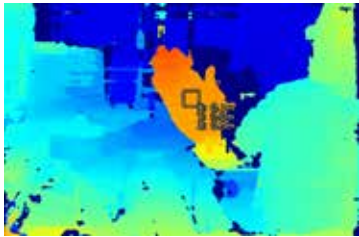# Luxonis

Product Guide

Functions, applications, and industry information for Luxonis devices.
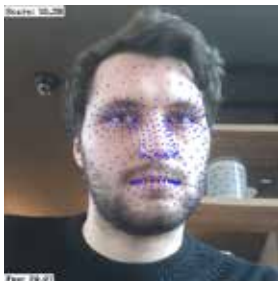
Application and Feature Overview

Included here is a non-exhaustive list of examples using our DepthAI platform that demonstrate just a piece of the extensive range of uses of OAK cameras.

Spatial depth/ location calculation

Stereo neural inference

Facial landmark detection and expression/ emotion detection

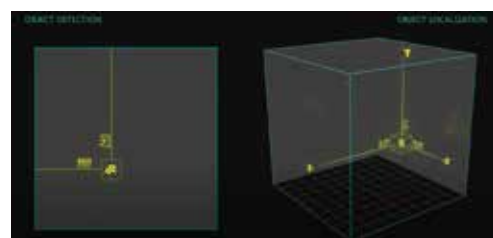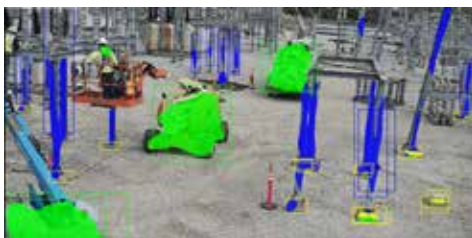Hand tracking

Human pose estimation

3D landmark localization

Semantic segmentation of depth

On-camera object detection

Multi-class segmentation

Object localization

Road lane segmentation

Optical character recognition

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Industry Overview

Following are some ideas for recommended industries and potential use-cases.

Industrial/Manufacturing:

- Safety monitoring. Track moving objects (eg. people/forklifts/robot arm), their trajectories, and signal a warning (alarm) or auto-shutdown if on a collision path.
- Check whether workers are wearing safety equipment.
- Quality assurance. Inspect products against pre-trained models to determine if they are made correctly.
- Barcode and QR code scanning.

Agriculture:

- Pest detection and elimination robots.
- Growth/performance observation and measurement.
- Crop size yield predictions.

Retail:

- In-store surveillance, tracking, and activity monitoring.
- Autonomous checkout/scanning.

Automotive:

- Safety. 360° vehicle view for object detection and collision avoidance, hazard identification, seatbelt detection, or driver drowsiness monitoring.
- Navigation assistance.
- License plate recognition.

Sports:

- Object/ball tracking, speed and trajectory tracking, and performance monitoring.
- Pose estimation for form improvement.

Drones/UAV:

- Inspection of retail spaces.
- Area or building mapping.
- Recreational competitive flying.

Healthcare:

- Patient vitals monitoring (breath, heart rate, or activity).
- Pose estimation for orthopedics.
- Disability assistance. Sign language reading or area mapping for visually impaired.

Autonomous Vehicles/Robots:

- Forklifts. Detect palette location for easier orientation and pick-up.
- Lawn mowing. Distinguish between grass and hazards.
- Submarines. Ocean floor mapping.
- Recreational racing or puzzle solving.

Entertainment:

- 3D engagement for children in locations such as museums, art galleries, or amusement parks.
- Interactive gaming.

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Customer Case Study Examples

Cobra Vision

Construction company specializing in power substations.

Focused on minimizing collisions by utilizing multiple forms of semantic segmentation to identify people, vehicles, and structures.

Simultaneously promoting improved worker safety by identifying if people on the jobsite are wearing appropriate safety equipment.

Also employing: corner detection, pose estimation, spatial depth/location, object tracking.

Greenzie

A company developing autonomous lawn mowing technology for large scale use.

Requires extensive machine learning to identify any/all scenarios that constitute a "blades on" command (grass) or a "blades off" command (object or obstacle) to avoid damage to both mowers and private property.

Relying on substantial dataset development, object detection and recognition, and semantic segmentation, as well as depth, 9-axis IMU, and feature tracking.
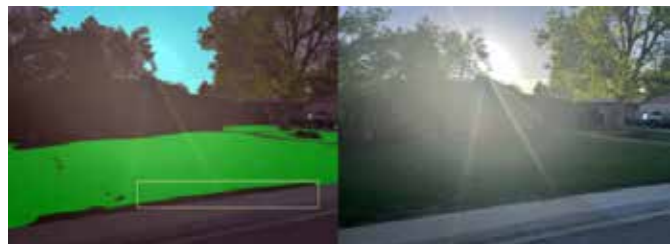
System learning to identify edge cases in bright light.
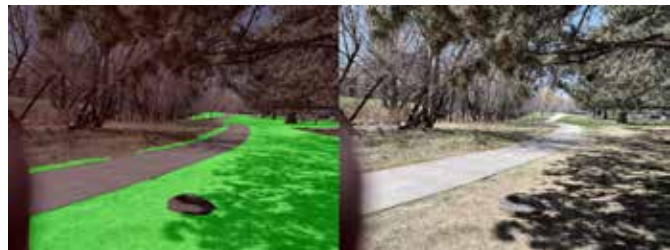
Sidewalk and storm drain segmented as "blades off".

Difficult to see sprinkler head correctly identified as "blades off".

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Customer Case Study Examples

Lantern

Developing an early warning system for road maintenance crews and lane painters.

Lane painting is increasing in frequency due to the growing demand of electric cars relying on clear/distinct lanes for navigation.

Painting often must be done in the midst of traffic, and the slow speed of painter vehicles increases risk for collisions.

By measuring the speed, distance, and position of approaching vehicles, Lantern's system triggers an escalating series of warnings to alert distracted drivers.

These variables must be measured from significant distance to give vehicles adequate time to slow down, placing added importance on depth perception performance.

Road lanes must also be properly segmented and vehicles must be accurately distinguished.
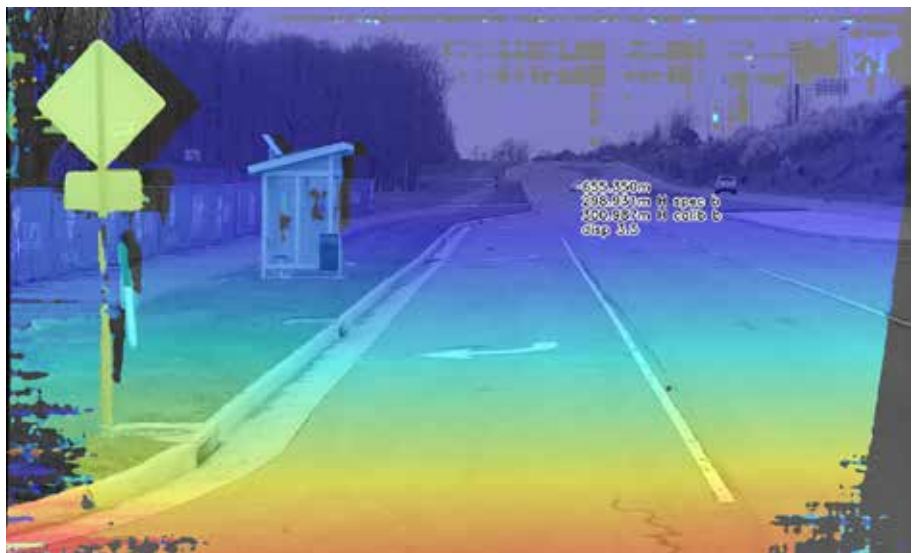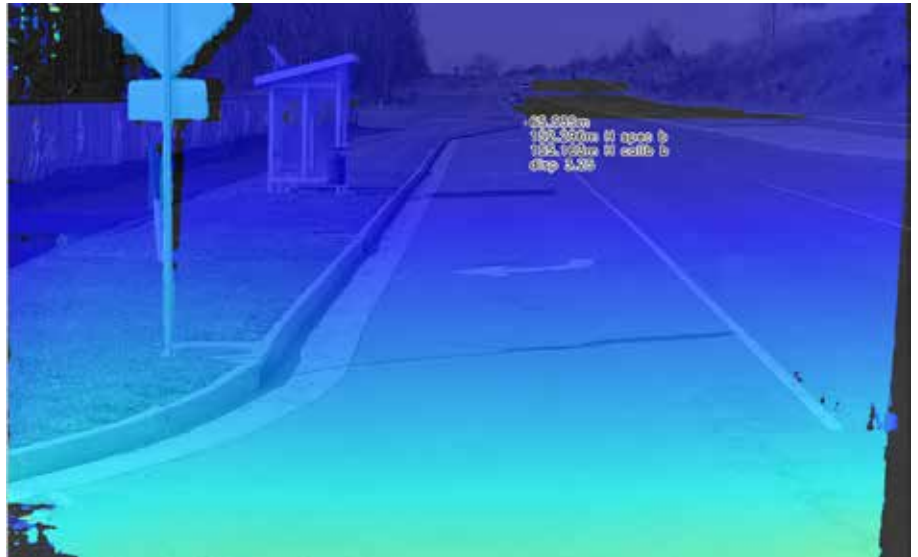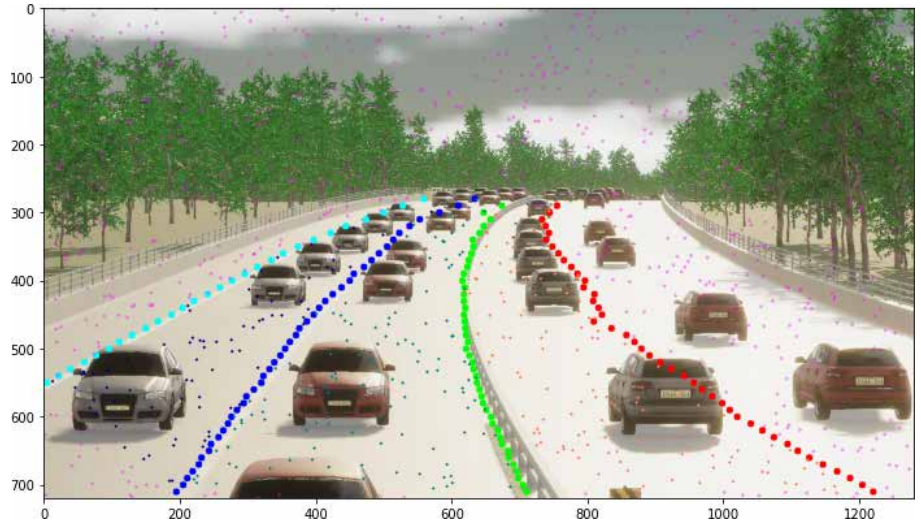
Products

Cameras:

OAK-1 OAK-1 Lite OAK-1 W OAK-1 PoE

OAK-D OAK-D Lite OAK-D S2

OAK-D W OAK-D Pro OAK-D Pro W

OAK-D PoE OAK-D S2 PoE OAK-D W PoE OAK-D Pro PoE OAK-D Pro W PoE

Development kits (for connection of custom camera configurations and stereo baseline distances):

OAK-FFC-3P OAK-FFC-4P OAK-FFC-6P

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Additional Functionality & Product Comparison

Below you will find Luxonis camera options and the functionality the offer in addition to what is standard across all models.

Cameras:

	OAK-1 / OAK-1 Lite	OAK-1 W	OAK-1 PoE	OAK-D / OAK-D Lite / OAK-D S2	OAK-D PoE / OAK-D S2 PoE	OAK-D W	OAK-D W PoE	OAK-D Pro	OAK-D Pro W	OAK-D Pro PoE	OAK-D Pro W PoE
				✔	✔	✔	✔	✔	✔	✔	✔
				✔	✔	✔	✔	✔	✔	✔	✔
				✔	✔	✔	✔	✔	✔	✔	✔
				✔	✔	✔	✔	✔	✔	✔	✔
		✔				✔	✔		✔		✔
								✔	✔	✔	✔
								✔	✔	✔	✔
PoE			✔		✔		✔			✔	✔
			✔		✔		✔			✔	✔

Development kits:

OAK-FFC-3P
OAK-FFC-4P
OAK-FFC-6P

	✔	✔

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Function Glossary

All OAK cameras offer certain standard functionality, and then offer additional functionality depending on model. Below are top-level definitions of these functions, followed by a table detailing the cameras that offer them.

Neural Inference: run any Neural Network (NN) on the camera.

Warp/Dewarp: image distortion correction.

Object Tracking: following objects as they move through space in real time.

H264/265 Encoding: significantly reduces video bandwidth by up to 250 MPixels/second.

Feature Tracking: detection of features and tracking them between consecutive frames using optical flow, by assigning a unique ID to matching features.

MJPEG Encoding: reduces video/image bandwidth size by up to 500 MPixels/second.

Lossless Digital Zoom: zooming in or out on specified area when motion is detected.

Corner Detection: identify edges and corners on the frame

Python Compatible: on-board Python scripting. Use Python scripts for business logic, which allows for complex pipelines to run fully on-device.

OpenVino Compatible: OpenVino is an open-source tool kit for optimizing and deploying AI inference

OpenVINO

3D Object Localization: finding objects in 3-dimensional space.
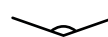
3D Object Tracking: tracking objects in 3-dimensional space.

Stereo Depth: perceive depth from a stereo camera pair using disparity matching.

9-Axis IMU Data: an internal measurement unit (IMU) to allow the device to know its position in space.
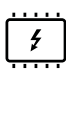
Wide FOV: support for wide FOV cameras.

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IR Illumination: infrared (IR) lighting of low-light areas (night vision).

IR Laser Projection: allows for stereo depth performance in low light.

PoE Connectivity: uses power-over-ethernet (poE) for power and communication.

Flash Edge/Standalone: accommodates operation without being connected to a host computer.

Multiple Camera Support: easily evaluate different sensors (with different FPS, resolution, or shutter type) and optics (FOV).

Custom Baseline: allows the user to select the stereo baseline distance for closer/further depth perception.

Standard Functionality

The following performance is offered standard across all OAK cameras.

NEURAL INFERENCE **WARP DEWARP** **OBJECT TRACKING** **H264/265 ENCODING** **FEATURE TRACKING** **MJPEG ENCODING**

MOTION ZOOMING **CORNER DETECTION** **PYTHON** **USB VIDEO CLASS** **OpenVINO™ FULLY COMPATIBLE**

Note: All PoE models offer IP67 sealed casings for waterproofing/dust proofing.

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