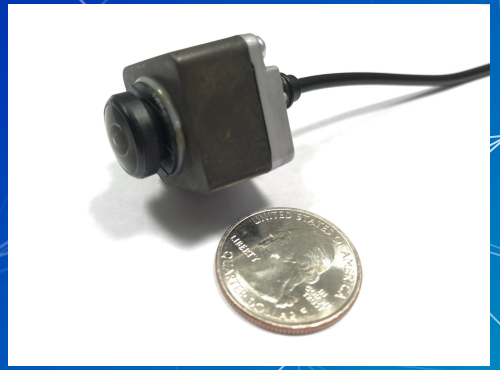
In-Camera CV for NCAP Pedestrian Rear AEB



Bjorn Grubelich, Product Manager

GEO Semiconductor

AutoSens

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About GEO

Camera Video Processors

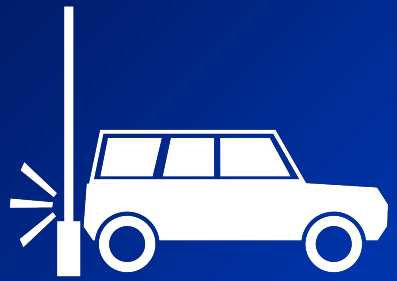
For Viewing and Machine Vision

170+ OEM Models

Design Wins since 2015

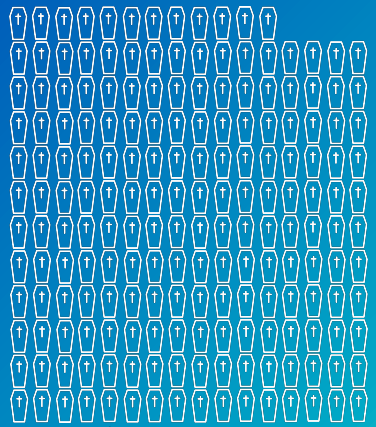
Every year in the US

188,000
reversing accidents



12,000
pedestrian injuries

284
deaths*



*NHTSA 2015 stats

GEO Semiconductor

Cameron Gulbransen KT Safety Act 2007

CAR AND DRIVER REVIEWS NEWS 2020 CHEVY CORVETTE FEATURES BUYER'S GUIDE SUBSCRIBE NEWSLETTER

Backup Cameras Are Now on All New U.S.-Spec Vehicles

As of May 1, it's a legal requirement.

By DAVID MULLER MAY 2, 2018

Backup camera efficacy*

42%
reduction for passive

78%
reduction for active

*Cicchino, IIHS 2018

Euro NCAP Rear AEB

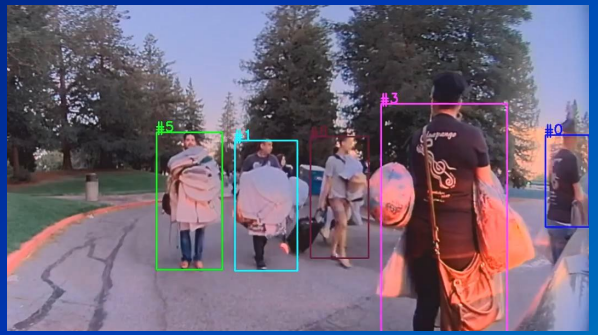
Rear AEB Test

- Stationary Pedestrian
- Moving Pedestrian
- Adult Mannequin
- Daytime

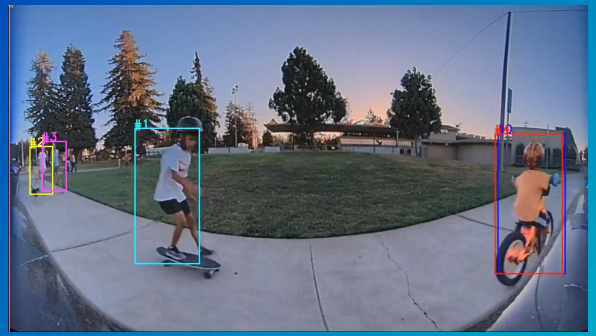
The real world…

180° Wide FOV

Occlusion



Children



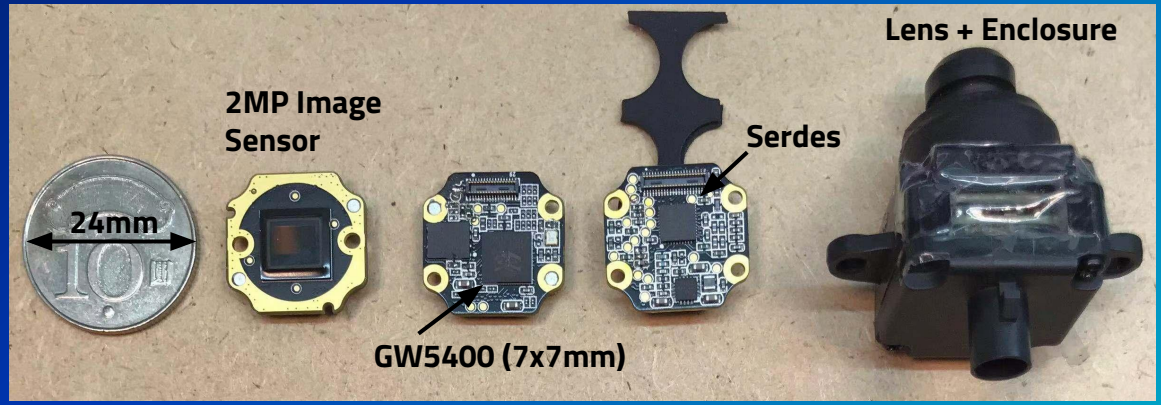
In-Camera Processing

1.5W

Worst for Camera

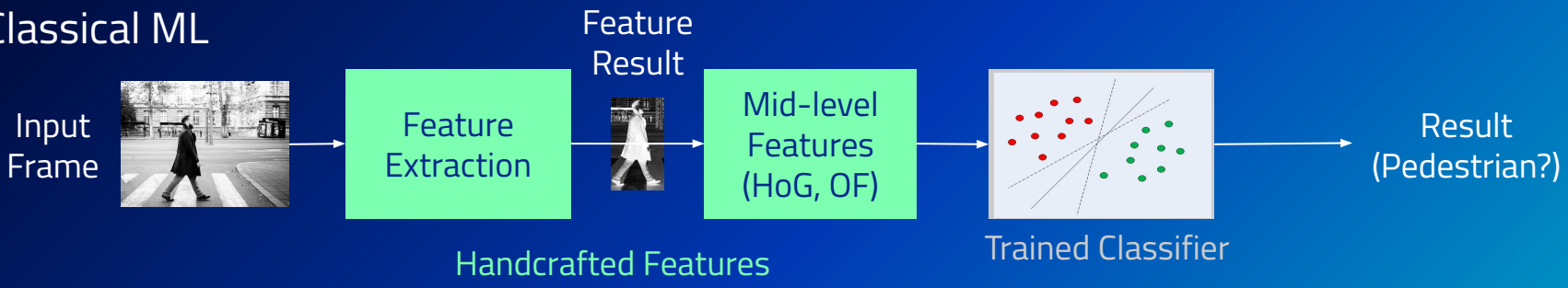
0.7W

Worst for Processor + Memory

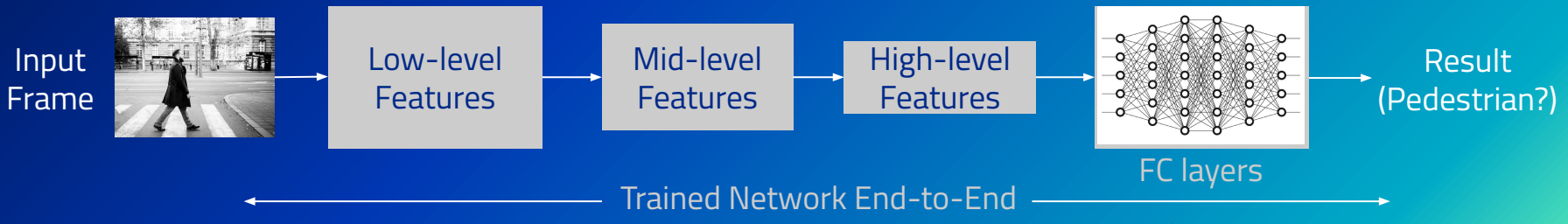


Classical CV vs. Deep Learning

Classical ML



Deep Learning



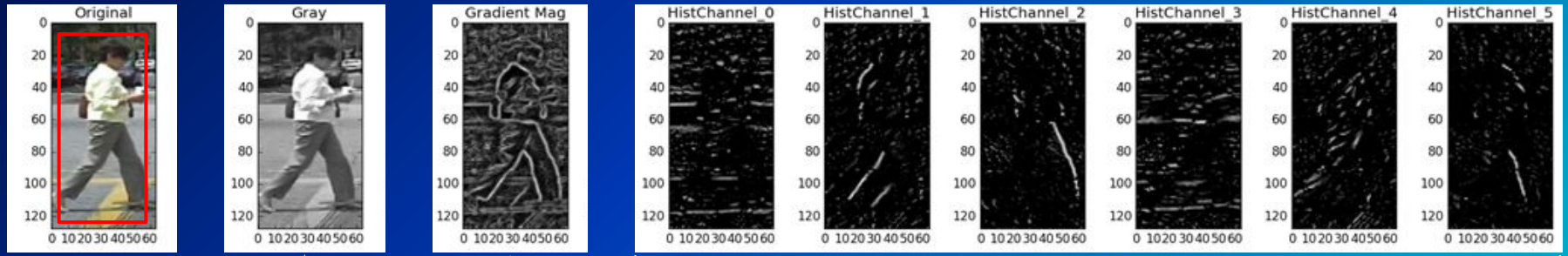
Cost of going Deep

	Classical	Deep Learning
Recall	~90%	>95%
Memory	<5MB	>10MB
Power*	<0.5W	>1W

*Includes memory

How do we describe pedestrians?

Feature Extraction



64 x 128

Luma

| Gradient |
$=\sqrt{(\partial x^2 + \partial y^2)}$

Histogram of Weighted Gradients $=\arctan(\partial y/\partial x)$

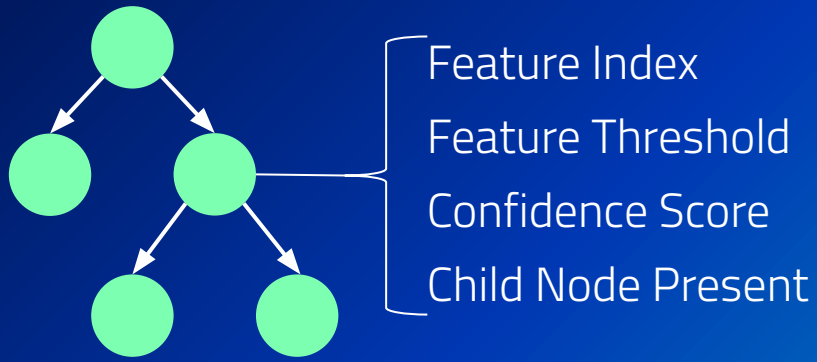
How do we deal with scale?

Downscaling -
Image Pyramids

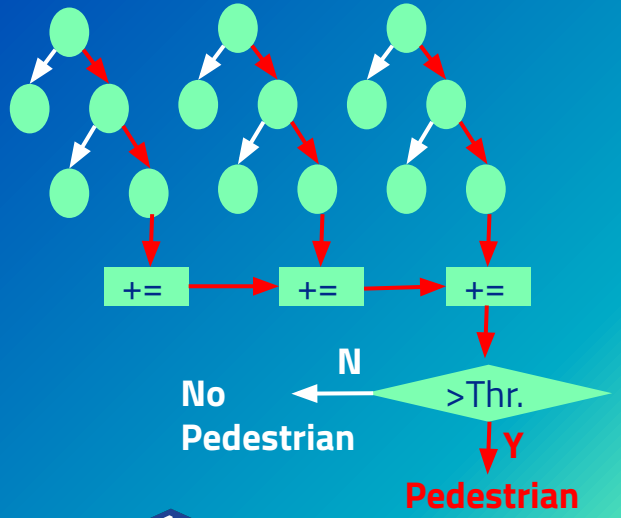
Upscaling -
eWarp ROI

How do we classify pedestrians?

Decision Tree Classifier

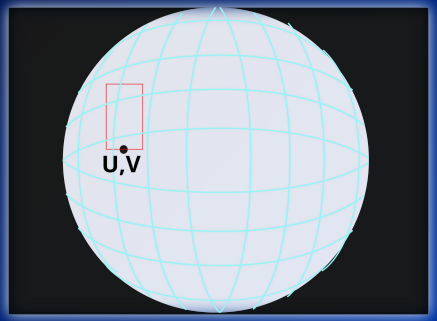


Cascaded Decision Trees

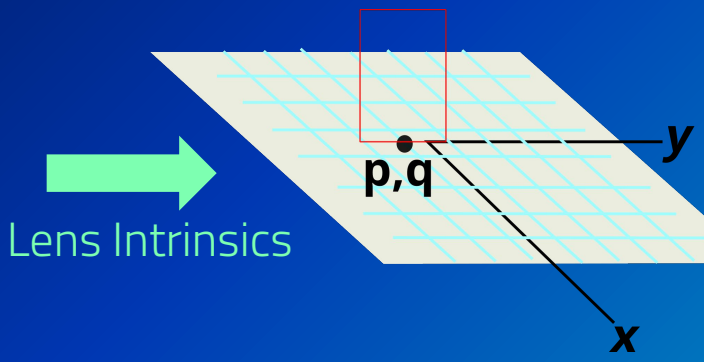


How do we estimate distance?

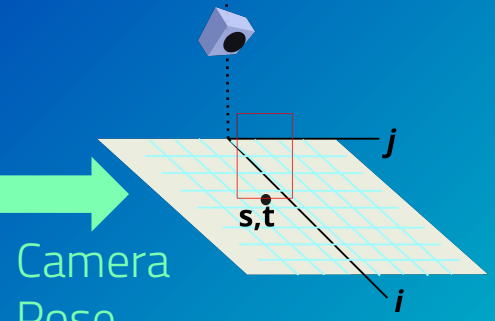
2D image



Virtual plane in 3D

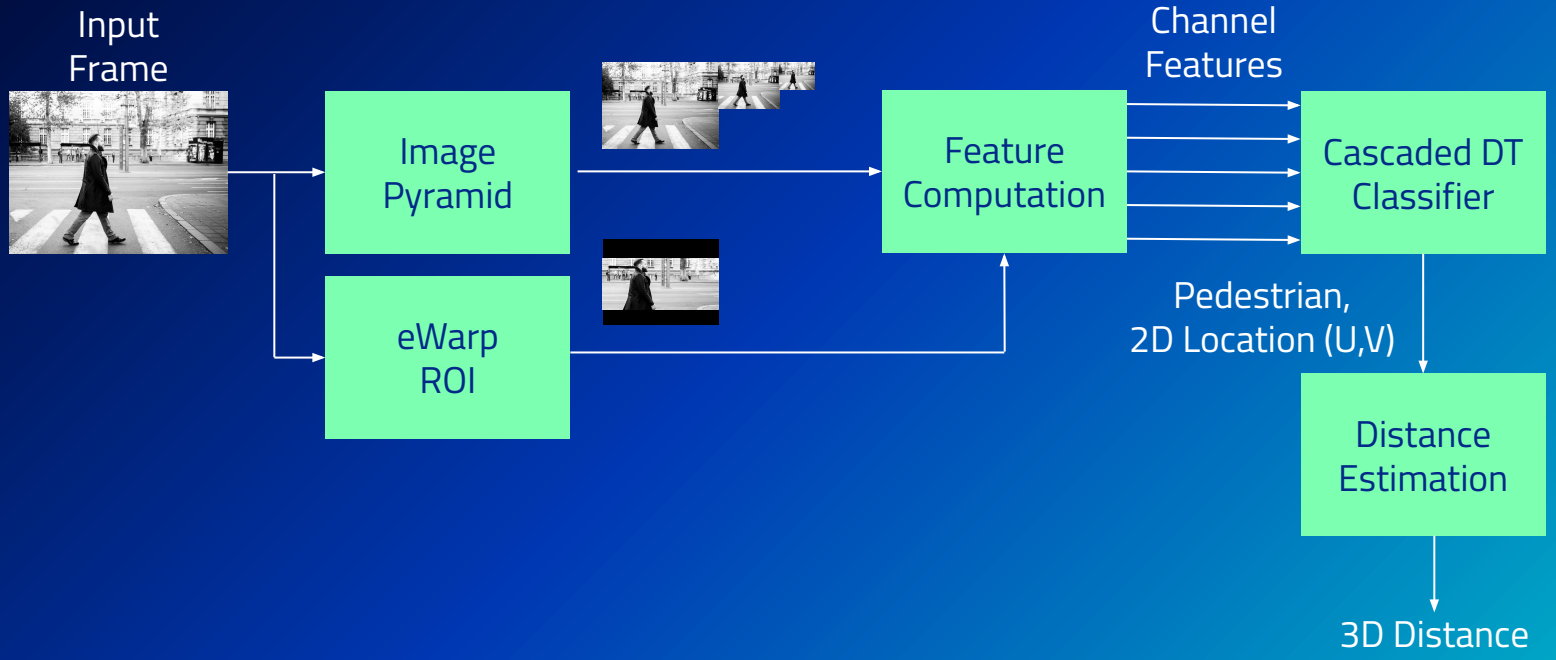


Road Homography



Radial Distance = sqrt (s^2 + t^2)

Putting it all together



Video

Summary

- NCAP Rear AEB rating starting next year
- In-camera CV requires efficient HW and SW
- In-camera Deep Learning is current challenge

THANKS!

Any questions?

You can find me at

- bgrubelich@geosemi.com

CREDITS

Special thanks to all the people who made and released these awesome resources for free:

- Presentation template by SlidesCarnival
- Photographs by Unsplash