



## A View from the Summit (Part 2)

Jeff Bier

Founder, Edge AI and Vision Alliance  
President, BDTI

May 24, 2023

# What I Learned Yesterday

## VD56G3: Optical Flow

embedded  
**VISION**  
SUMMIT

**Outputs**

- **Points of Interest**  
as automatically detected by the sensor on each frames, Up to 2000 points per frame
- **Movement vectors**  
indicates points position change  
- Up to 2000 vectors per frame at 60 fps  
- or 300fps with lower number of vectors
- **Quality estimation**  
of vector relevance

VD56G3 sensor

Pixel Array  
ADC  
Vimimg  
Power

Raw ISP

Optical Flow

Output interface

CSI2  
2 lanes  
at 1.5Gbps

SLAM ⇒ Enabling odometry only with Optical Flow + IMU

Motion vectors  
6-dim acceleration

Odometry Computation (Host)

Trajectory

**Optical Flow Embedded and 100% Autonomous**

- Lower external processing usage
- Much lower host power consumption
- Only 20mW feature
- Preserved people privacy

STMicroelectronics

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Ruchi Upadhyay, ST



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**VD56G3:Optical Flow** embedded  
**VISION**  
SUMMIT

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**Interview:**  
**Lessons Learned in Developing a High-Volume, Vision-Enabled Coffee Maker**

**Jason Lavene**  
Director, Advanced Development Engineering  
Keurig Dr Pepper

**KEURIG**  
**K-Supreme Plus®**  
**SMART**  
SINGLE SERVE COFFEE MAKER

**BrewID™**  
recognizes your K-Cup® pod and customizes the brew settings to make each cup distinctively delicious

Keurig Dr Pepper



# What I Learned Yesterday

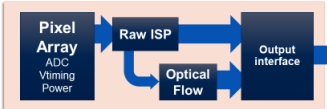
## VD56G3: Optical Flow

embedded VISION SUMMIT

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SLAM → Enabling odometry only with Optical Flow + IMU



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ST logo | © 2023 STMicroelectronics 12

Ruchi Upadhyay, ST

## Interview: Lessons Learned in Developing a High-Volume, Vision-Enabled Coffee Maker



**Jason Lavene**  
Director, Advanced Development Engineering  
Keurig Dr Pepper

## KEURIG K-Supreme Plus<sup>®</sup> SMART

SINGLE SERVE COFFEE MAKER




**BrewID™** recognizes your K-Cup<sup>®</sup> pod and customizes the brew settings to make each cup distinctively delicious

Keurig Dr Pepper

## Go-to-Market – Misunderstood

embedded VISION SUMMIT



CONNECTED VISION ADVISORS | © 2023 Connected Vision Advisors | Source: <https://www.linkedin.com/pulse/who-should-lead-go-to-market-strategy/> | 11

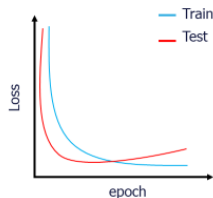
Simon Morris,  
Connected Vision Advisors



# What I Learned Yesterday

## Overfitting Indicators

- The loss on the test set will start to diverge.
- Happens when the model memorizes the training data.
- Happens when the epoch number is too large.
- Happens when the dataset is too small.

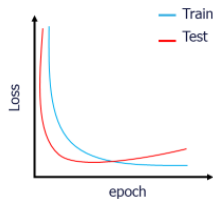


Fahed Hassenat, Sensor Cortex

# What I Learned Yesterday

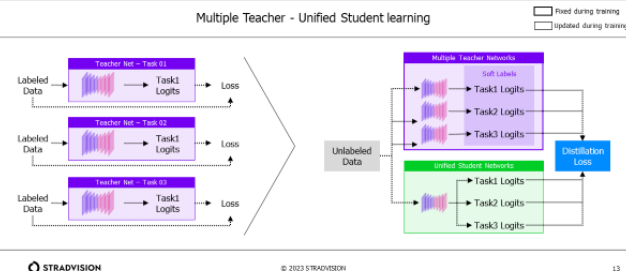
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Fahed Hassenat, Sensor Cortek

## Proposed Development Process



Jack Sim, Stradvision



# What I Learned Yesterday

## Overfitting Indicators

- The loss on the test set will start to diverge.
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Train  
Test

Loss

epoch

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Fahed Hassentat, Sensor Cortex

## Proposed Development Process

Multiple Teacher - Unified Student learning

Fixed during training  
Updated during training

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Jack Sim, Stradivision

## Time of Flight (ToF) sensor ecosystem

Established application Emerging Expected?

© 2023 Yole Intelligence

Florian Domengie, Yole





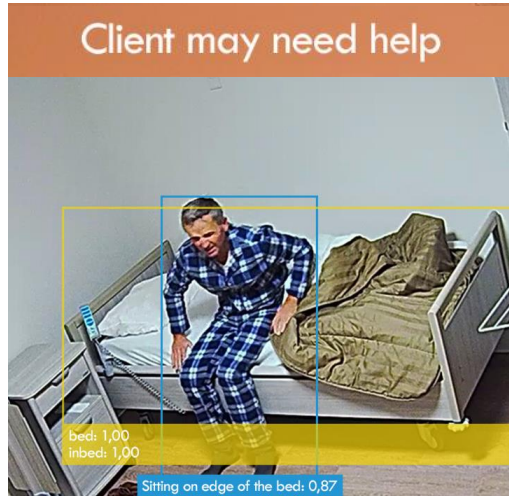
# **Opportunities: Health Care**



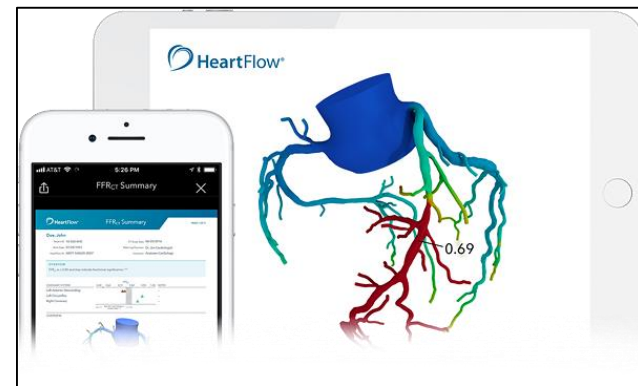
# Applications at Scale: Health Care



VirtuSense



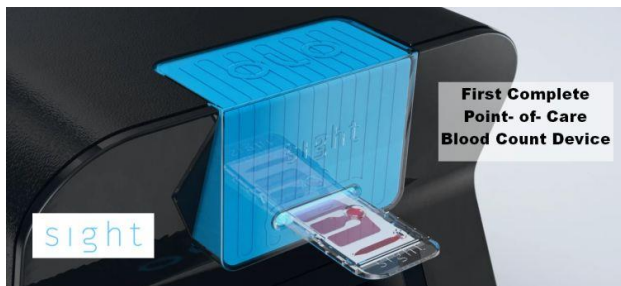
HeartFlow



Kepler Vision Technologies



# Applications at Scale: Health Care



Sight Diagnostics

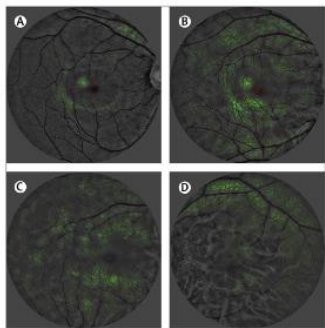


Verily



# What Machines See in the Human Retina

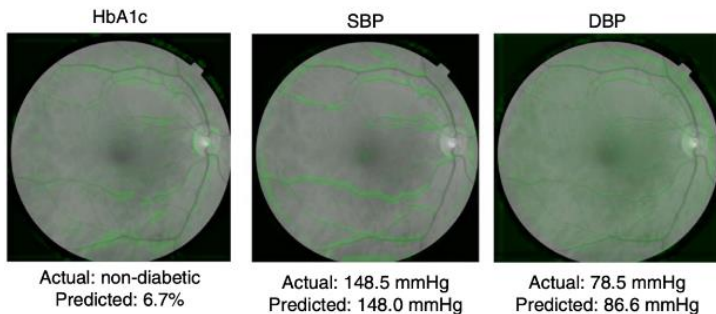
## Kidney Disease



A deep learning algorithm to detect chronic kidney disease from retinal photographs in community-based populations

*Lancet Digital Health* May 2020

## Diabetes and Blood Pressure Control



Prediction of cardiovascular risk factors from retinal fundus photographs via deep learning

nature  
biomedical engineering March 2018

## Alzheimer's Disease

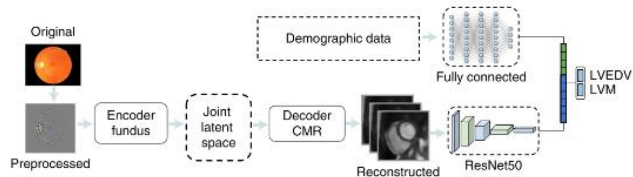


A system based on AI will scan the retina for signs of Alzheimer's

AlzEye Moorfields Eye Hospital NHS Foundation Trust  
Detecting signs of dementia in the retina

*Lancet Digit Health* :Sept 2022

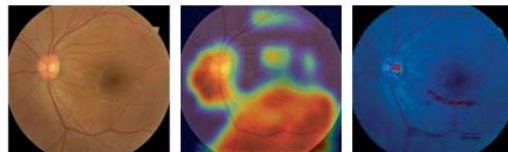
## Predicting heart attack



Predicting myocardial infarction through retinal scans and minimal personal information

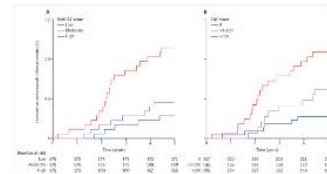
Jan 2022

## Liver and Gall Bladder Disease



*Lancet Digit Health* Feb 2021

## Heart Calcium Score

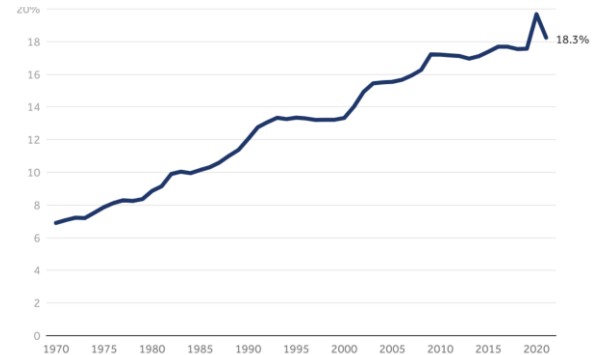


*Lancet Digit Health* Apr 2021

# Perceptual AI in Healthcare

- Earlier and more accurate detection of health issues
- More convenient care (e.g., at home)
- Less invasive tests
- More effective treatment
- Reduced costs

## Total U.S. Health Expenditures as a % of Gross Domestic Product



Peterson-KFF Health System Tracker

- U.S. healthcare spending is over \$4 trillion, ~18% of GDP (as of 2021)<sup>1</sup>
- Worldwide healthcare spending is over \$9 trillion, ~11% of GDP (as of 2020)<sup>2</sup>

[1] Commonwealth Fund  
[2] World Health Organization



# Hazard Ahead: Bias

- Perceptual and other forms of AI are fueling powerful advances in healthcare
- As the role of AI grows, bias in algorithms is a huge risk



“Dermatologist-level Detection of Suspicious Pigmented Skin Lesions from Wide-field Images”

Soenksen, MIT News



# Hazard Ahead: Bias

- Perceptual and other forms of AI are fueling powerful advances in healthcare
- As the role of AI grows, bias in algorithms is a huge risk
- Regulators are showing interest in this topic

*California investigating racial bias in healthcare algorithms*  
Los Angeles Times

**Algorithmic Bias in Health Care Exacerbates Social Inequities**

Harvard H.T. Chan School of Public Health

**Most Americans are uncomfortable with artificial intelligence in health care, survey finds**  
CNN



# Hazard Ahead: Bias

- Perceptual and other forms of AI are fueling powerful advances in healthcare
- As the role of AI grows, bias in algorithms is a huge risk
- Regulators are showing interest in this topic
- Minimizing harmful biases can't be an afterthought

### Bias in CV: Looking Beyond Facial Recognition

Agriculture  
Plant Disease Detection

Manufacturing  
Quality Inspection

Transportation  
Pothole Detection

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Santa Clara University

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Susan Kennedy,  
Santa Clara University

### Diversity Attributes for Metrics

01	Environmental attributes	<ul style="list-style-type: none"><li>• Background: walls, flooring, furniture, windows</li><li>• Lighting, shadows, reflections</li><li>• Other people, animals in the field of view</li><li>• Occlusion</li><li>• Equipment (mat, dumbbells)</li></ul>
02	Member attributes	<ul style="list-style-type: none"><li>• Gender, skin tone</li><li>• Body type</li><li>• Fitness level</li><li>• Disabilities</li><li>• Clothing</li></ul>
03	Geometric attributes	<ul style="list-style-type: none"><li>• Camera/Member relative placement</li><li>• Camera mounting Height</li><li>• Camera tilt</li><li>• Member orientation</li><li>• Member distance</li></ul>

PELOTON

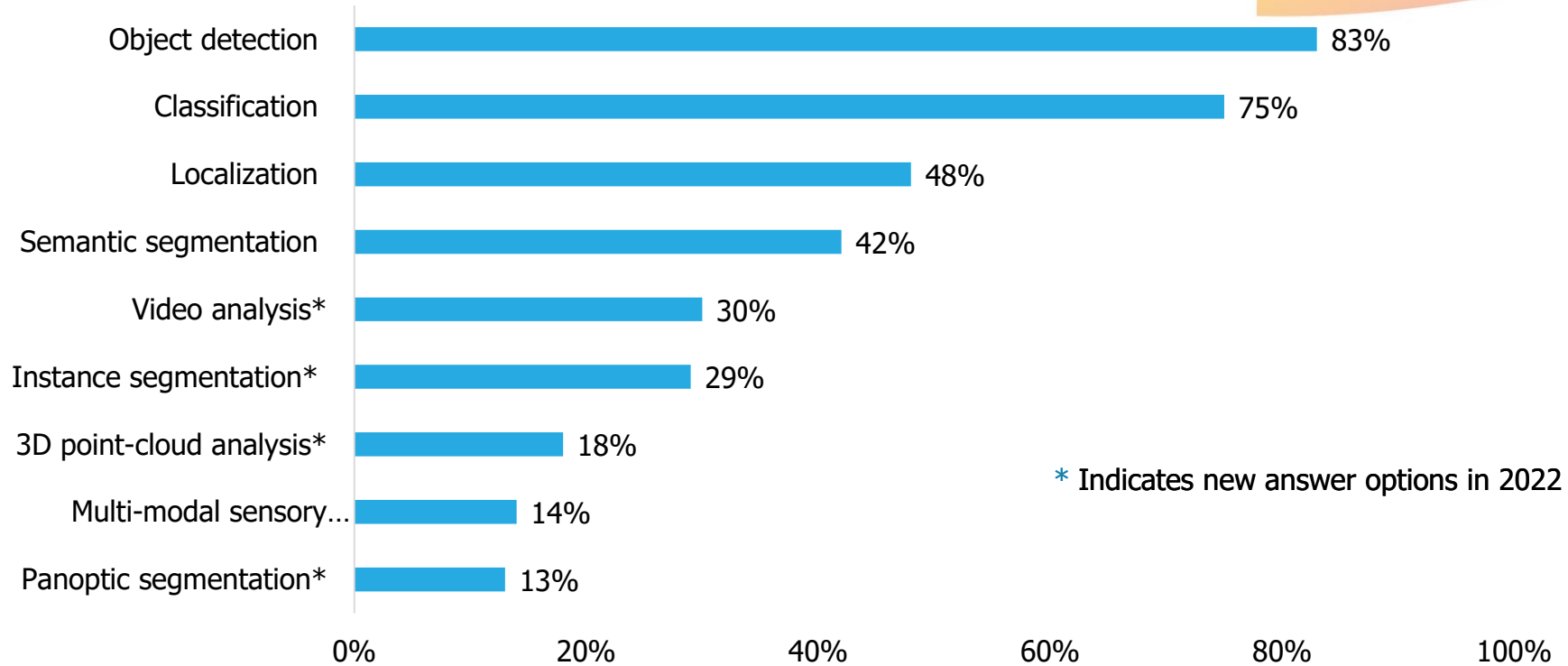
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Sanjay Nichani, Peloton



# Functions Served by Neural Networks

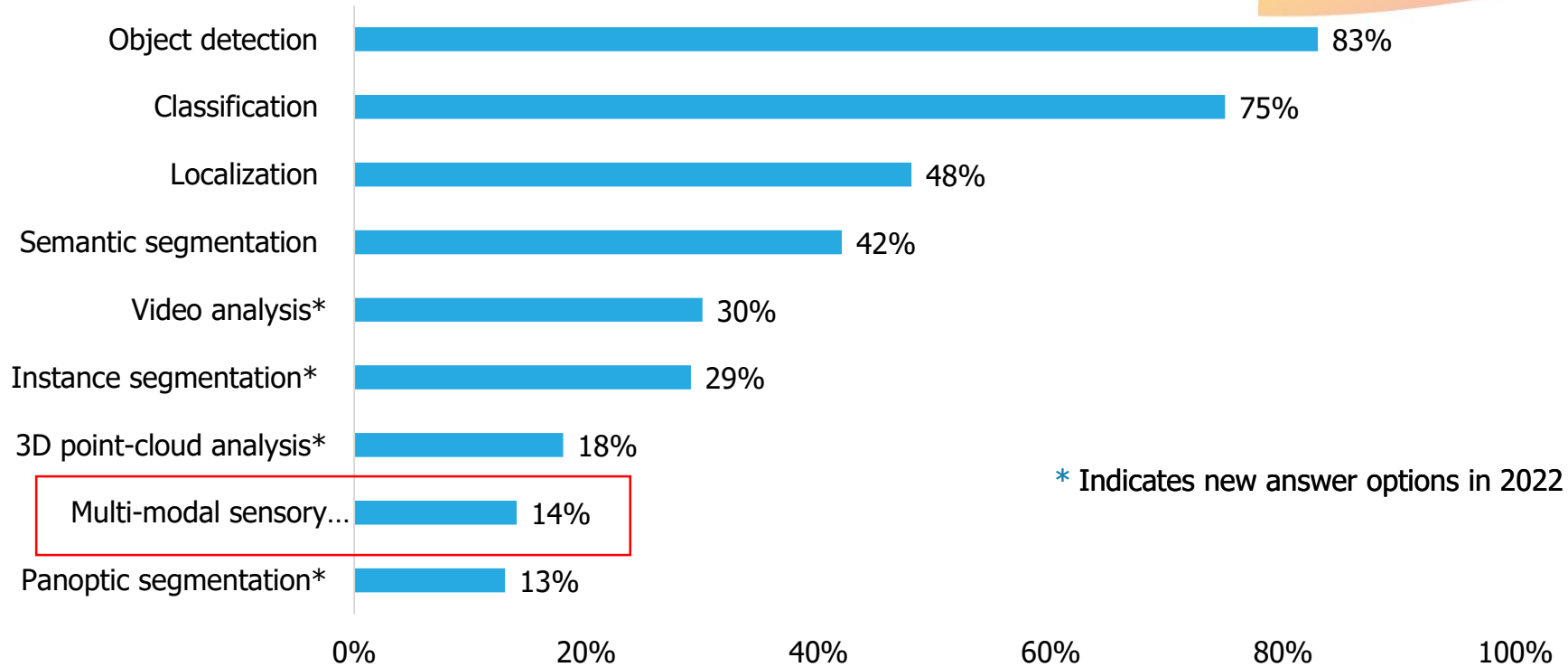


Source: Edge AI and Vision Alliance, *Computer Vision Developer Survey, November 2022*



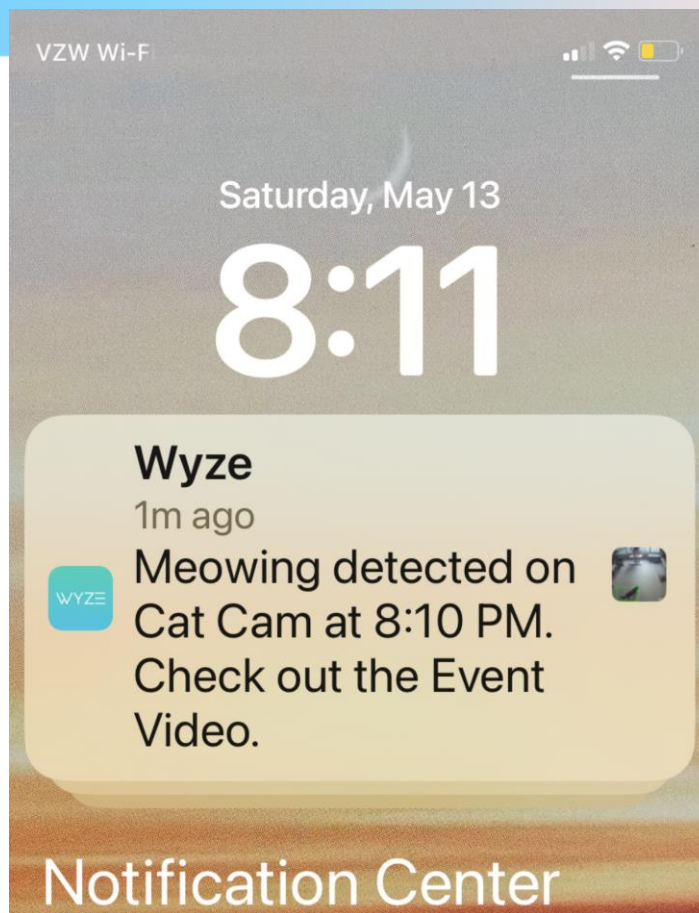


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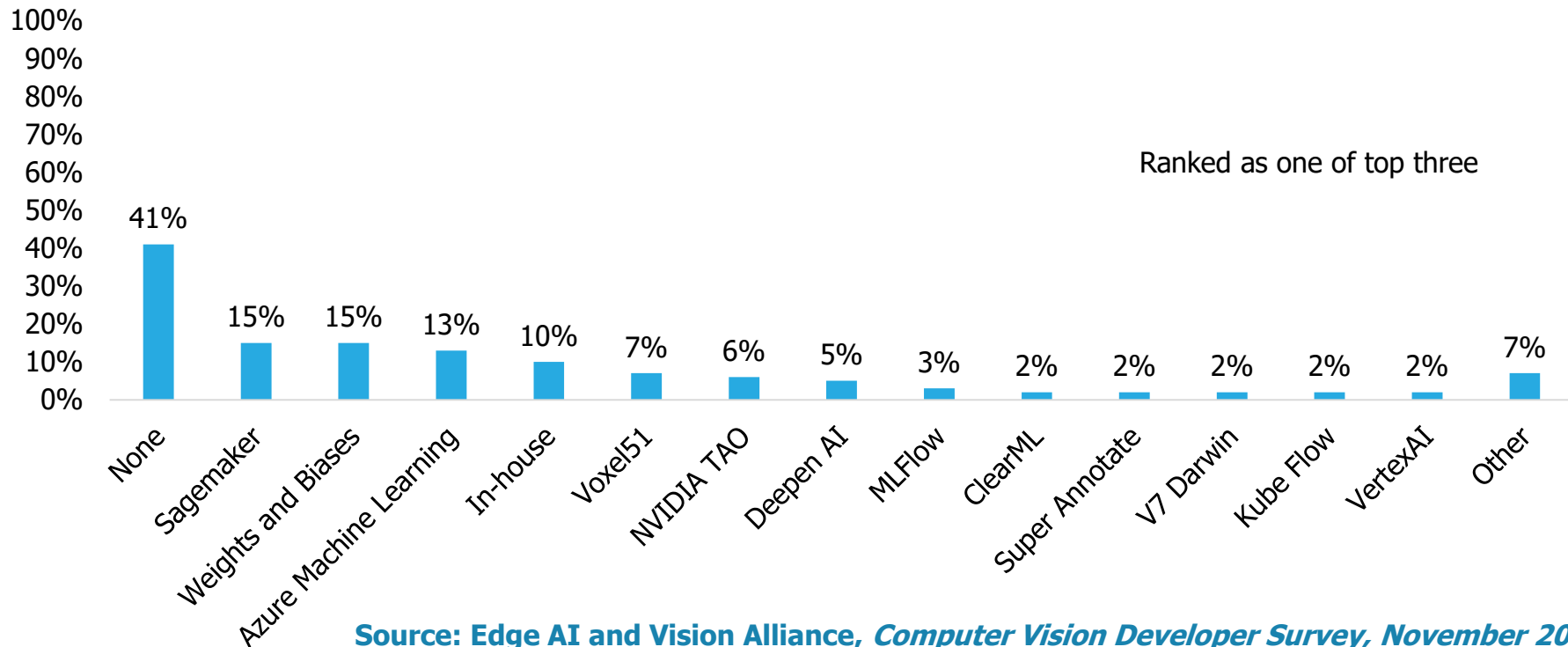


Source: Edge AI and Vision Alliance, *Computer Vision Developer Survey, November 2022*





# Tools Used for Managing and Automating Deep Neural Network Training and Data



Source: Edge AI and Vision Alliance, *Computer Vision Developer Survey, November 2022*



# See You Next Year—

***2 Weeks Earlier!***

**May 7-9, 2024**

The logo for the 2024 Embedded VISION Summit is centered within a white octagonal frame. The frame is surrounded by a complex, multi-layered geometric pattern of overlapping triangles and polygons in various colors including teal, purple, yellow, green, red, and blue. The text inside the octagon reads: "2024" in a small sans-serif font, "embedded" in a lowercase sans-serif font, "VISION" in a large, bold, uppercase sans-serif font with a blue-to-orange gradient, "SUMMIT" in a smaller, bold, uppercase sans-serif font, "MAY 7-9" in a very small font, and "SANTA CLARA, CALIFORNIA" in a small font at the bottom.

2024  
embedded  
**VISION**  
SUMMIT<sup>®</sup>  
MAY 7-9  
SANTA CLARA, CALIFORNIA

[embeddedvisionsummit.com](https://embeddedvisionsummit.com)

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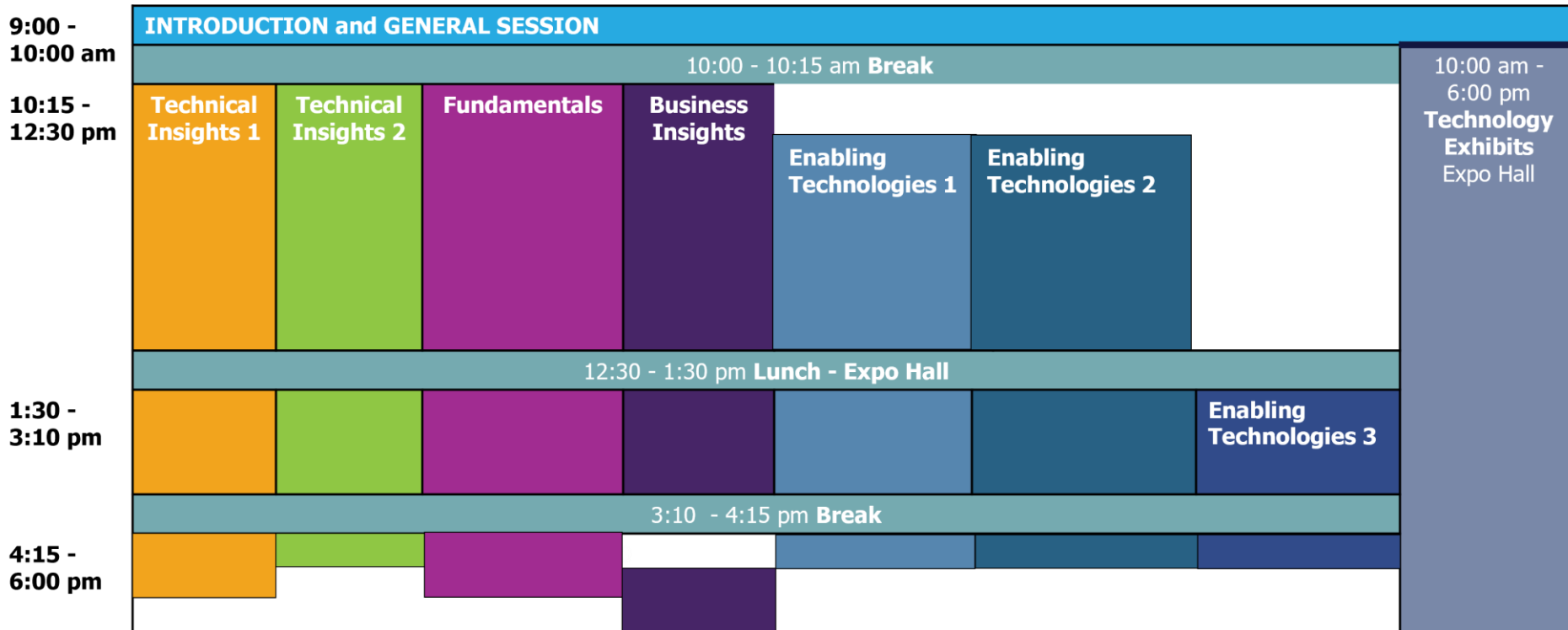


edge ai + vision  
**ALLIANCE**

























**Making the Most of Your Day**

# Wednesday Schedule



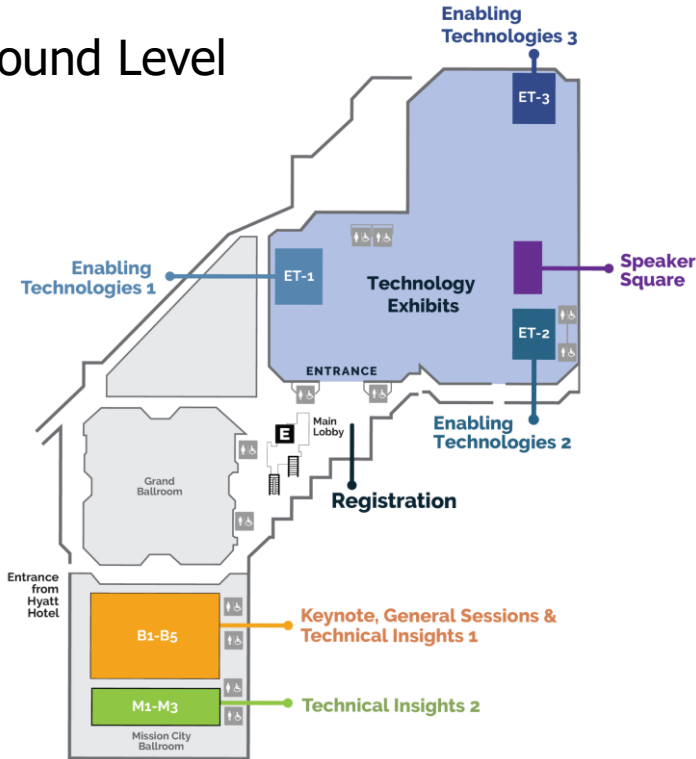
# Check Out the Exhibits!

 7sensing™	 AIM FUTURE	 ANALOG DEVICES AHEAD OF WHAT'S POSSIBLE™	 arm	 armi <small>Advanced Reconfigurable Manufacturing Institute</small>	 avasssa	 AVNET	 AXELERA ARTIFICIAL INTELLIGENCE	 BASLER
 BDTi	 blaize	 BLAXTAIR	 brainchip Essential AI	 cadence	 CEVA	 CIRCUIT SUTRA CLOUD FIRST	 CLIKA	 codeplay
 Connect Tech Inc.	 D3	 deci	 DEEPIX	 DeGirum	 DEKA RESEARCH & DEVELOPMENT CORP.	 e-con Systems Think Global. Think e-con.	 edge ai + vision ALLIANCE	 EDGE IMPULSE
 edgeworx	 EFINIX	 ETRI Electronics and Telecommunications Research Institute	 embed EFFICIENT DEEP LEARNING	 expedera	 fidus innovate • design • deliver	 FIRST	 flexlogix reconfigurable	 FRAMOS
 Generalplus	 G GLOBAL INTELLIGENCE	 HAILO	 IMMERVISION	 InnoPhase IoT	 INUITIVE	 IRIDA LABS	 KHRONOS GROUP	 LANTRONIX
 LATTICE SEMICONDUCTOR	 lemur imaging	 LEOPARD IMAGING	 MICROCHIP	 MOUSER ELECTRONICS	 n NetworkOptix	 nextchip	 Nota AI	 NXP
 ONIT it experience	 OpenCV AI Consulting	 optimizing mind	 outsight	 PARROTS MEDICAL ASSISTIVE AI	 Perceive	 Plumerai	 ProHawk	 QLAIRVOYANCE
 Quadric	 RECOGNI	 RENASAS	 seeed studio	 SONY	 ST life.augmented	 STRAD VISION	 Sunex Excitement in Digital Imaging Optics	 supergate
 synaptics	 SYNOPSYS	 TARSENS	 TENYKS	 USEFUL SENSORS	 VeriSilicon	 VC vision components	 VISIONARY.AI	 XPERI

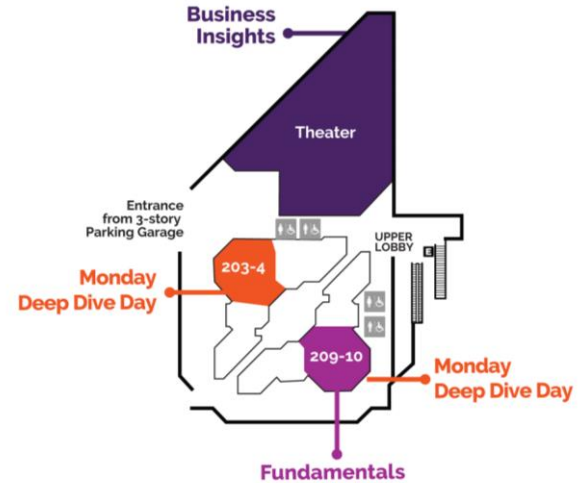


# Facility Map

## Ground Level



## Upstairs





# Speaker Office Hours (in the Speaker Square)

**Greg Kostello**

Huma.AI

**Roland Memisivic**

Qualcomm AI

**(All at 10:30 am)**

**Vivek Pradeep**

Microsoft

**Steve Teig**

Perceive

**Generative AI**

Today!

**11:30 am: Alex Thaman**

Red Cell Partners

**Bias in computer vision systems**

**2:30 pm: Jason Lavene**

Keurig Dr Pepper

**Developing low-cost vision systems**

**1:30 pm: Chris Rowen**

Cisco

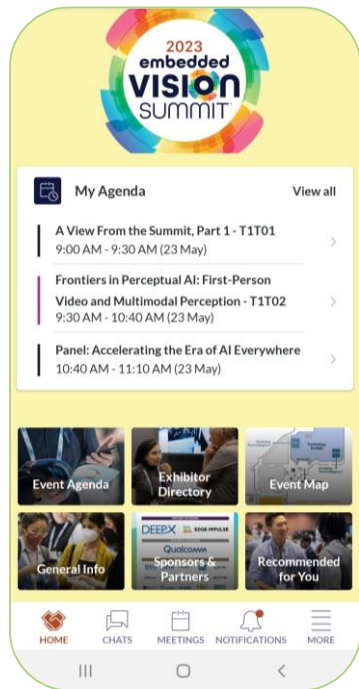
**Machine learning for video**

**3:30 pm: Ian Riches**

TechInsights

**Automotive markets and technologies**

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[noreply@event.embeddedvisionsummit.com](mailto:noreply@event.embeddedvisionsummit.com)

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**Turn on notifications** to receive important reminders.





## Please fill out your **Embedded Vision Summit** survey!

Completed surveys will be entered into a drawing for one of three \$100 Amazon gift cards.



# Thank You!



# Panel on Generative AI: How Will It Impact Edge Applications and Machine Perception?



**Sally Ward-Foxton**  
*EE Times*



**Greg Kostello**  
Huma.AI



**Roland Memisevic**  
Qualcomm AI Research



**Vivek Pradeep**  
Microsoft



**Steve Teig**  
Perceive

**Text your questions to +1 408-400-2702**



# Wednesday Schedule

