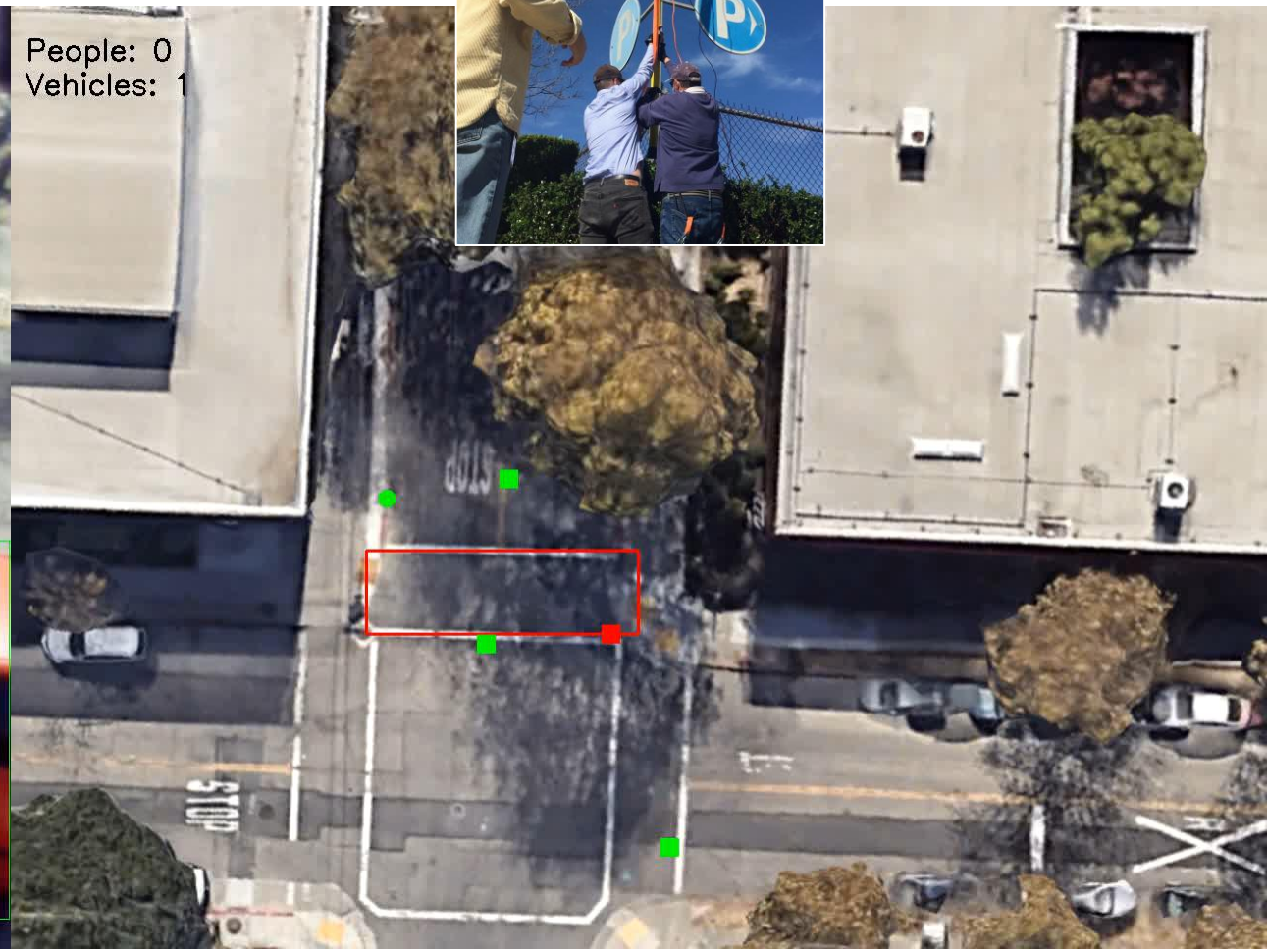
Oyla Camera Produces Multiple Data Types
Oyla Software Blends to Fuel AI Models



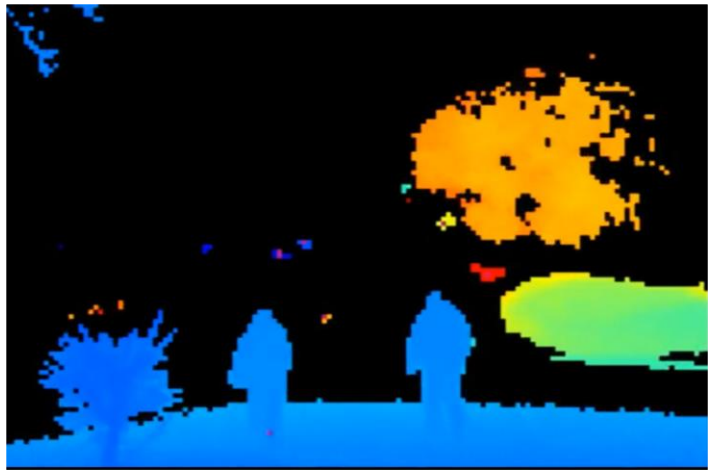


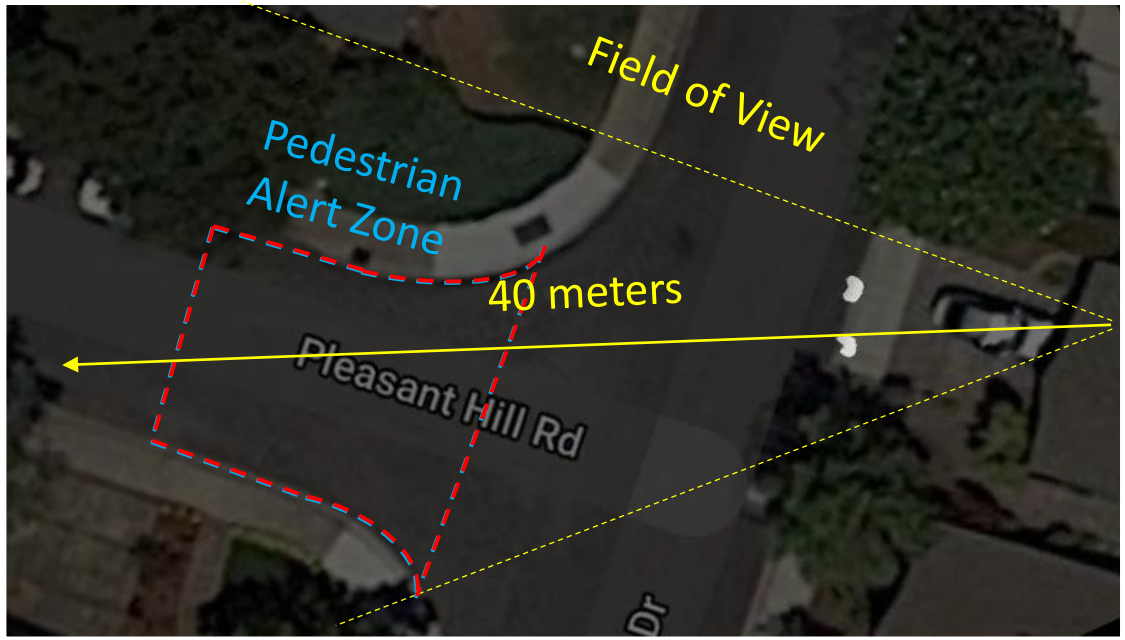
Oyla in Action:
Traffic Monitoring





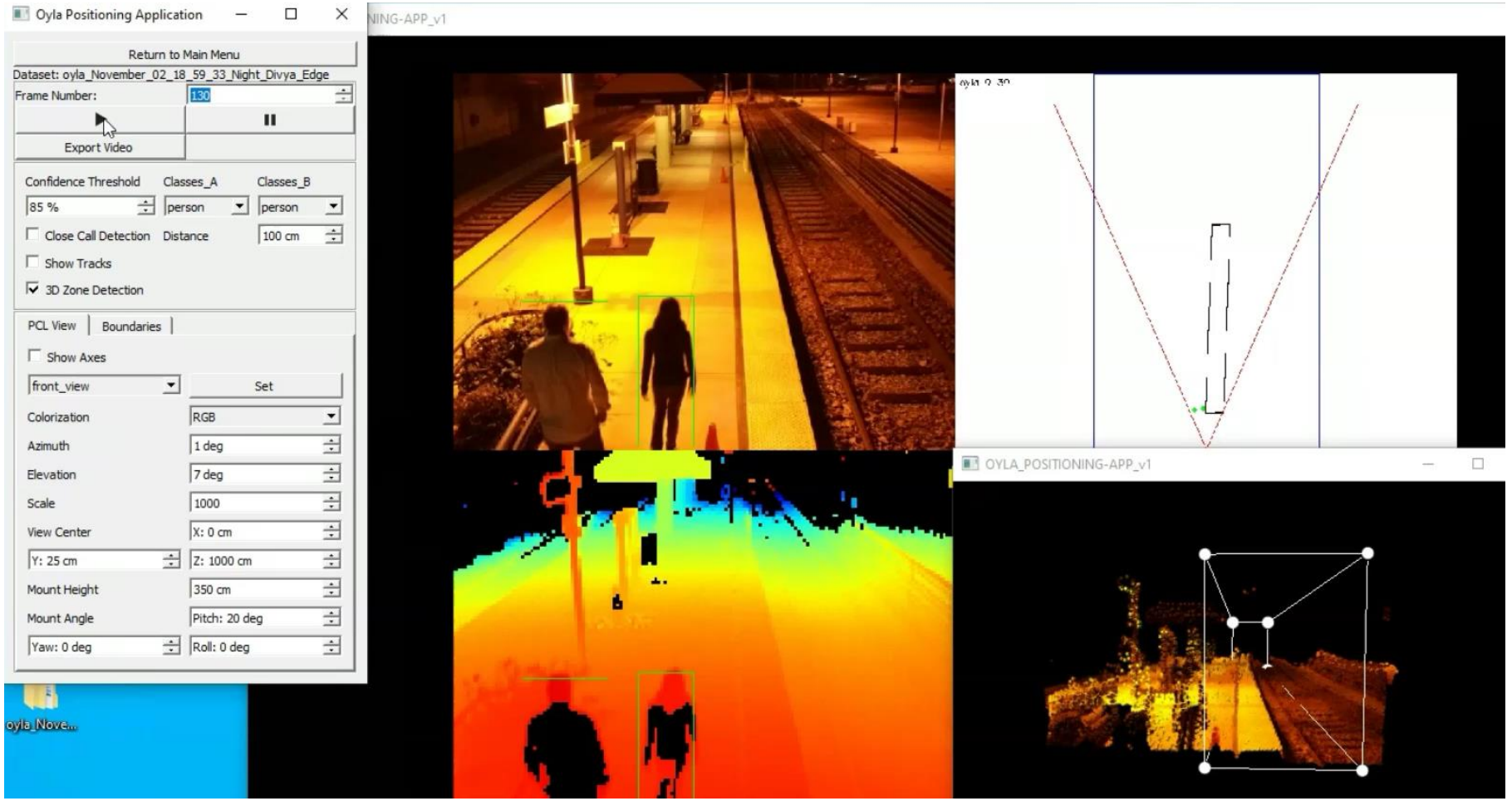
Oyla in Action: High Accuracy Safety Zone/Intrusion Detection





ALERT:
Intruders in Zone

Oyla in Action:
Railway Platform Safety

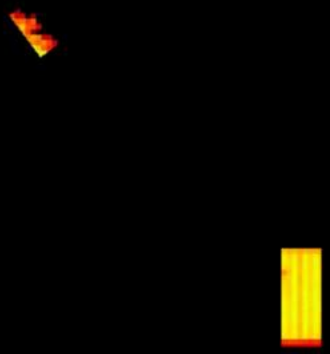


Oyla in Action: High Accuracy Anomaly Detection

Amplitude Map

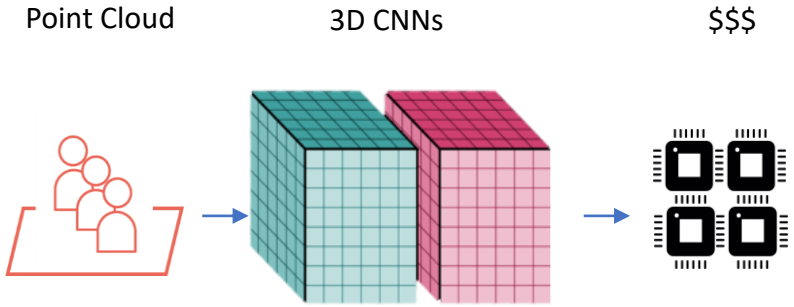
Gate opened 70 cm
then back to only 20 cm
then fully closed again

Indicated Changes

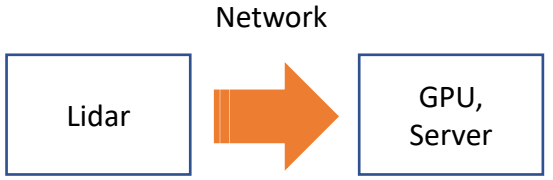


Consuming Depth on Camera for Efficient CV

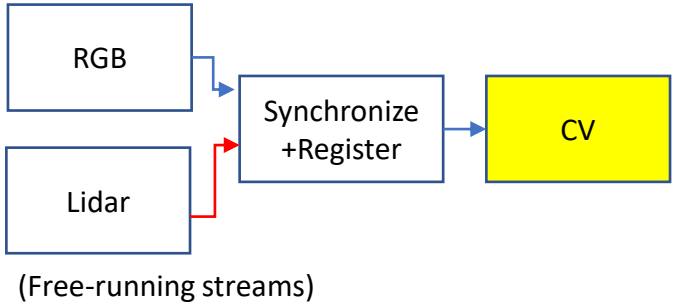
PROCESSING POINT CLOUDS IS EXPENSIVE



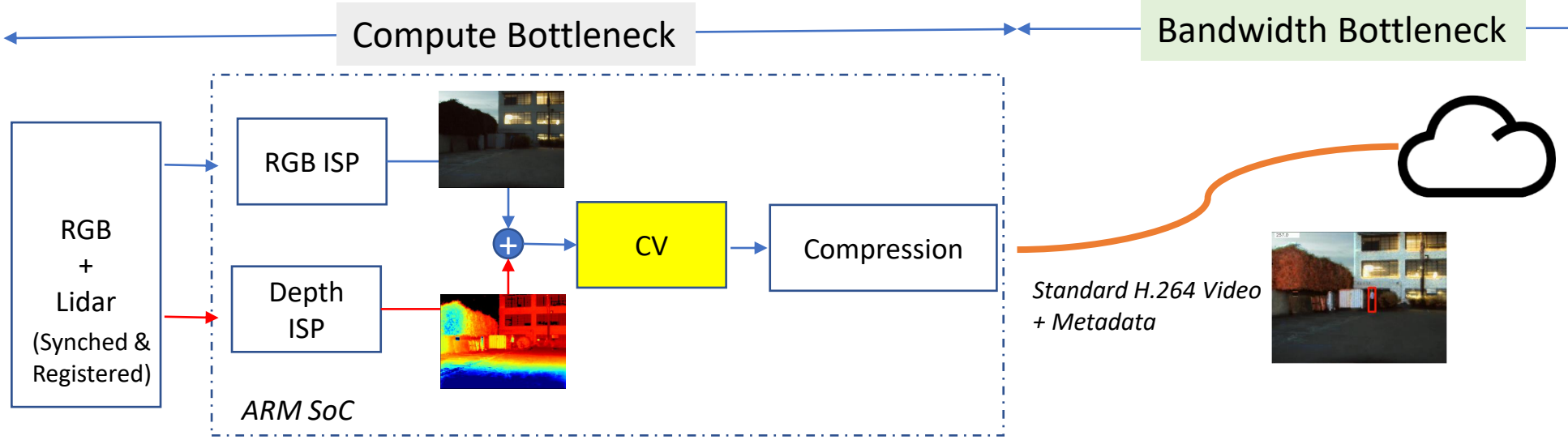
LIDAR REQUIRES HIGH BANDWIDTH



LATE FUSION IS HARD



SOLUTION



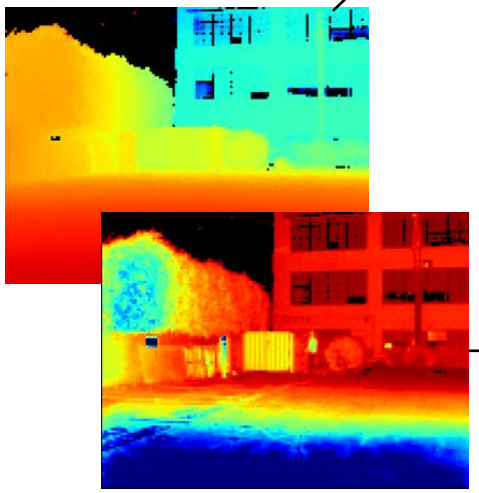
Oyla's early fusion ***consumes*** depth on-camera for efficient computer vision

Use 3D Data to Enhance RGB and Add Spatial Metadata

RGB Image

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

Depth Maps



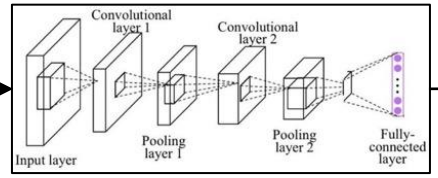
- ✓ Invariant to lighting
- ✓ Object size/scale information

Data streams produced by Oyla camera

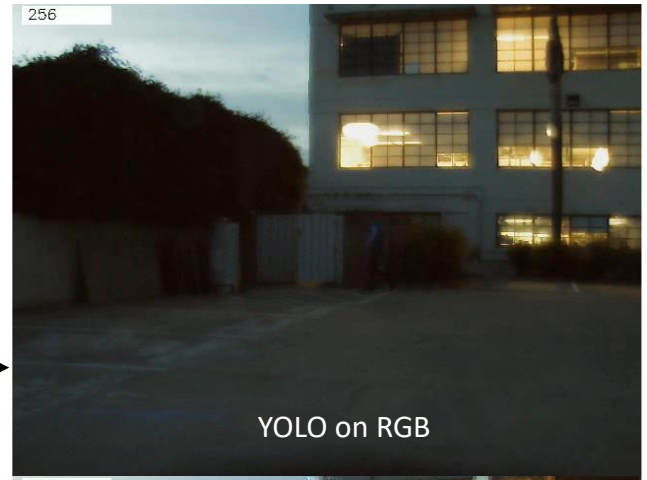
Oyla e-RGB Image

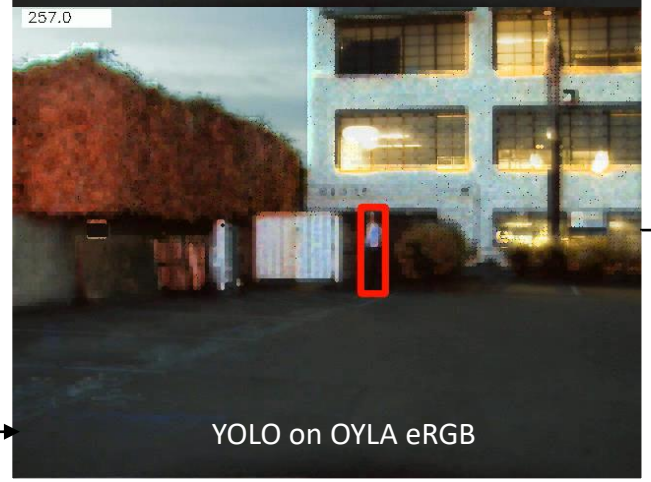
- Extract true physical characteristics from depth channel to augment RGB image

2D CNN Models



- Reuse efficient 2D convolutional neural network architectures (object detection, classification, etc.)
- Light fine-tuning of SOTA computer vision models





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

Detection outputs + spatial metadata

	ts	frame_num	archive_file	Area_in_sqm	Distance_from_camera_in_m	Height_above_ground_in_m	class_name	confidence	dominant_color
2	2022-01-13 13:29:17,660	47	cpd_0.mp4,	1.02	23.28	0.63	person	0.732	blue

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

eRGB reduces false positives by 80% in variable lighting conditions over RGB

RGB Image

- ✓ Rich data – color, texture, fine details
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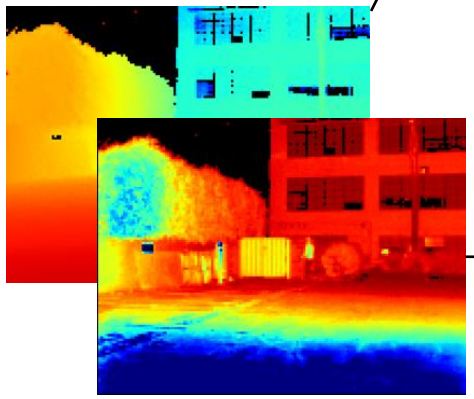
Depth Maps



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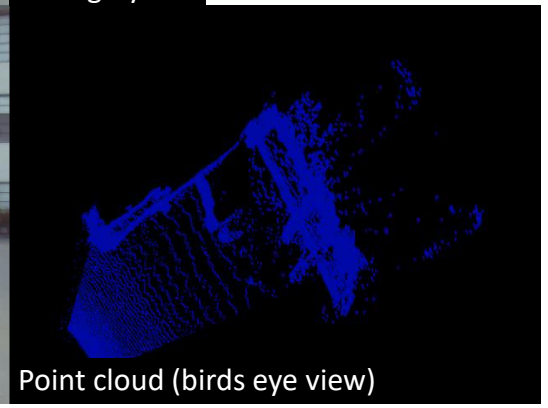
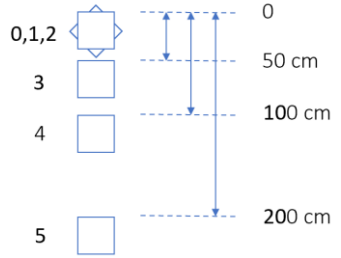
2D Change Detection Models

- Reuse existing change detection algorithms (e.g. MOG2, GMM)





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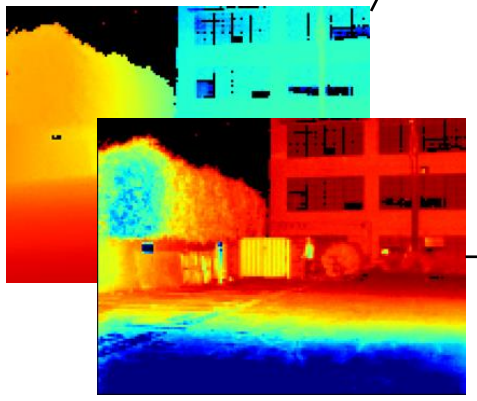

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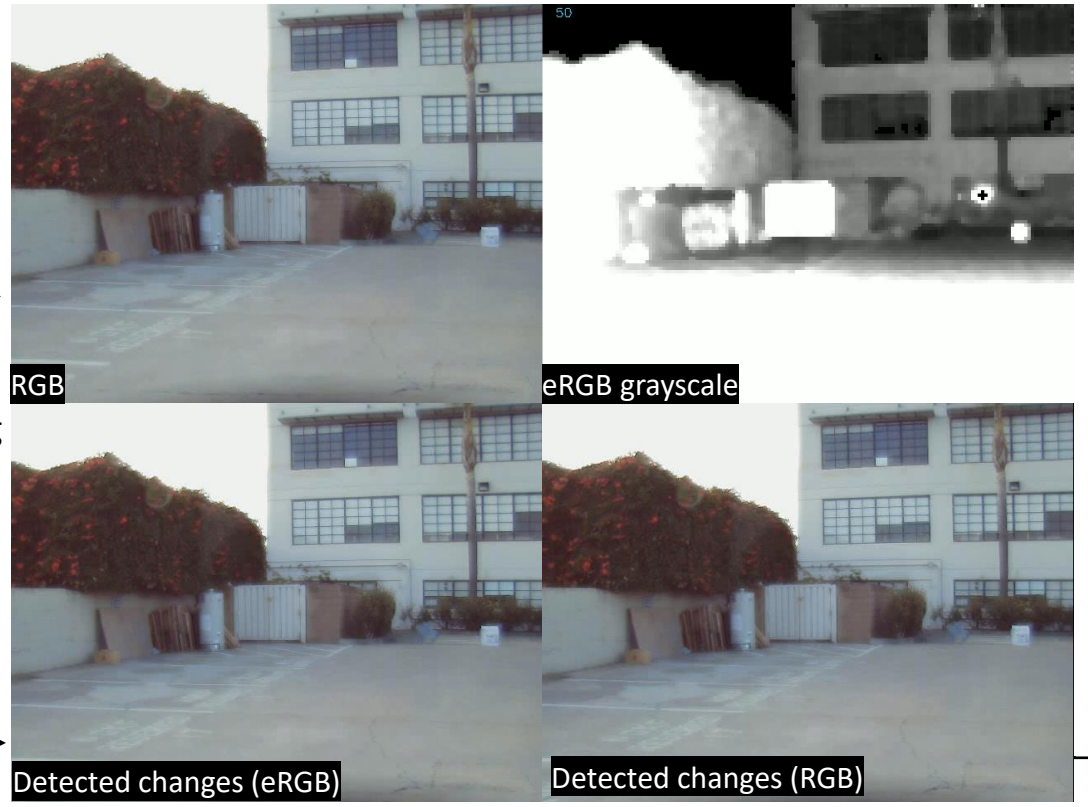

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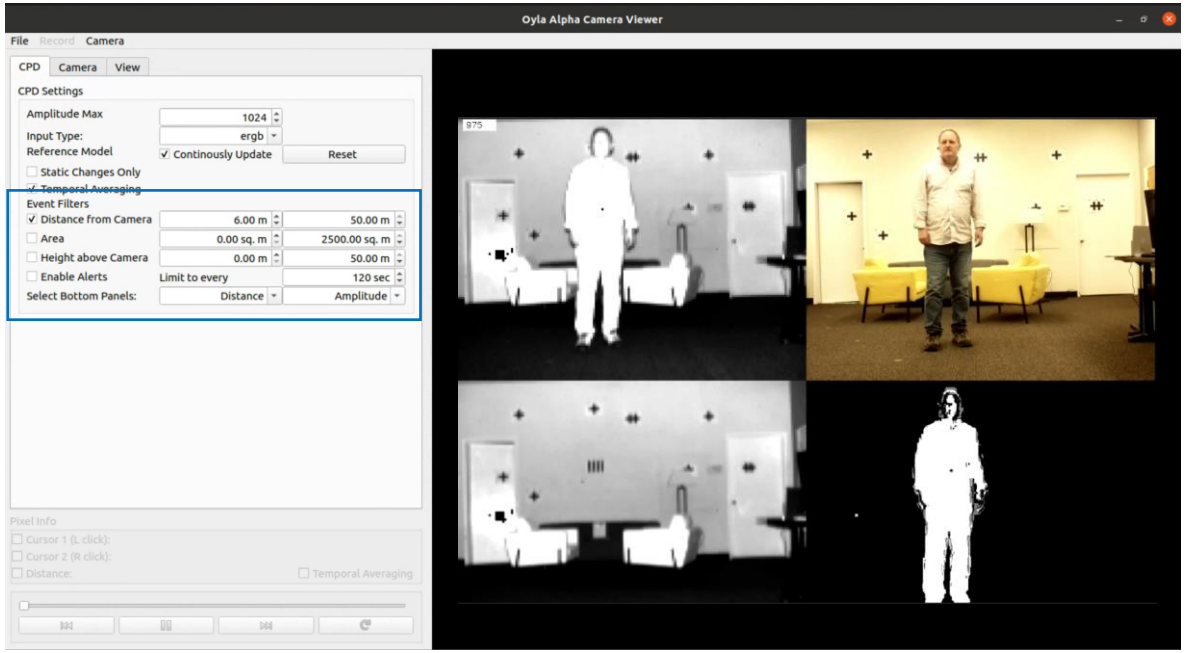
Oyla Advantage: Provide richer, more accurate meta-data, using known off-the-shelf detection models and methods

Uses of Metadata

Filter events by 3D location, zone, size, distance from camera, distance between objects, etc.



Visualize

	ts	frame_num	archive_file	Area_in_sqm	Distance_from_camera_in_m	Height_above_ground_in_m	class_name	confidence	dominant_color
2	2022-01-13 13:29:17,660	47	cpd_0.mp4,	0.064	5.62	0.63	person	0.732	blue
5	2022-01-13 13:29:18,396	55	cpd_0.mp4,	0.022	5.13	0.54	bicycle	0.965	black
11	2022-01-13 13:29:20,728	79	cpd_0.mp4,	0.005	3.98	0.43	person	0.992	black
15	2022-01-13 13:29:20,728	79	cpd_0.mp4,	0.002	3.19	0.78	car	0.921	blue

Change detection alert! Inbox ×

divya.oyla@gmail.com Wed, Jan 12, 11:48 AM (5 days ago)

to me

2022-01-12 11:48:44,557 cpd_0.mp4, Frame 69: 1 change(s) detected: [{'Area': '0.012 sq. m.', 'Distance from camera: ': '7.96 m', 'Height above camera: ': '0.94 m'}]

SELECT from database entries
Classify detections
Filter event alerts

Oyla “Software Defined” Lidar+Video Fusion Unmatched for < 50M Range Applications

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