Key Trends in the Deployment of Visual AI

Jeff Bier, Embedded Vision Alliance / BDTI

October 2019

What's Changing?

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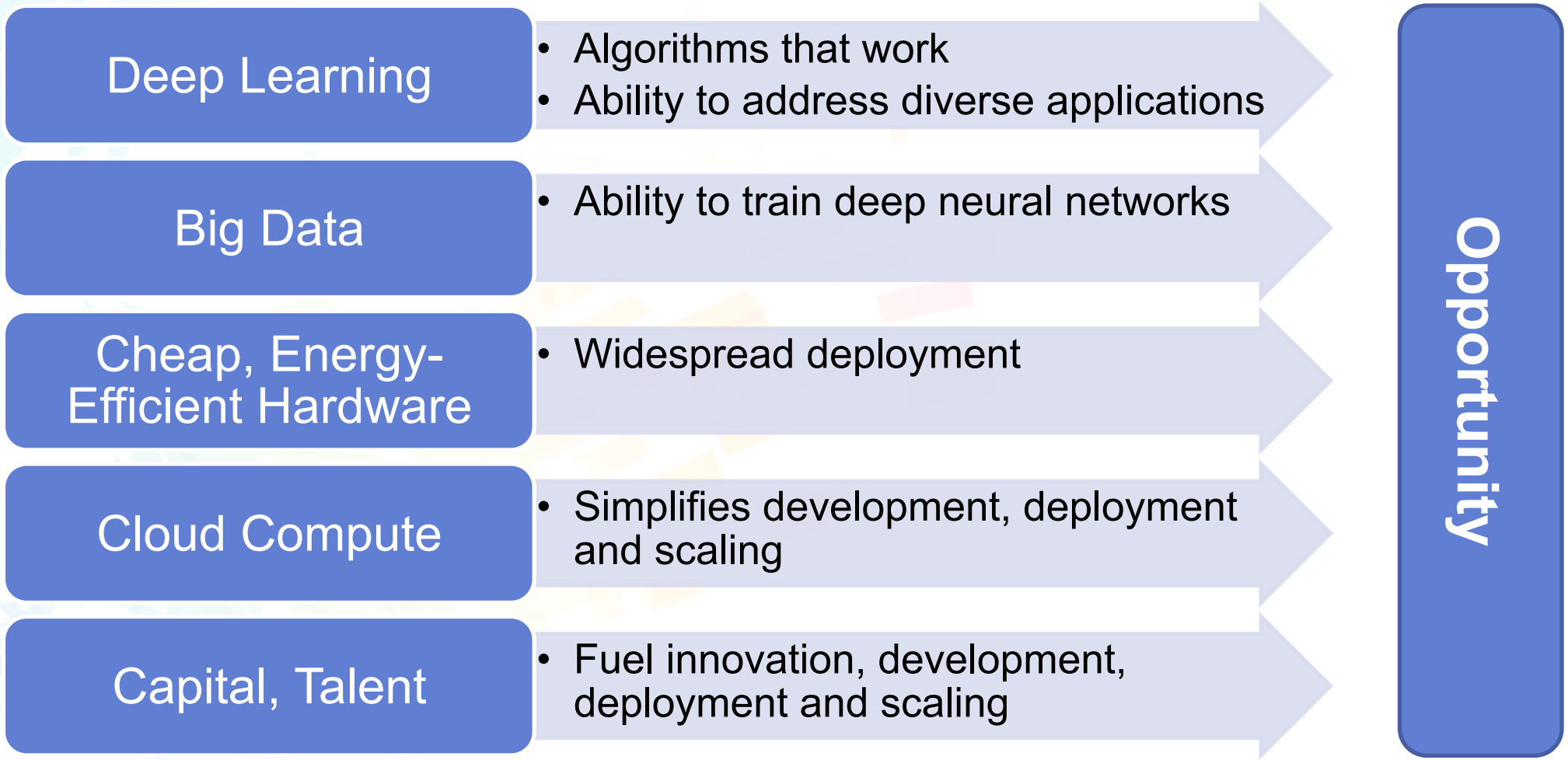
What Makes This a Unique Era?



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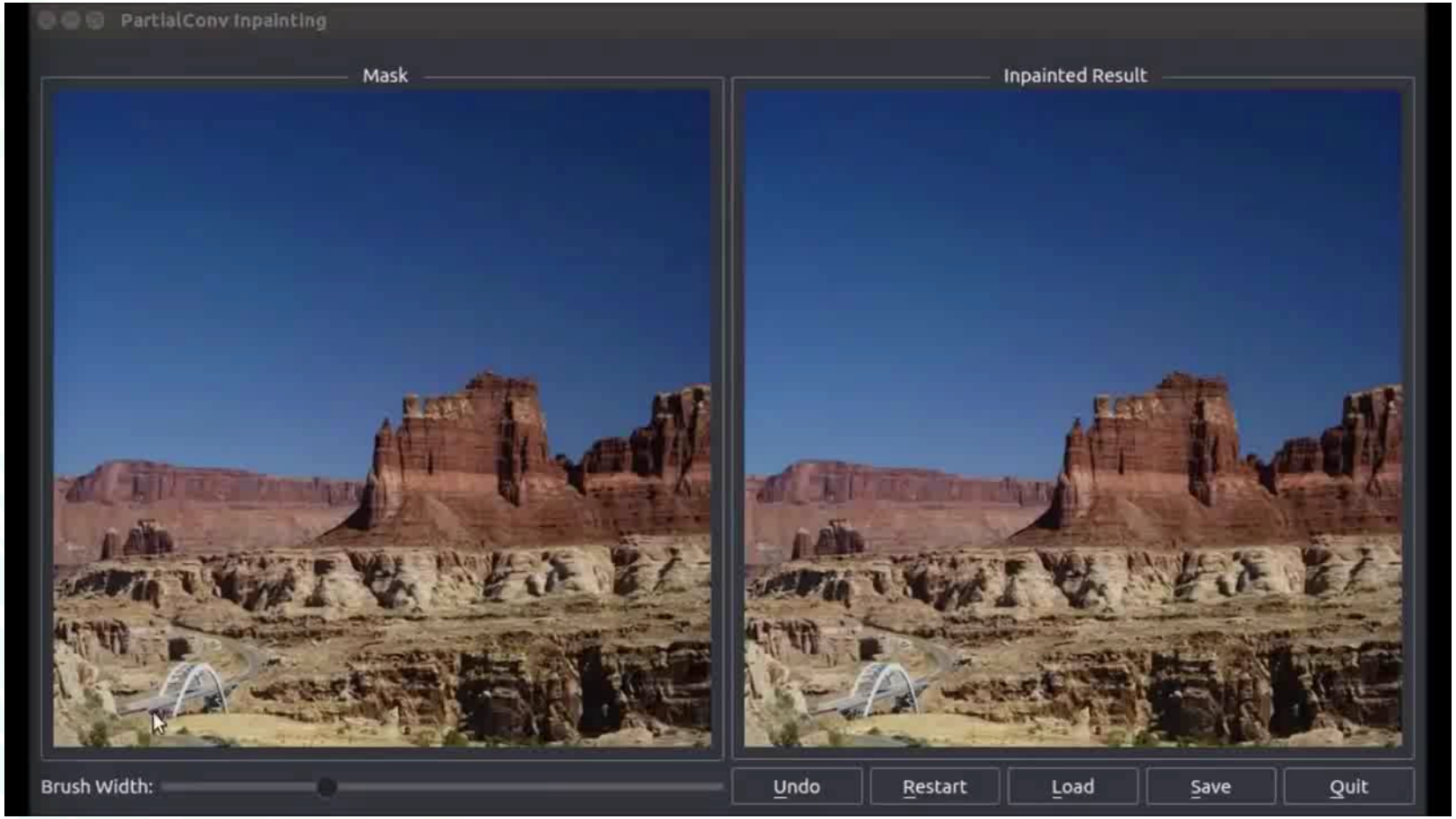
Deep Learning Matches Skilled Human Performance



Watch the video: https://youtu.be/gg0F5JjKmhA

Source: Guilin Lin et al., NVIDIA

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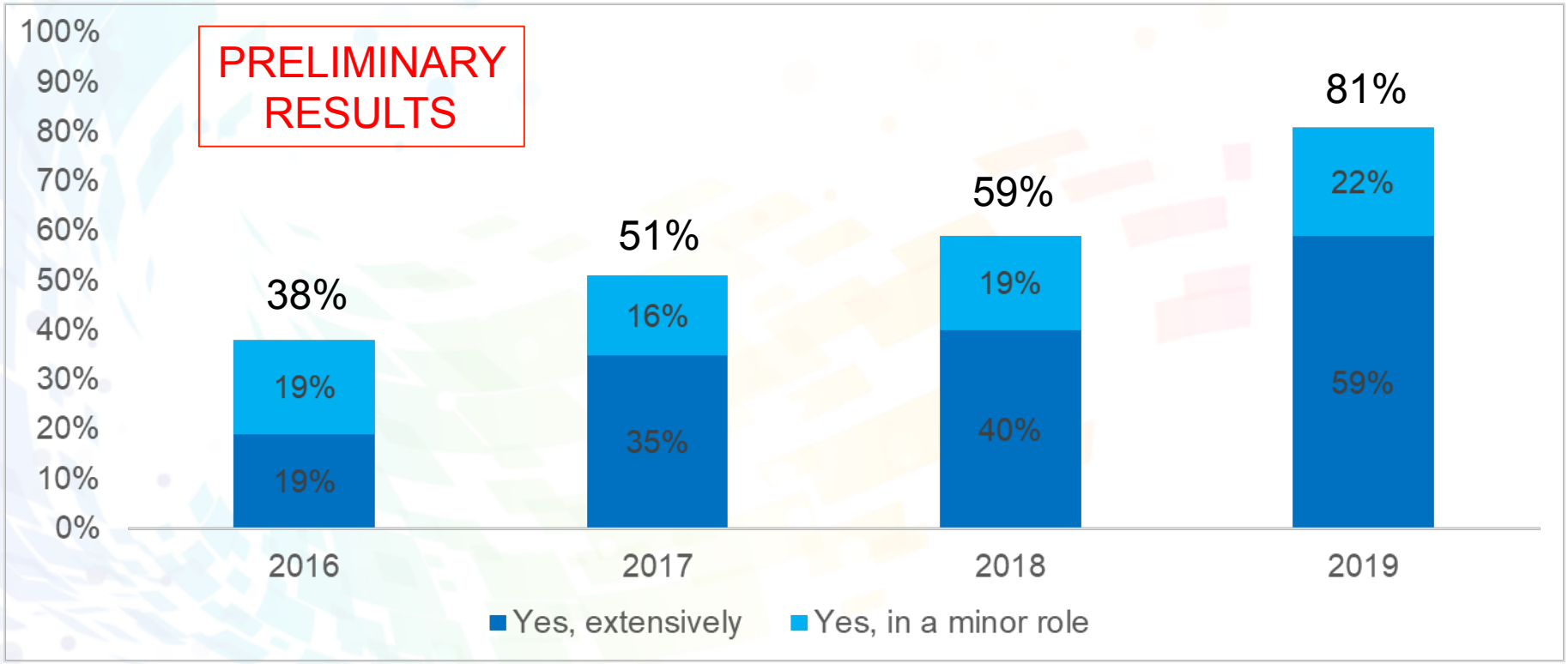
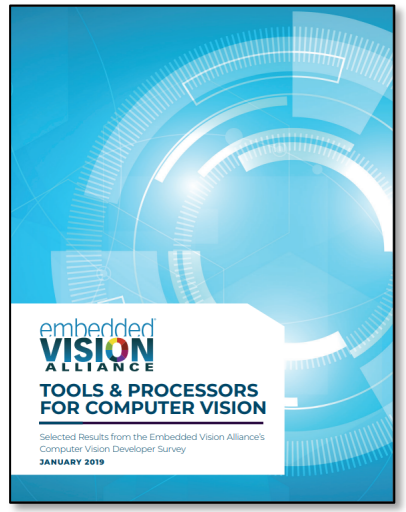
Use of Neural Networks in Vision Applications





tinyurl.com/CVDevSurvey

Source: Embedded Vision Alliance, *Computer Vision Developer Survey, Oct. 2019*

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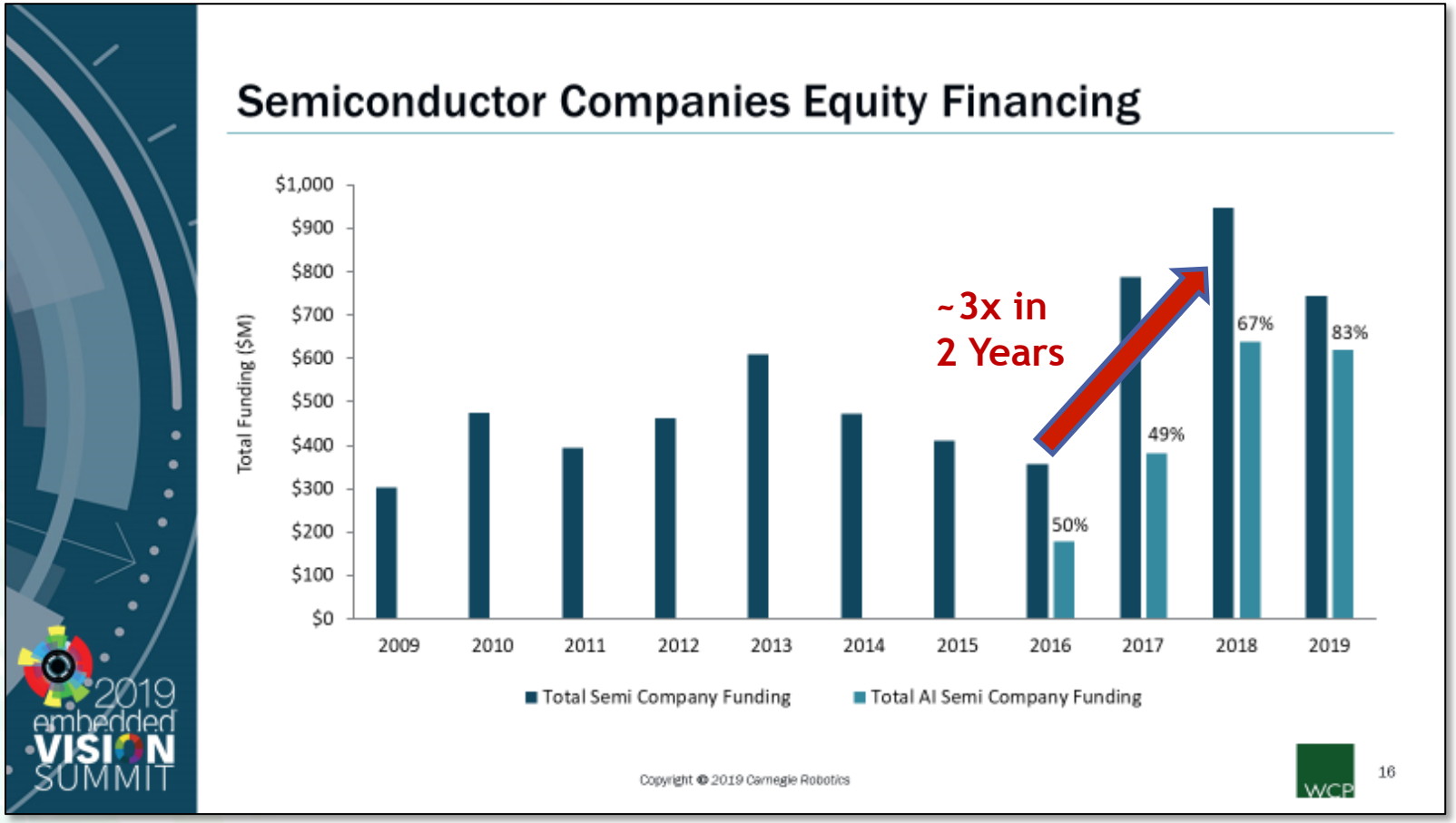
Deep Learning Catalyzes Acceleration in Innovation and Applications



Source: Rudy Burger, Woodside Capital

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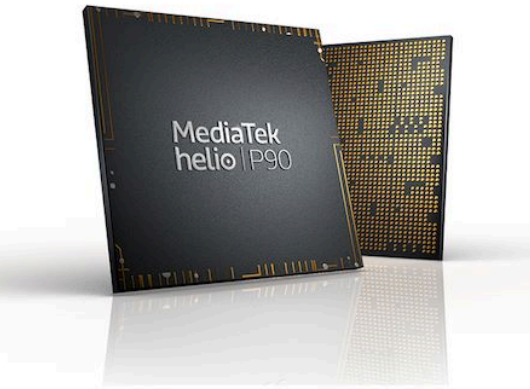
Processors

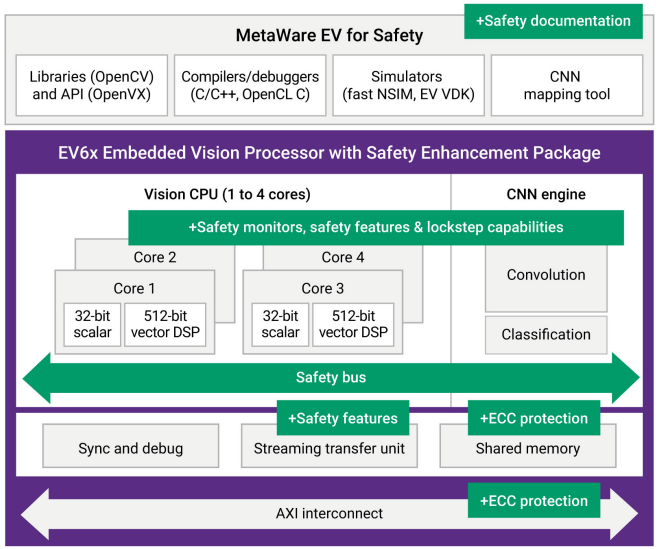
Roughly 75 companies are developing processors for deep learning, including…



MediaTek Helio P90

Image: Anandtech.com

VISION PRODUCT OF THE YEAR



Synopsys EV6x Embedded Vision Processors with Safety Enhancement Package (SEP)

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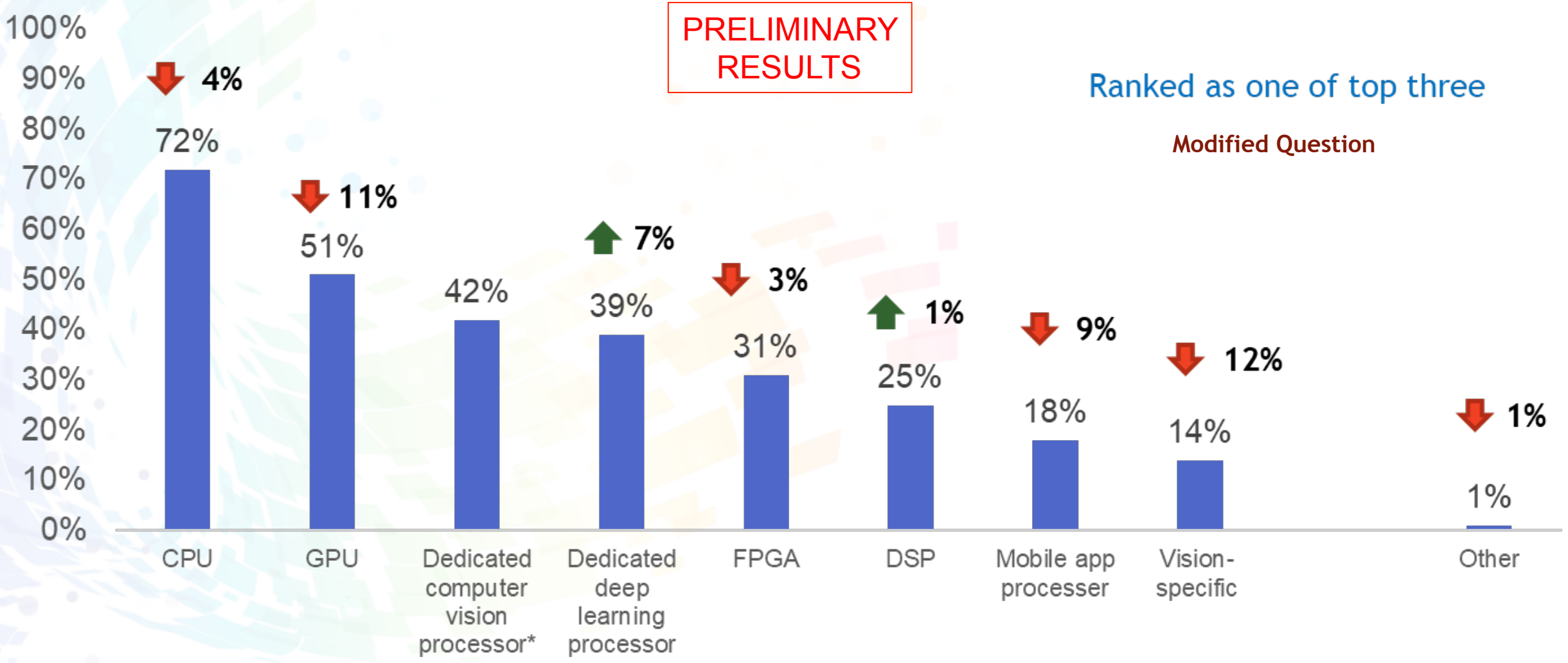
Type of Processor Used for Deployment of Vision Tasks

PRELIMINARY RESULTS

Ranked as one of top three

Modified Question



Source: Embedded Vision Alliance, *Computer Vision Developer Survey, Oct. 2019*

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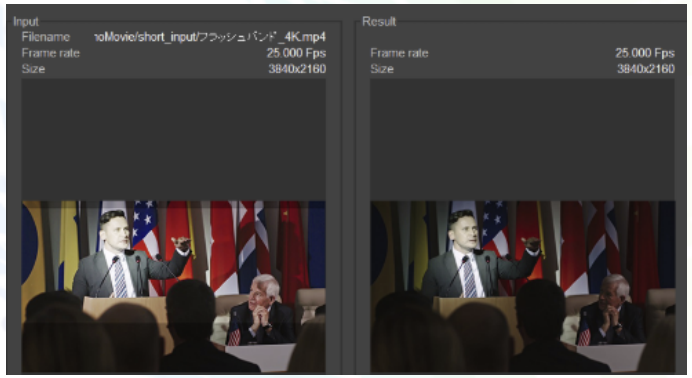
Democratization

- Big investments are also being made in simplifying development
  - Reference designs
  - Camera and processor modules
  - Tools
  - Algorithm and software components

Morpho



Morpho Video Processing Solutions

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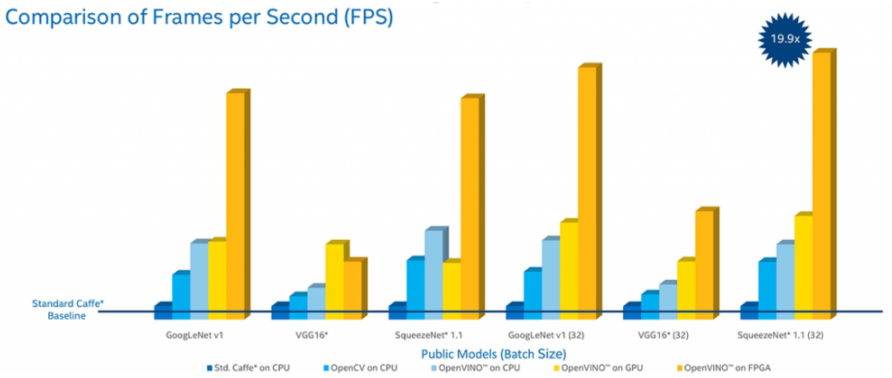
intel

OpenVINO™



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The Cloud Shuffles the Deck

	Edge	Cloud
Time-to-market		✔✔✔
Upgradability		✔✔
Accuracy		✔✔✔
Coordination among distributed devices		✔✔✔
Device cost		✔✔
Recurring costs	✔✔✔	
Internet connectivity, bandwidth required	✔✔✔	
Response time	✔✔✔	
Privacy/security	✔	

✔ = **Advantage**

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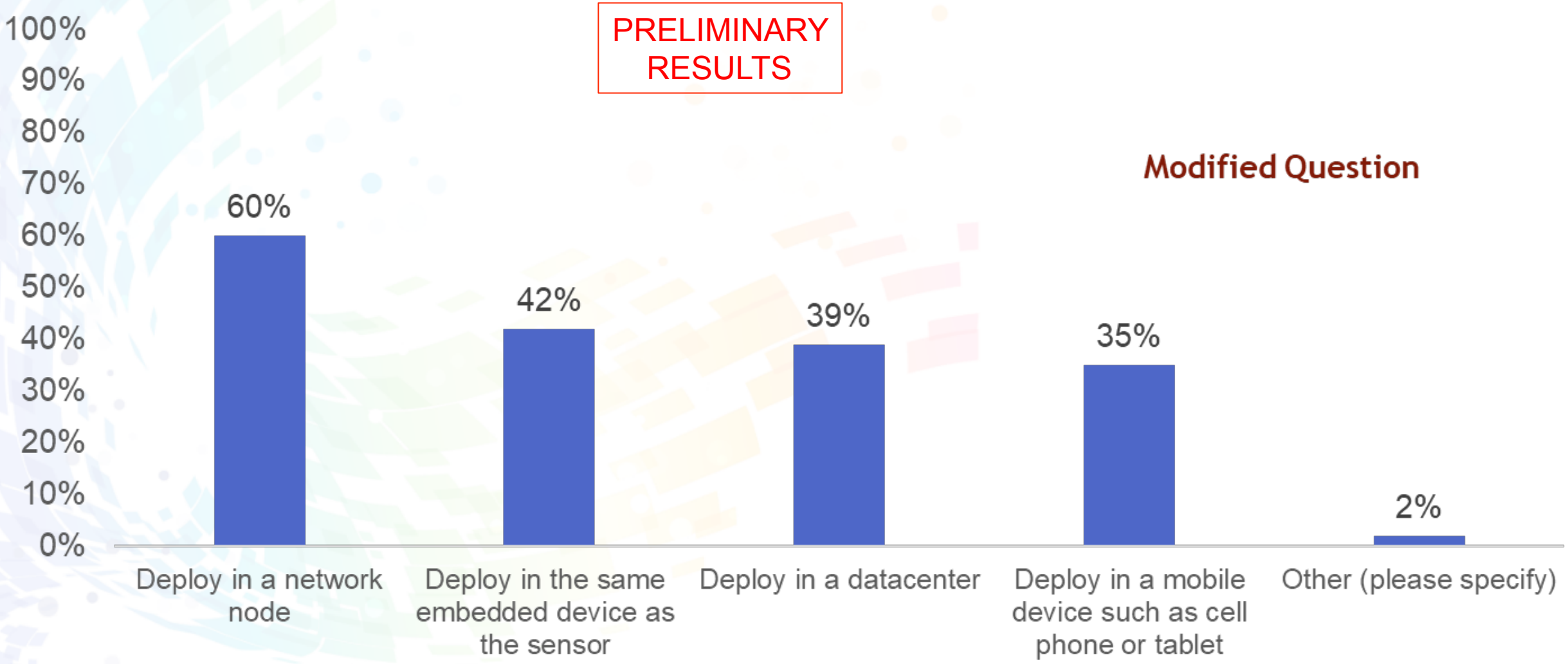
How is Your Neural Network Deployed?

PRELIMINARY RESULTS



Source: Embedded Vision Alliance, *Computer Vision Developer Survey, Oct. 2019*

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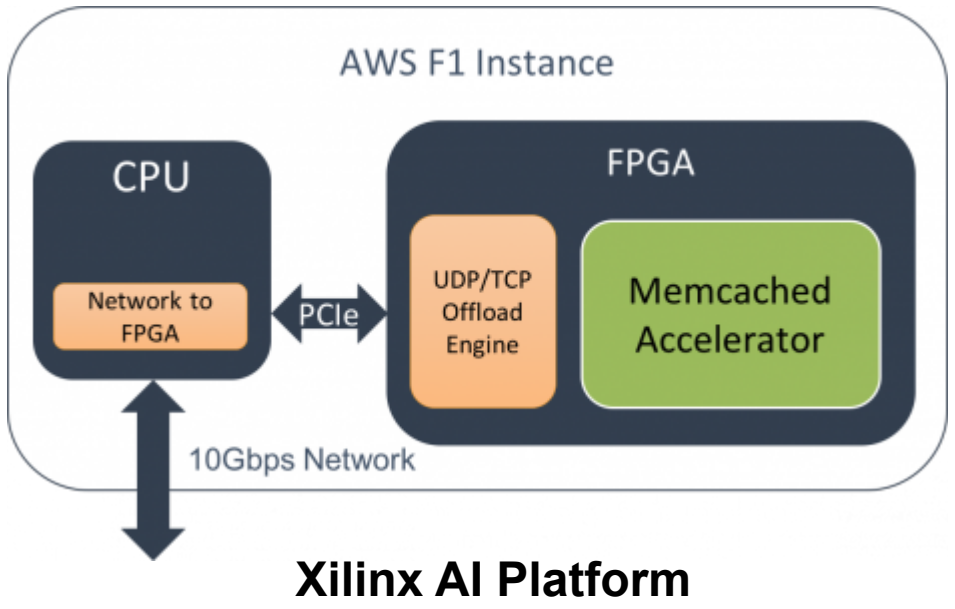
Deploying Vision in the Cloud

- Public cloud providers offer a growing selection of accelerators for computer vision and machine learning
  - GPUs, FPGAs, TPUs
- Expanding array of APIs (e.g., Amazon Rekognition)
- Cloud platforms ease assembling solutions and scaling them



Xilinx AI Platform

Image: legupcomputing.com

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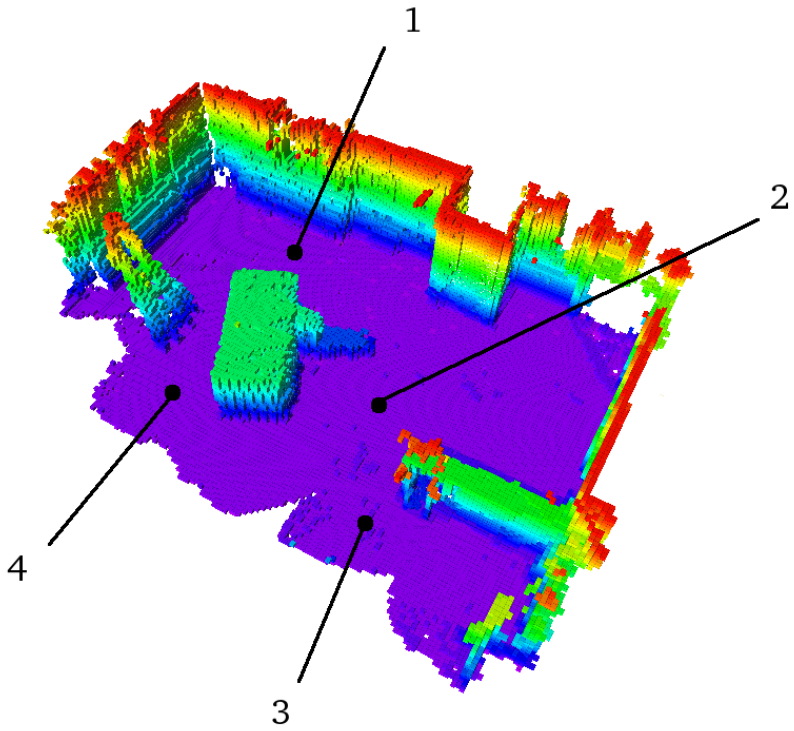
3D Perception



Source: pcc.disam.etsii.upm.es

Source: appleinsider.com

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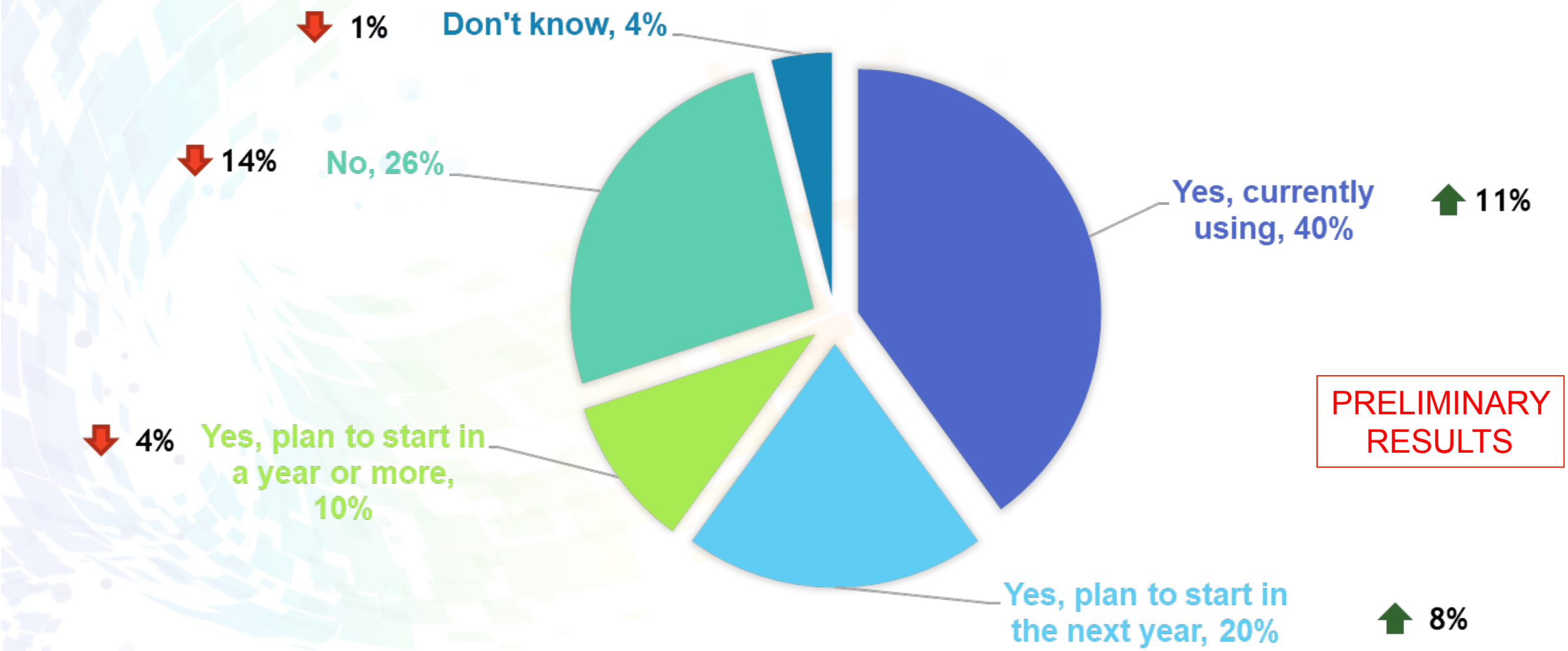
Use of 3D Perception in Products



Source: Embedded Vision Alliance, *Computer Vision Developer Survey, Oct. 2019* V

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3D Perception

- 10 years after the debut of the Kinect, 3D camera modules are now ready for deployment in cost- and power-sensitive applications.

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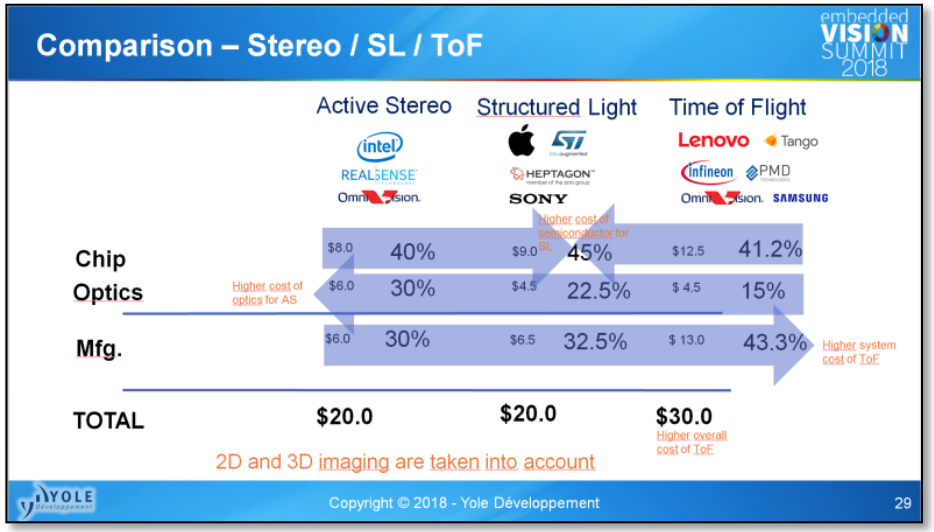
Infineon

Infineon Technologies – IRS2381C 3D Image Sensor



Source: Guillaume Girardin, Yole Developpement

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Applications and Opportunities

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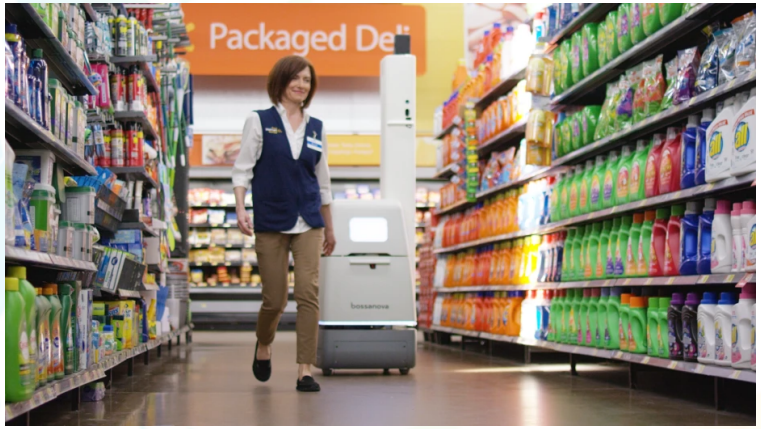
Applications: Autonomous Machines



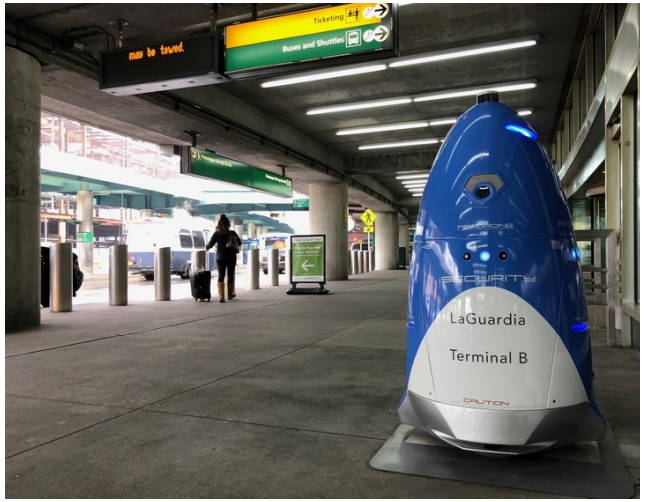
Source: Bossa Nova Robotics

Source: Seegrid

Source: iRobot

Source: Restoration Robotics

Source: Blue River Technology



Source: Knightscope

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Driver Monitoring – Cadillac Super Cruise

Watch the video: https://www.youtube.com/watch?v=hADi5h0BzQA

Source: General Motors/

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Domain-specific Platforms

- For a few high-volume markets (e.g., automotive, mobile phone, video surveillance), suppliers offer integrated domain-specific platforms
- These complex hardware-software subsystems provide much of the functionality required for the application

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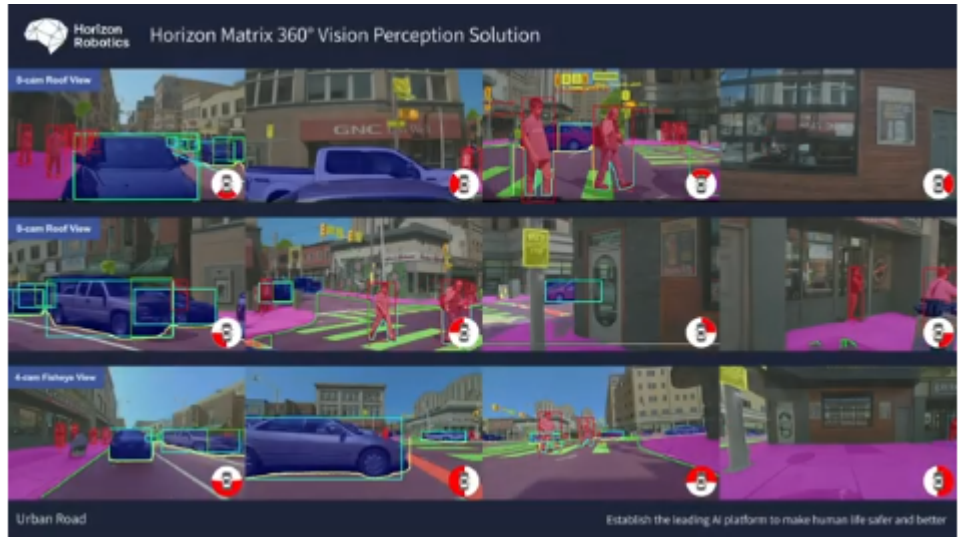
Horizon Robotics



Horizon Robotics – Horizon Matrix

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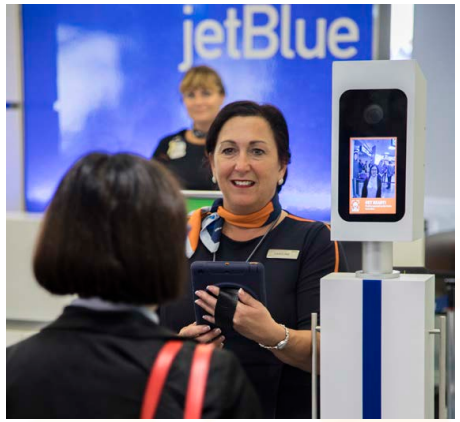
Applications: Smart Spaces

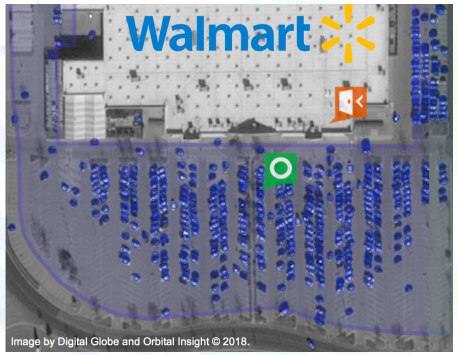
Source: Petcube



Source: cpb.gov

Source: Compology

Source: Ringdoorbell.eu



Source: Orbital Insight

Source: Identified Technologies

Source: Amazon

Source: Hortdaily.com

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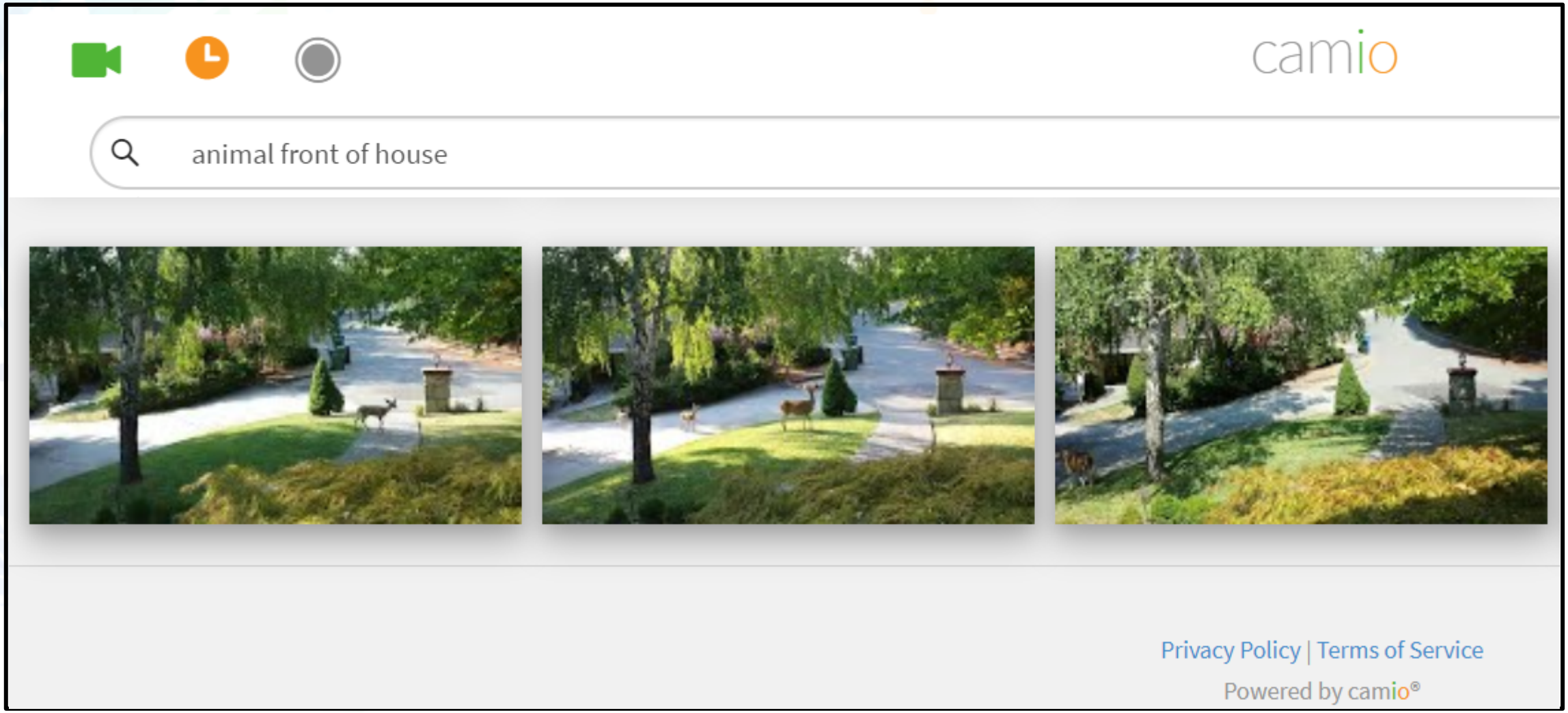
Smart Spaces: Camio



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Who's Eating My Roses?

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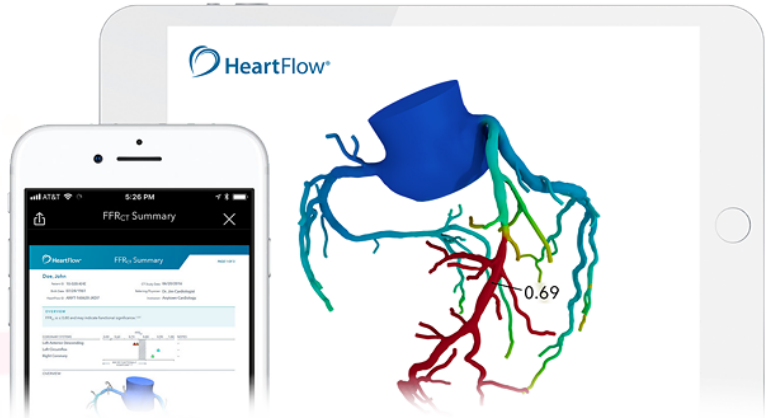
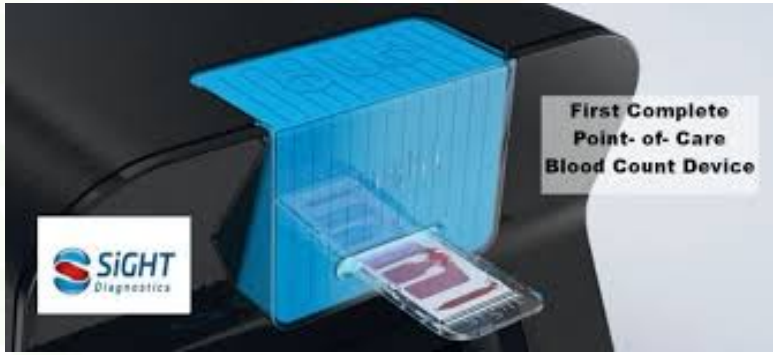
Applications: Health and Safety

Source: VirtuSense

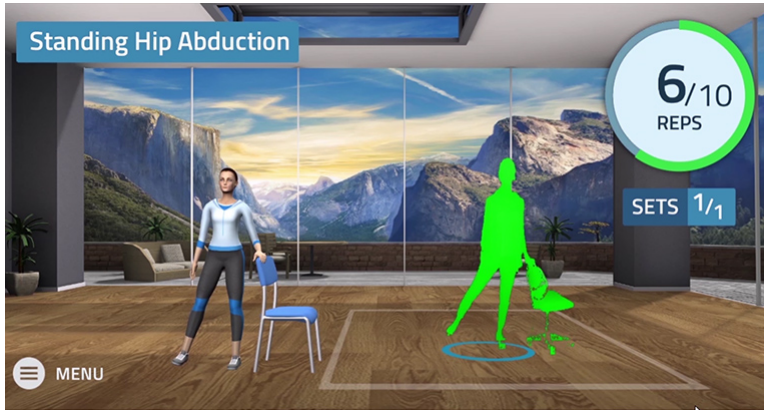
Source: Opternative



Source: HeartFlow



Source: Sight Diagnostics



Source: Reflexion Health

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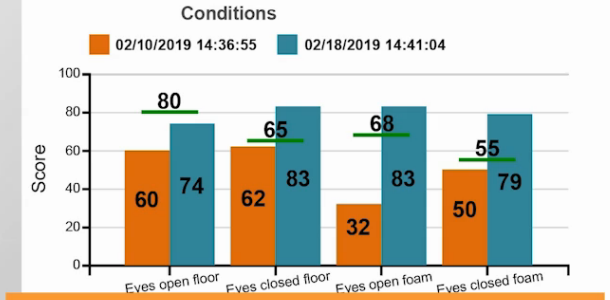
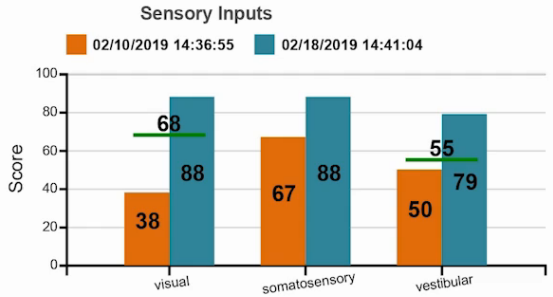
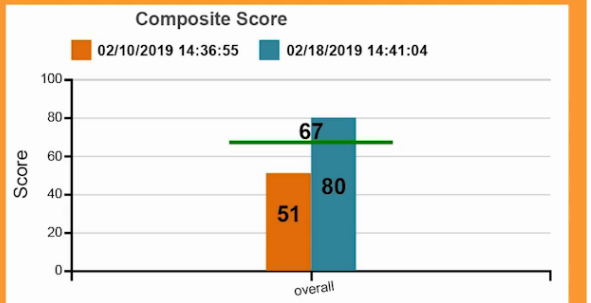
Preventing Injuries from Falls

Description: Balance is the result of visual system (eyes), vestibular system (ears) and proprioception (the body's sense of where it is in space) working together. mCTSIB is designed to assess how well an older adult is using sensory inputs when one or more sensory systems are compromised which can lead to balance deficits.[1]

Overall Result: Patient's Overall score has increased by 29 from 51 to 80. This change occurred from 02/10/2019 to 02/18/2019. This is a percentage increase in overall score is 56.86%.







References:

1. Sturnieks DL, St George R, Lord SR (2008). Balance disorders in the elderly. Clinical Neurophysiology. 38 (6): 467-478. doi:10.1016/j.neucli.2008.09.001. PMID

Source: VirtuSense

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The Embedded Vision Alliance

The **Embedded Vision Alliance** is a partnership of 90+ leading computer vision technology and systems companies

We inspire and empower product developers to create better products using computer vision and visual AI

For free educational resources, visit www.embedded-vision.com and sign up for our newsletter

We help companies find their best opportunities in this burgeoning industry

For membership info, contact us: info@embedded-vision.com

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Live Training: Deep Learning for Computer Vision with TensorFlow 2.0 and Keras

An Embedded Vision Alliance training class

- Friday, **November 1**, 2019, 9:00 am – 5:00 pm
- Mentor - Fremont, California

TensorFlow 2.0

Instructor: Doug Perry, a Google Developer Expert in TensorFlow

- ✓ Combination of lecture and lab exercises using Jupyter Notebooks
- ✓ Includes lunch and breaks
- ✓ You will learn:
  - ✓ Neural networks in TensorFlow
  - ✓ Linear regression
  - ✓ Shallow image recognition
  - ✓ Deep image recognition
  - ✓ Convolutional neural networks
  - ✓ Data set creation and augmentation
  - ✓ Off-the-shelf network architectures; transfer learning
  - ✓ Object detection
  - ✓ TensorFlow Lite

https://tensorflow.embedded-vision.com

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The only industry event focused on practical computer vision and visual AI

- *95% of attendees would recommend the Summit to their colleagues building vision products*
  - *"Fantastic. Learned a lot and met great people."*
  - *"Wonderful speakers and informative exhibits!"*

Embedded Vision Summit 2020 will include:

- **100 expert technical, business and product talks**
- **Hands-on** full day technical trainings
- **100+ demos** by more than 60 exhibitors
- Visit www.embedded-vision.com/summit for details!

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What Does It All Mean?

- Computer vision/visual AI deployment is accelerating rapidly
  - Fueled by:
    - Deep learning – “dominant design”
    - Rapid improvements in processors
    - Better tools, libraries, platforms
    - 3D sensors
- There are numerous huge opportunities
  - At the solutions level – thousands of applications
  - At the software level – especially tools-as-a-service
  - At the module level
- We are entering a golden era of commercial computer vision
  - Take advantage of it! Go out and make something!

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Embedded Vision Alliance Member Companies

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Questions?

We'll email you a link to these slides, and to a recording of the webinar.

Email me for:

- Questions
- Information about the Embedded Vision Summit (May 18-21, 2020)
- Information about how your company can become a Member of the Embedded Vision Alliance

Jeff Bier
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Chairman, Embedded Vision Summit
President, BDTI

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