WE WILL BEGIN AT 11:00 AM EST

Welcome to Technology Takes the Wheel®

2021 SEMINARS ON AUTONOMOUS VEHICLES

Welcome to today's event

Dean Mike Toole

College of Engineering

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Welcome to our Emcee

Ms. Lissa Guyton

13 abc News

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Dr. James Jenness

Associate Director
Center for Transportation, Technology, and Safety Research
Westat

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Improving Lives Through Research®

External Human Machine Interfaces for Autonomous Vehicles: Design Challenges

James Jenness

Technology Takes the Wheel Seminar Series
Keeping Pedestrians Safe in the AV World

February 26, 2021

A few working definitions

- ~~**"Autonomous vehicle?"**~~
- **Automated Driving Systems (ADS)** - SAE Levels 3, 4, 5. Automation system primarily controls vehicle within its operational design domain
- **External Human Machine Interface (eHMI)** - broadly considered, all aspects of the vehicle's appearance and behavior that can be used outside the vehicle to predict its actions and safely interact with it
- **Users** - broadly considered, people who interact with the ADS vehicle inside and outside, including shared road users who encounter it (including pedestrians!)

Design of eHMI for ADS vehicles

- What, if anything really needs to be designed?

User needs for eHMI

User needs – What should eHMI communicate?

› Possible needs – replacing what an engaged driver would do

User needs – What should eHMI communicate?

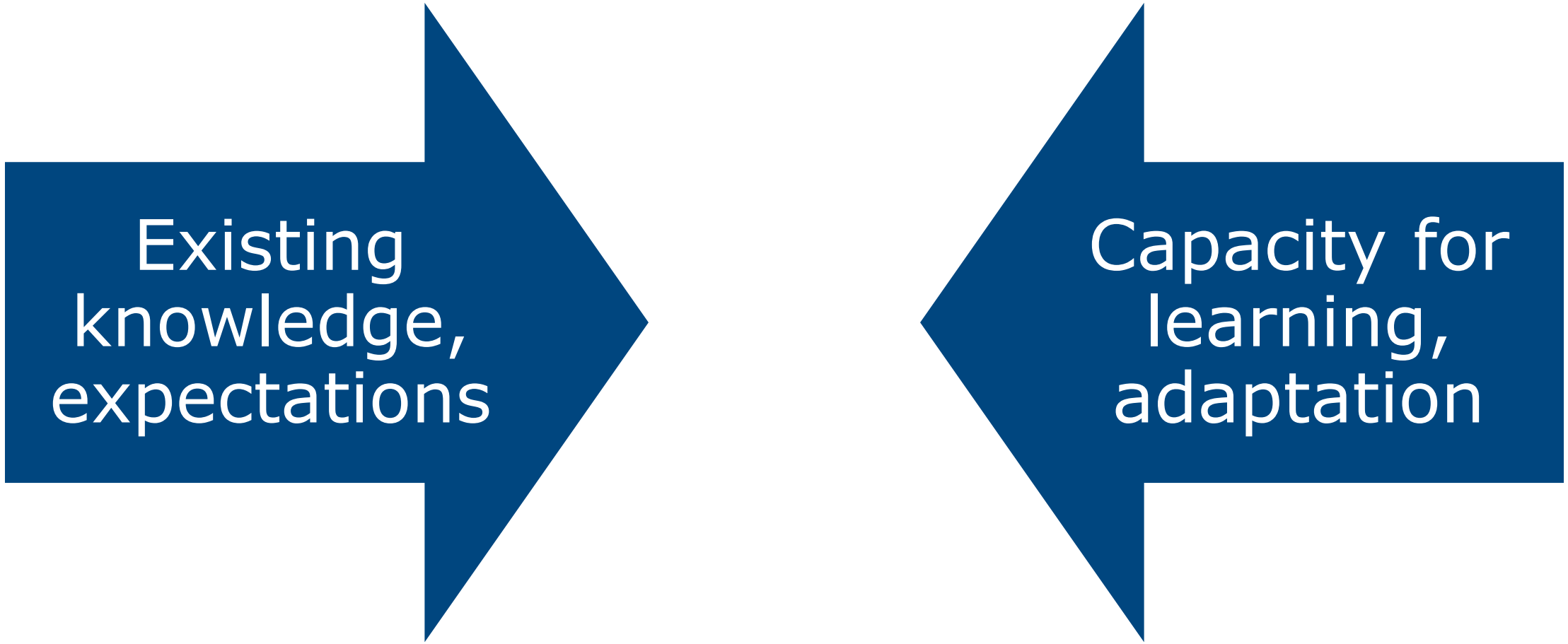
› Possible new needs for ADS vehicles

Design guidance for eHMI?

- No need to reinvent the wheel!
- Consider how existing design guidance and principles for HMI can be applied to eHMI

Some eHMI Design Challenges

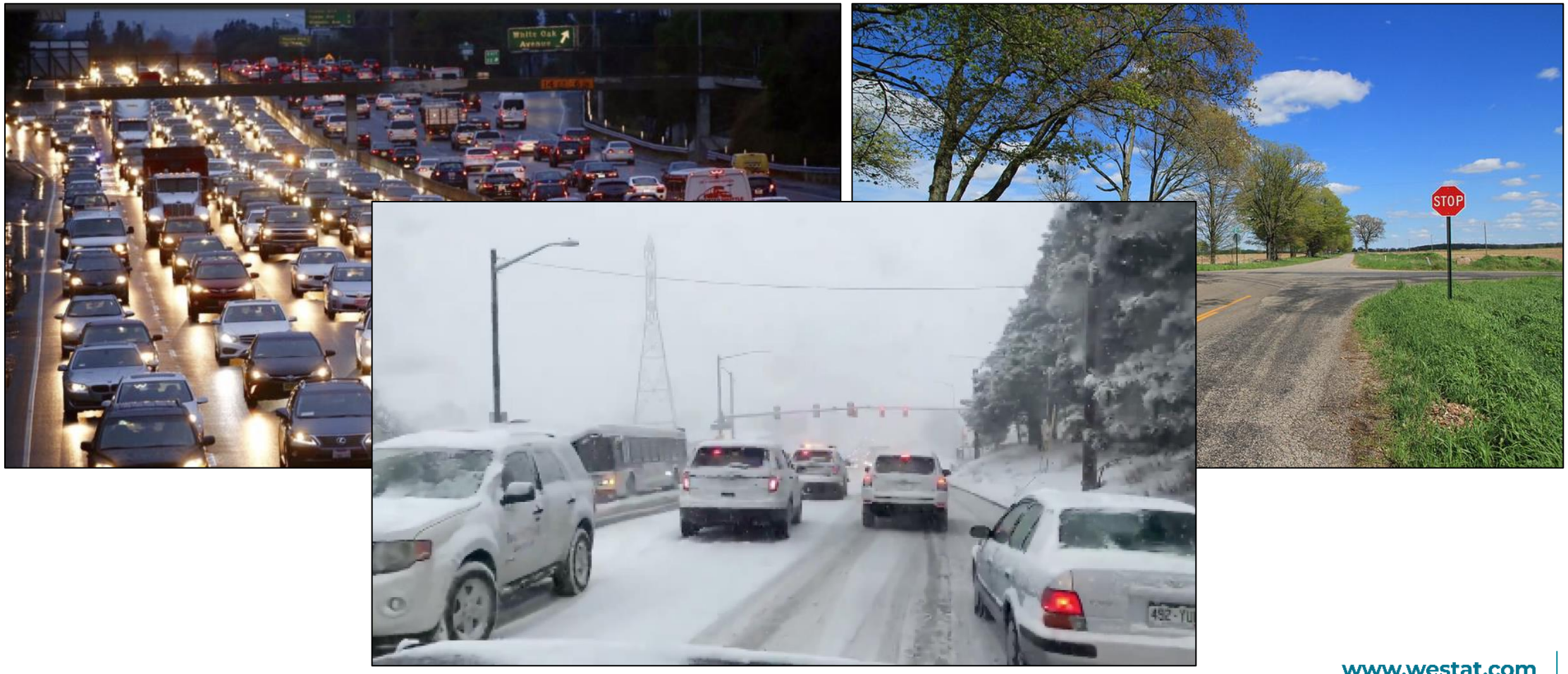
Challenges: Achieving usability and acceptance



Design Challenge: Communicate to the appropriate users

Design Challenge: Communicate with appropriate timing

Design Challenge: Consider the entire traffic context



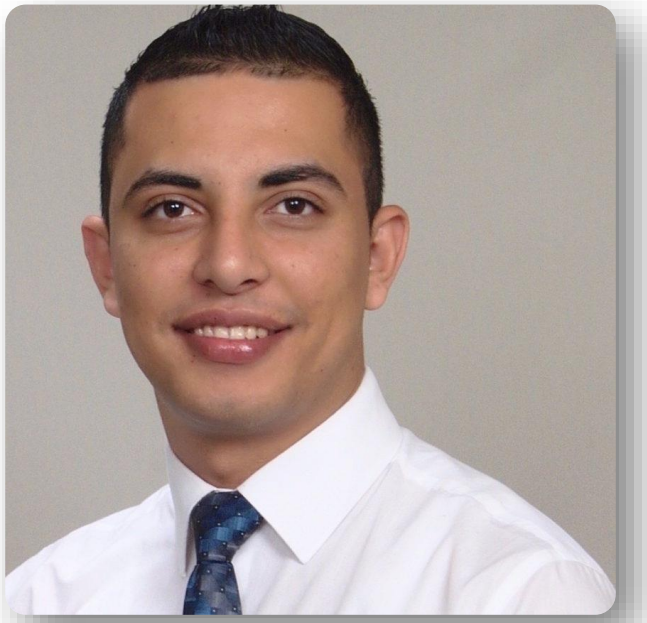
Design Challenge: How much is too much?

- Should we keep adding eHMI elements to vehicles?
- Design opportunity to use dynamic vehicle cues (gestures)

Thank You

JamesJenness@Westat.com

All images used in this presentation are for educational purposes only. These are NOT recommendations for eHMI design!



Assam Alzookery

Founder and CEO

Intvo

INTVO

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Technology
Takes the Wheel®

INTVO

ENHANCING PEDESTRIAN SAFETY IN URBAN ENVIRONMENTS

Office in

Ann Arbor and Detroit

Working with

Tier 1s and autonomous mobility companies

Launched two pilots with

TARTA and UMTRI

Founded 2018 with focus on **understanding and predicting pedestrian behavior** in the context of **autonomous cars**

Partner with AEye and AVL

on display for CES 2020

WHAT WE'LL COVER

- Why is pedestrian safety important?
- How Driverless Cars See the World Around Them Today
- Scooters using "A/V" type technology to enhance safety
- Why human behavior prediction is important
- Intvo approach to understand human behavior
- System in action

A pedestrian is killed every 1.5 hours in traffic crashes

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AAA Warns Pedestrian Detection Systems Don’t Work When Needed Most

U.S. PEDESTRIAN DEATHS TOTALED NEARLY 6,590 IN 2019

ADAS Lack Of Communication

Today vehicles must have the ability to communicate with pedestrians to increase safety

Distracted Pedestrians and Drivers

Distracted walking and driving incidents are on the rise, and everyone with a cell phone is at risk.

No Solutions Available

Today pedestrian detection system doesn’t work when needed the most in all the time in all scenarios.

From 2008-2017, pedestrian fatalities increased by 35%

35%

In 2018, 76 percent pedestrians killed after dark.

76%

E-scooters embrace AI to cut down on pedestrian collisions

Nearly 3 in 5 scooters were injured while riding on a sidewalk

Footage from a camera on a Voi e-scooter.

INTVO

What is the most important safety tip to avoid pedestrian injuries?

- Follow the rules of the road and obey signs and signals
- Walk on sidewalks whenever they are available
- If there is no sidewalk, walk facing traffic and as far from traffic as possible
- Always keep alert; don't be distracted by electronic devices that take your eyes (and ears) off the road.

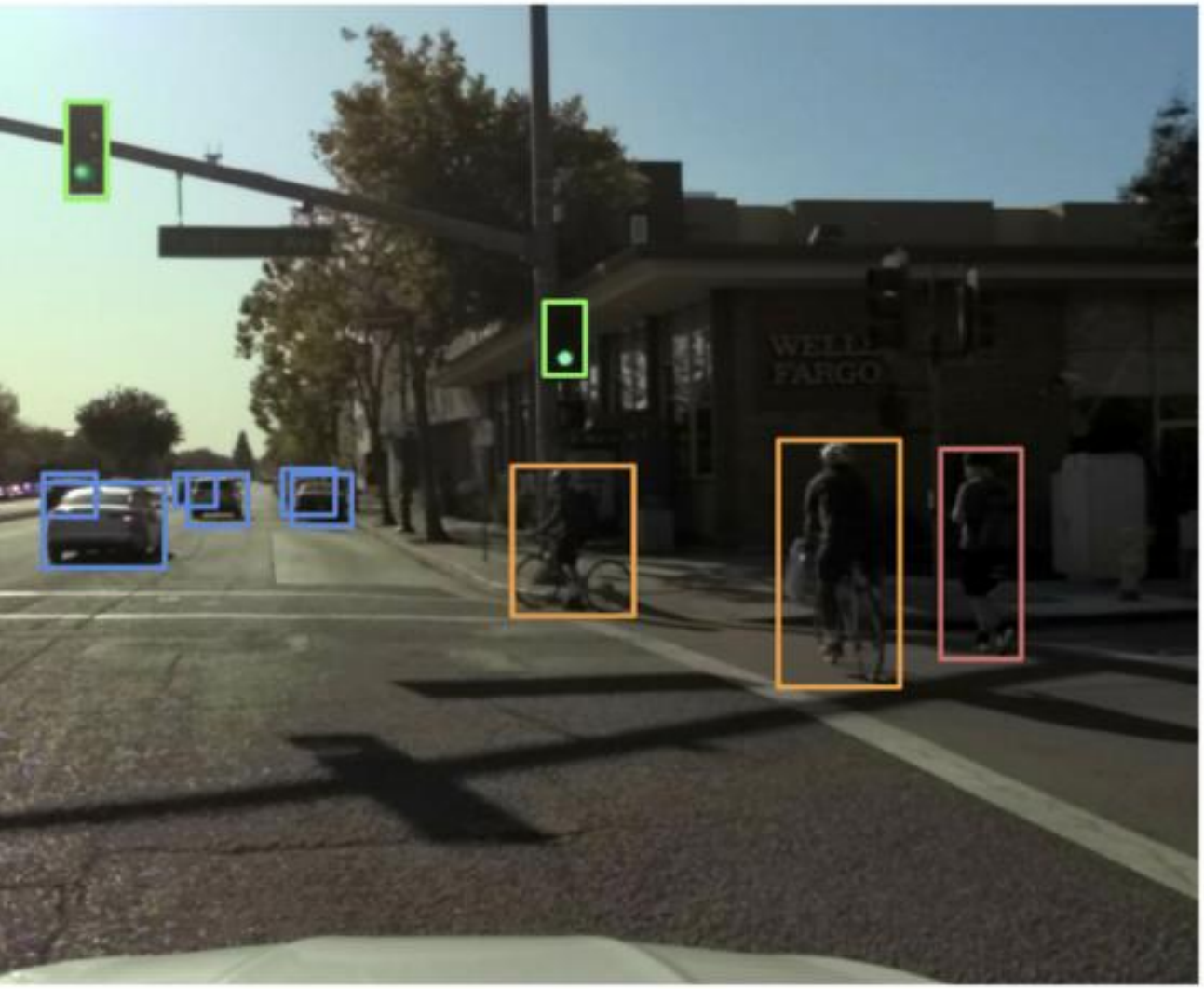
Human Driver Perception

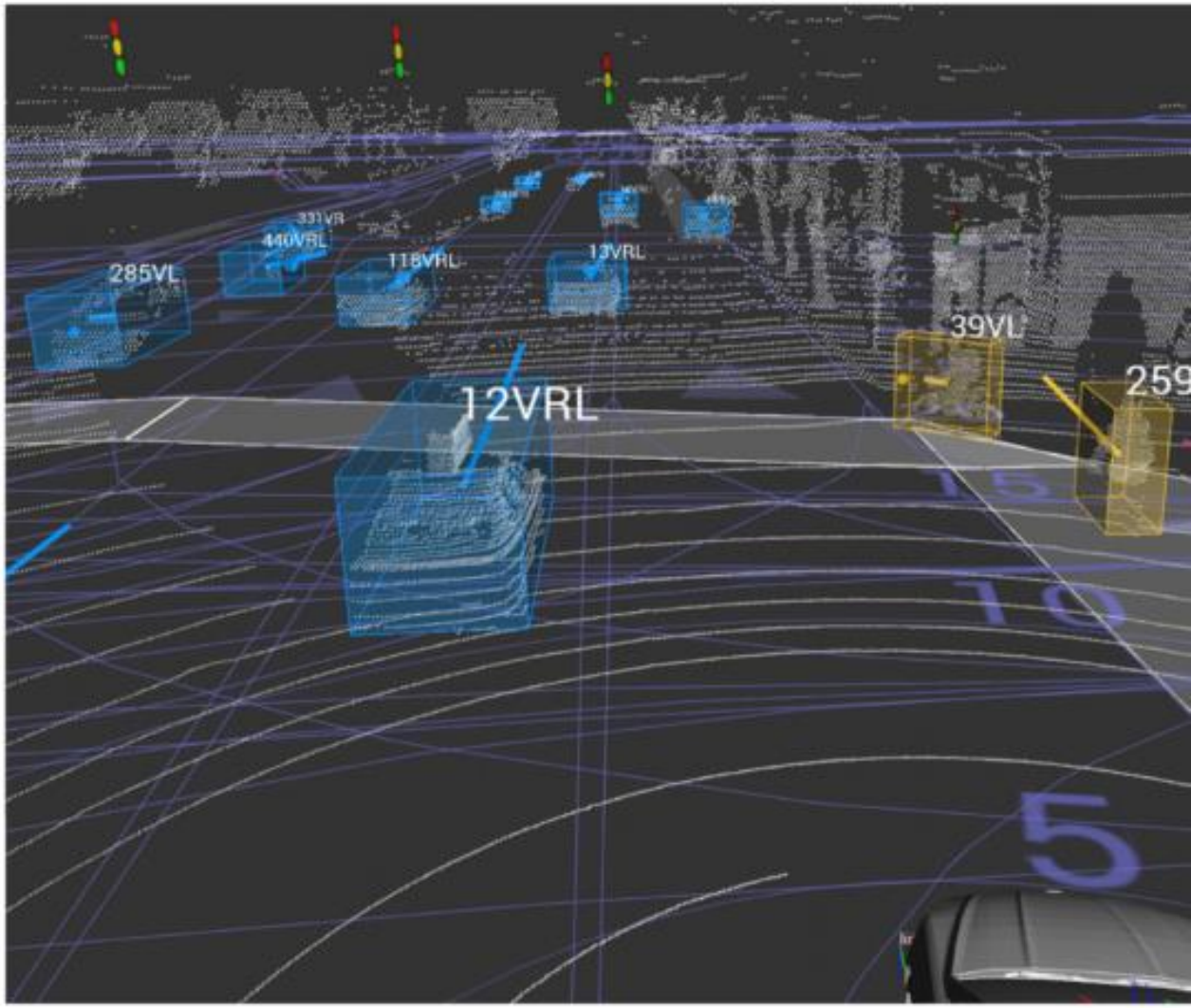
INTVO

Human Driver Perception

INTVO

How Driverless Cars See the World Around Them Today





SquadNest

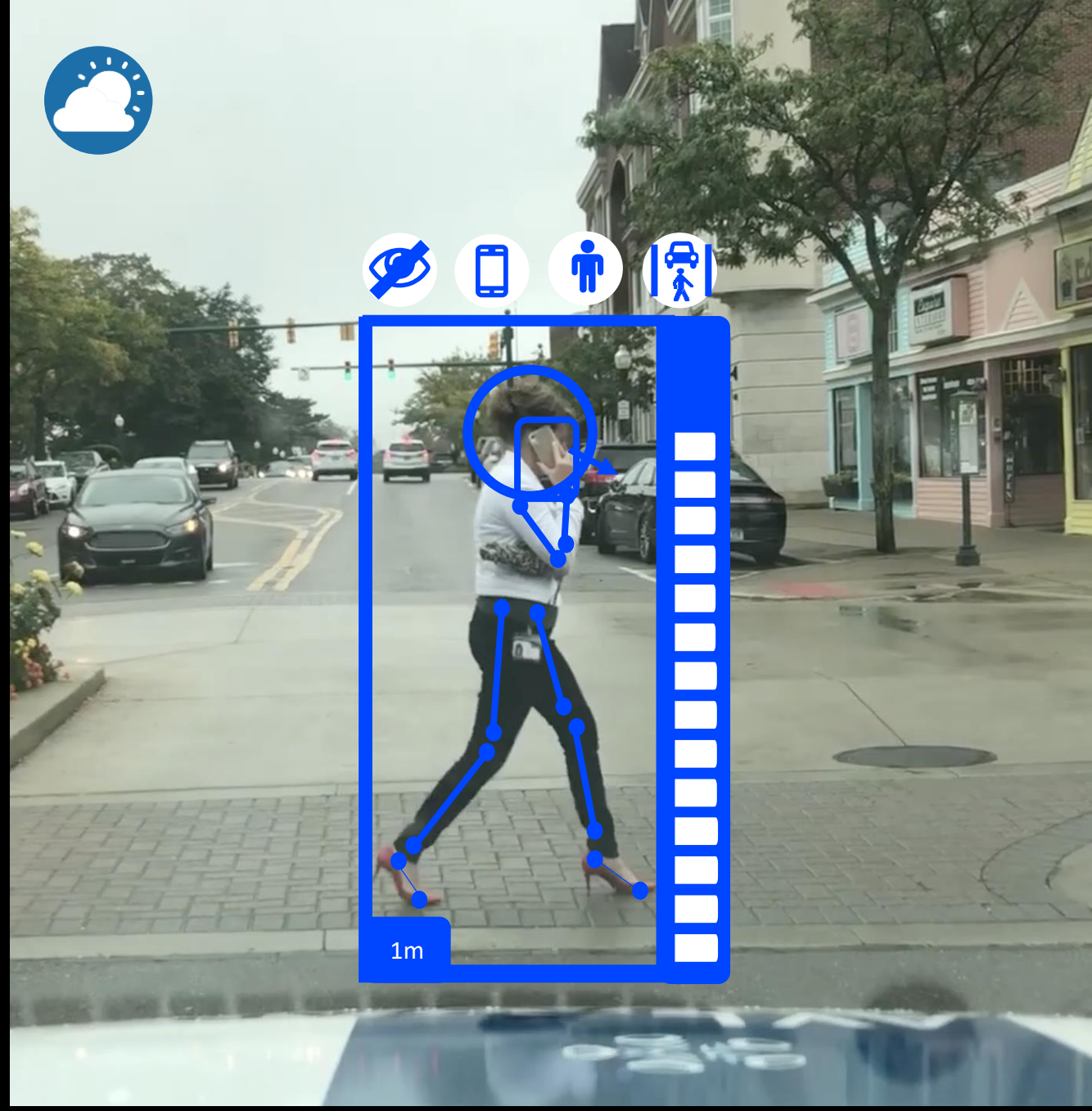
Are They Going to Cross?

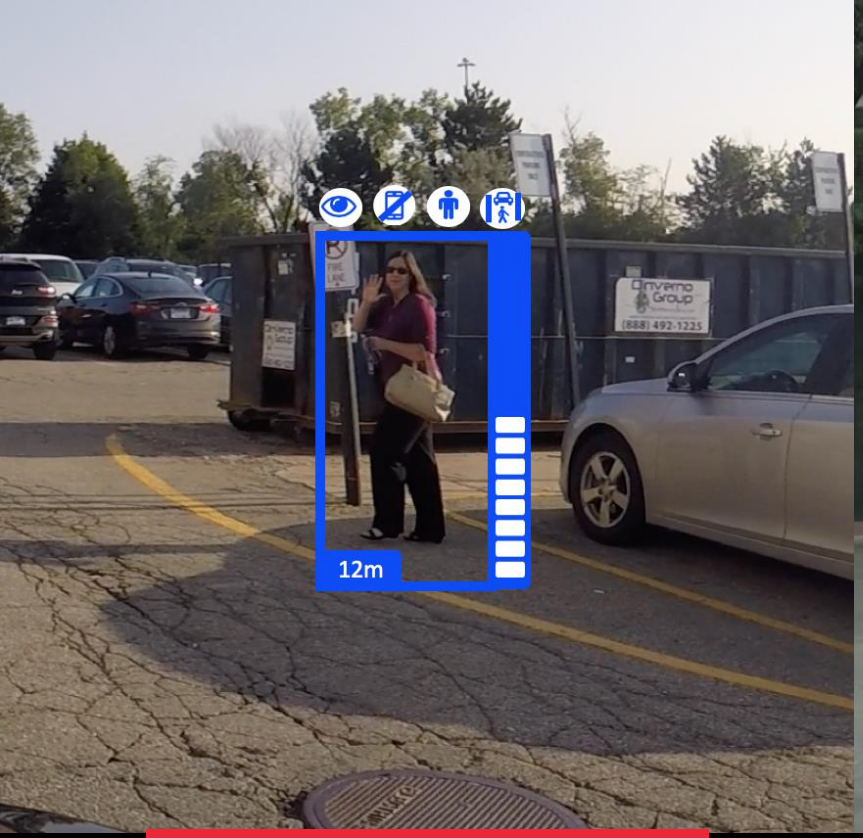
Context: Aware, standing, green light, Body movement, zebra crossing
Prediction: Crossing

INTVO

What Intvo Sees

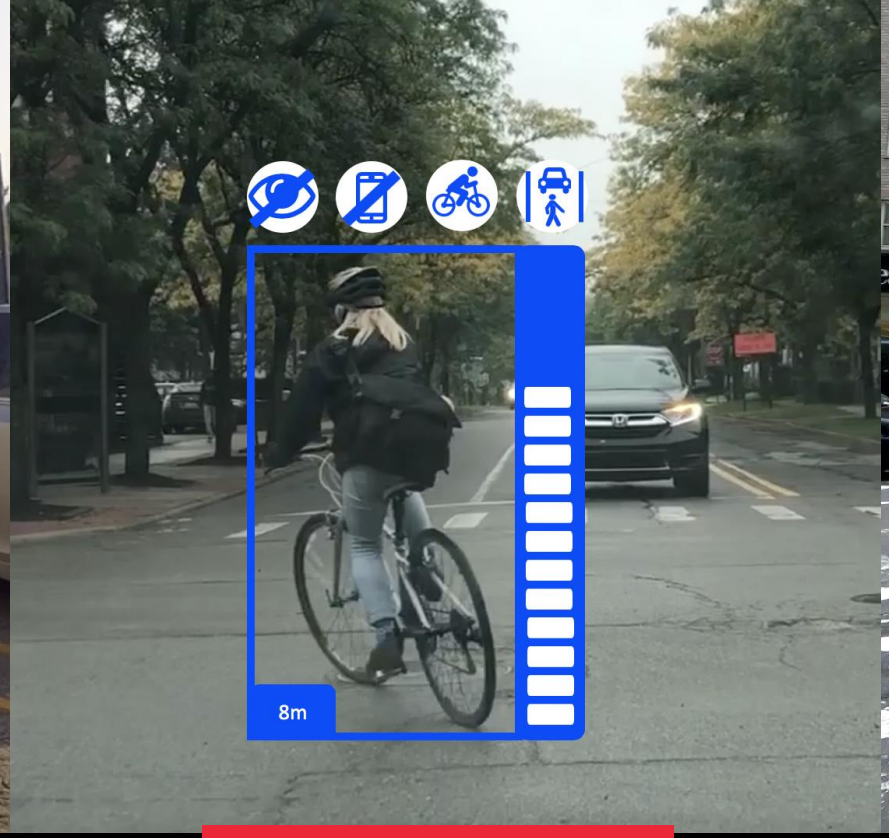
- Type Of person
- Head Position
- Eye Contacts
- Holding Object
- Feet Position
- Leg Movements
- Arm Movements
- Weather Condition
- Risk Level
- Area Of Interest
- ...





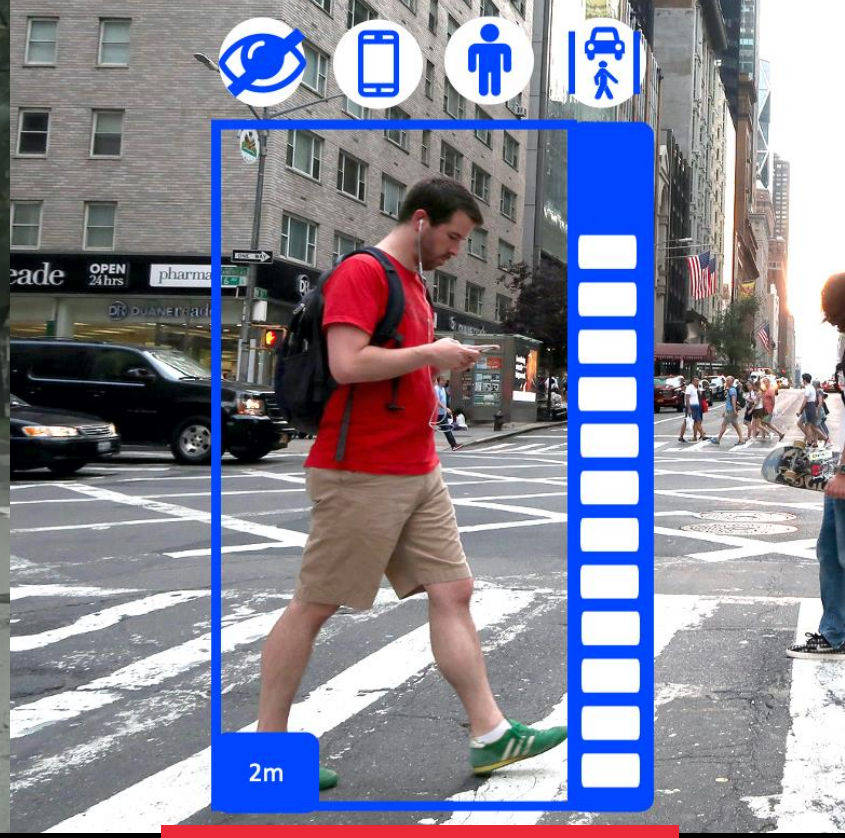
INTERACTION

Low Risk



AWARENESS

Medium Risk



DISTRACTION

High Risk

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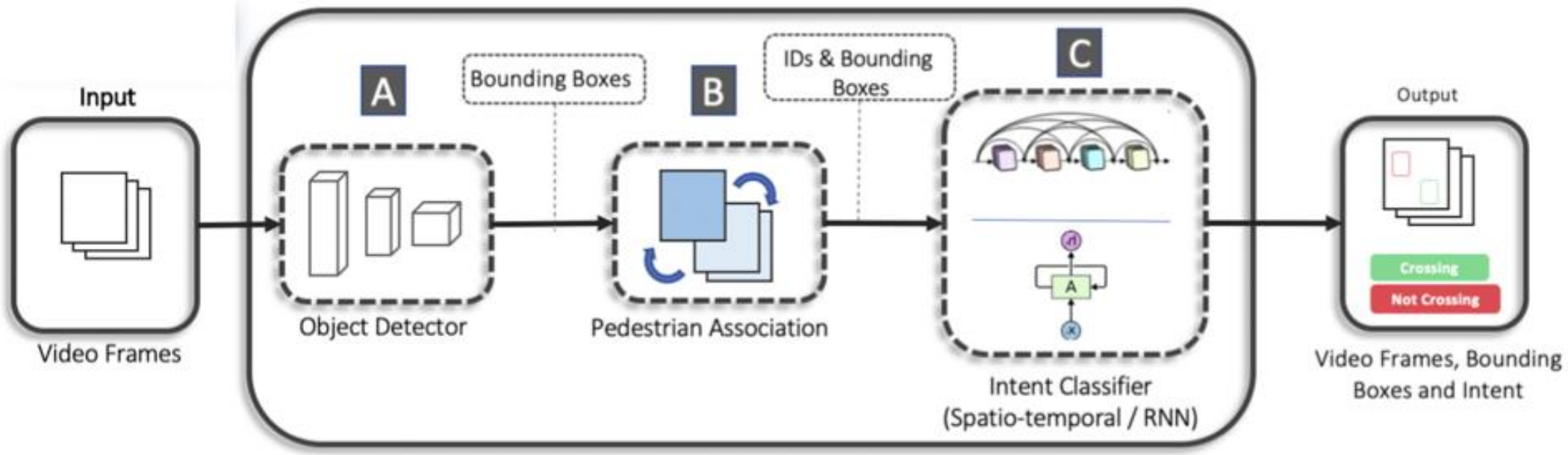
Warnings

Current State of the Art: Serial Processing

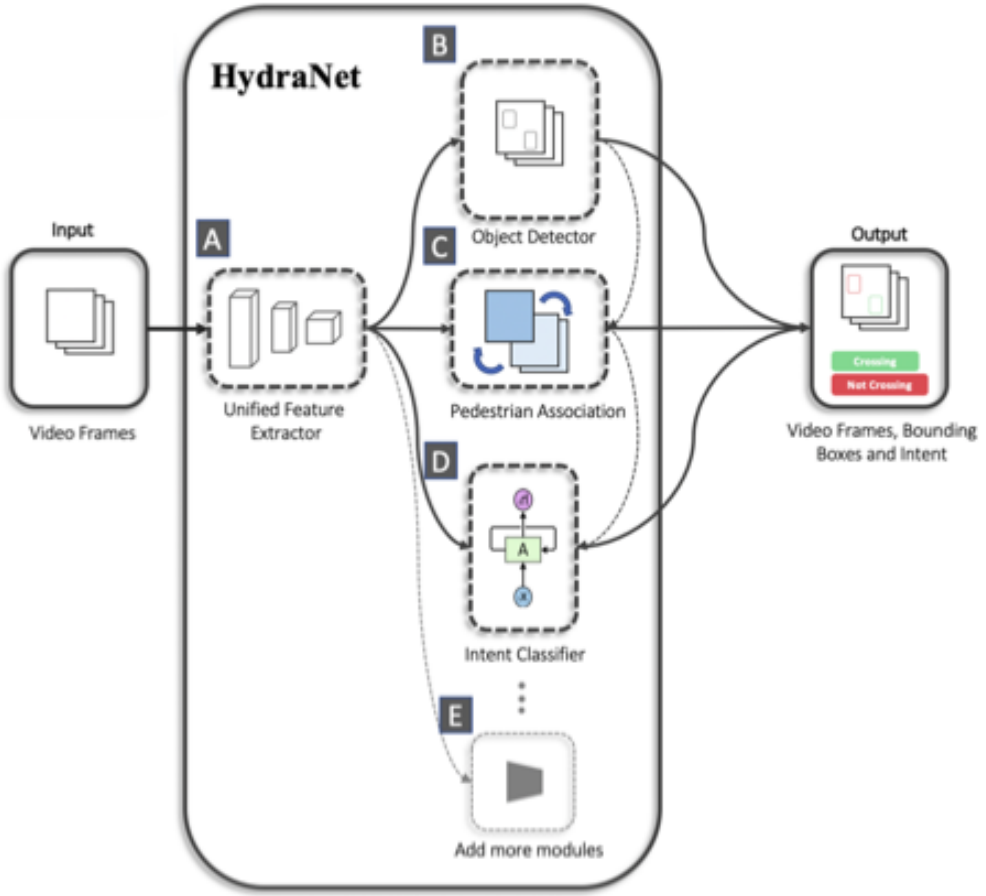
ONE thing at a time.



INTVO

Warnings

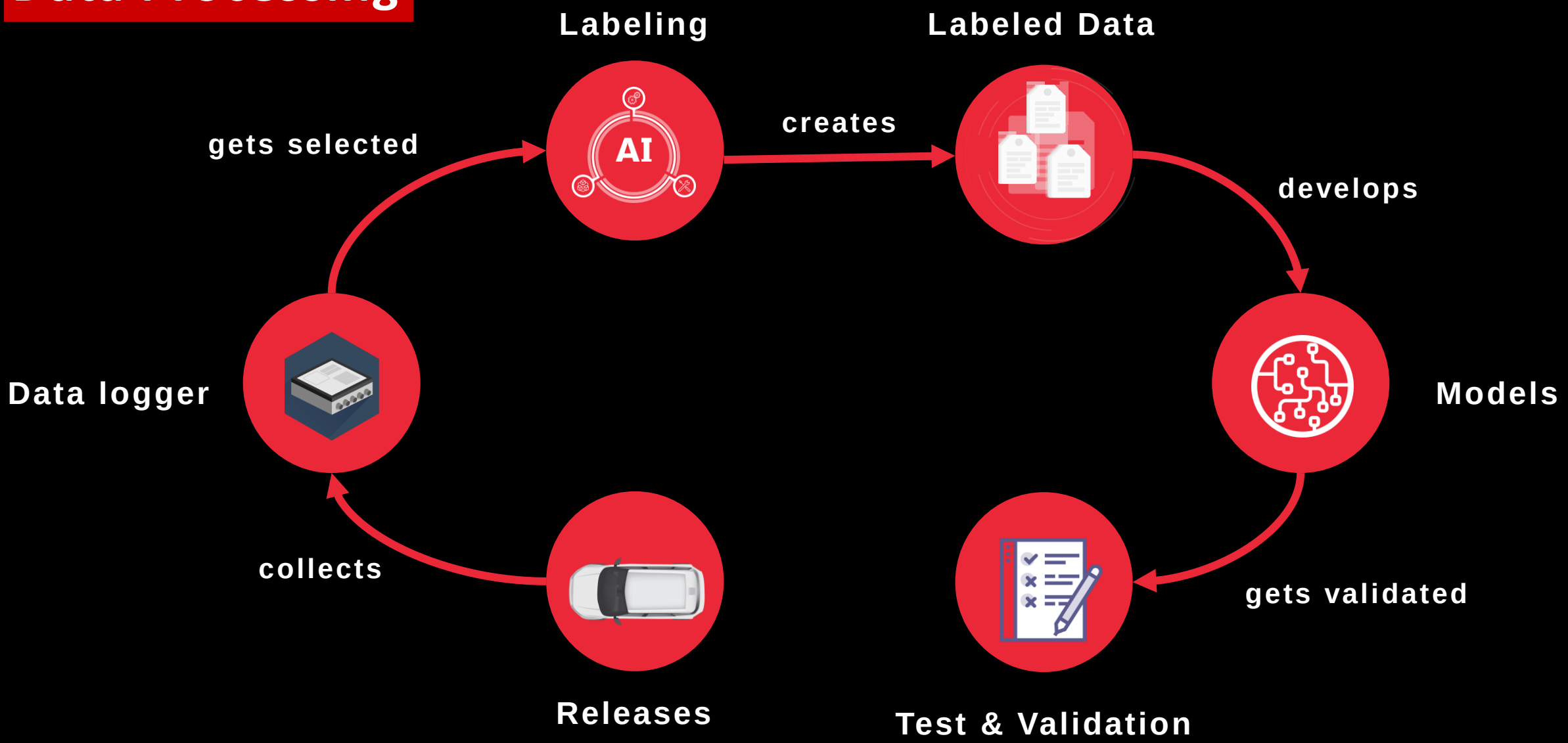
Intvo's Approach: HydraLoop with parallelizations, faster speed can reduce accidents



Repeat for continuous learning

INTVO

Data Processing



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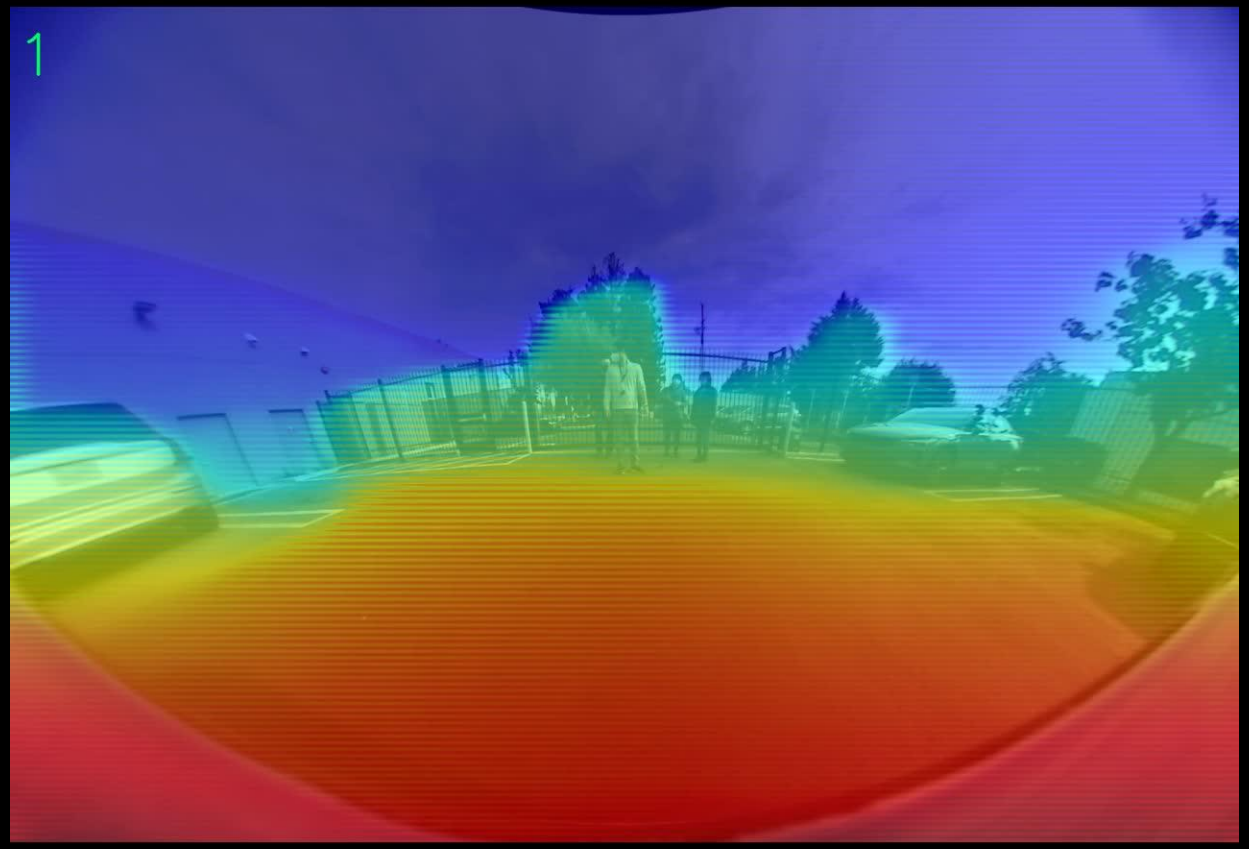
DEMO



Depth Estimation

Intent Estimation

INTVO

Assam Alzookery

Founder & CEO

Sharena Rice

Co-Founder & CSO

Alain Charlois

VP Strategic Partnerships

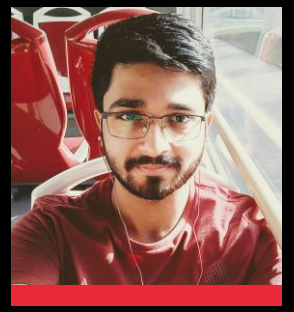
Tony Bozzini

VP Sales and

Marketing

Francis Glorie

Business Advisor



Danish Syed

Computer Vision Engineer

Janpreet Singh

Machine learning Engineer

Stuart Castle

Software Engineer

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INTVO
PEDESTRIAN
SAFETY
IS EVERYONE'S RESPONSIBILITY

Bastien Beauchamp

CEO

!important

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Problem
Road deaths are
Top 3 fatality cause
of 1-35 y.o. in the US
Pedestrian fatalities
increased by 51%
over the last decade in the US
Every decade,
a country disappears
from the world map
TEMPE
DEADLY CRASH WITH SELF-DRIVING UBER
abc 15
ARIZONA
11:01
64°

Solution

Smartphone detection and AI prediction protecting pedestrians from vehicles

Connected vehicles can receive alerts, slow down and brake automatically.

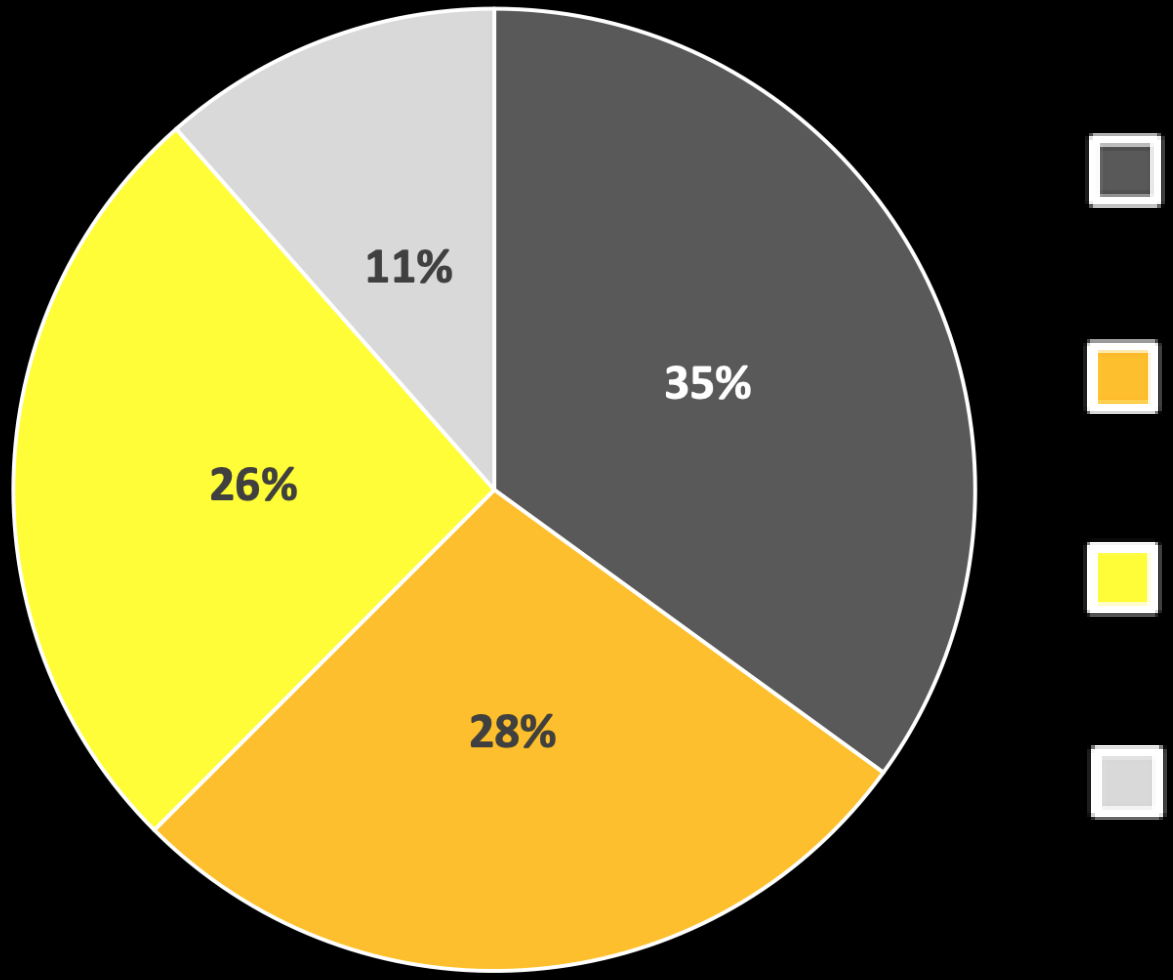
Safety App Pro

New: Fleet Product

Why?

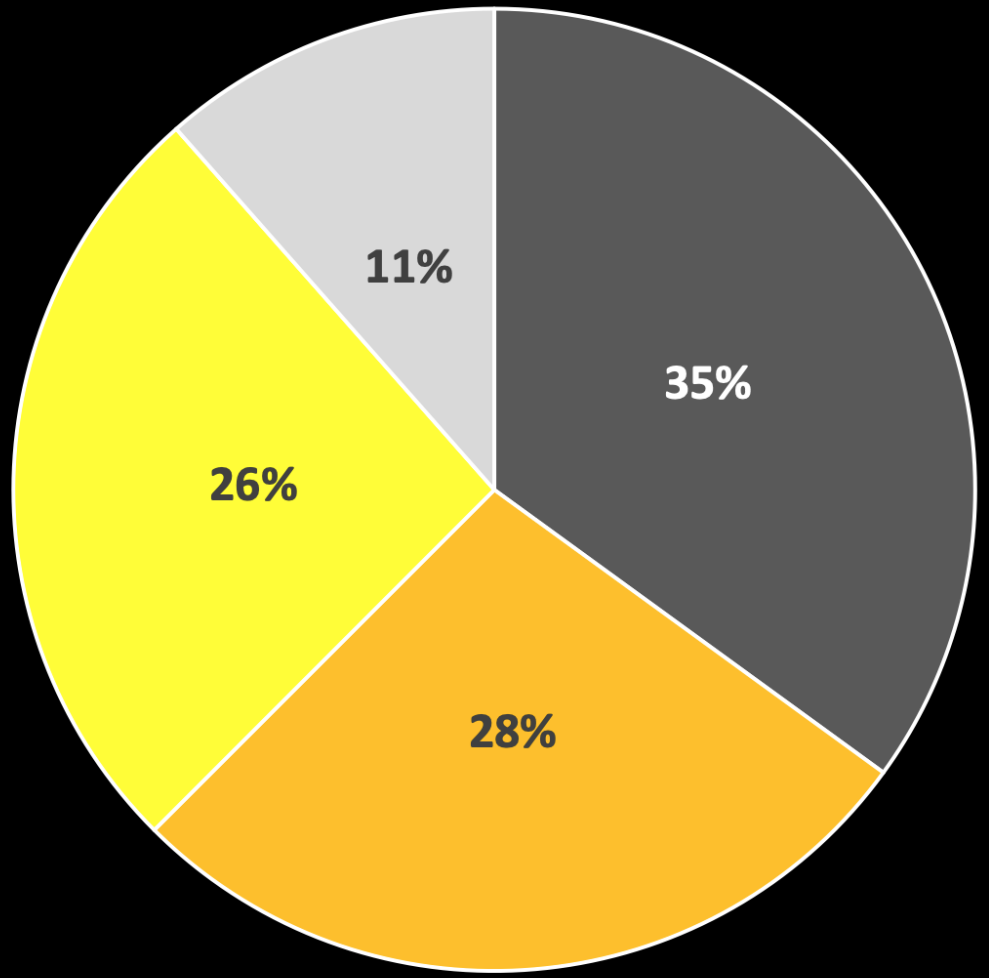
Pedestrian Fatality Causes

© !important, 2020 from INRETS Report No. 256 (France, 2003)



Why?

Pedestrian Fatality Causes



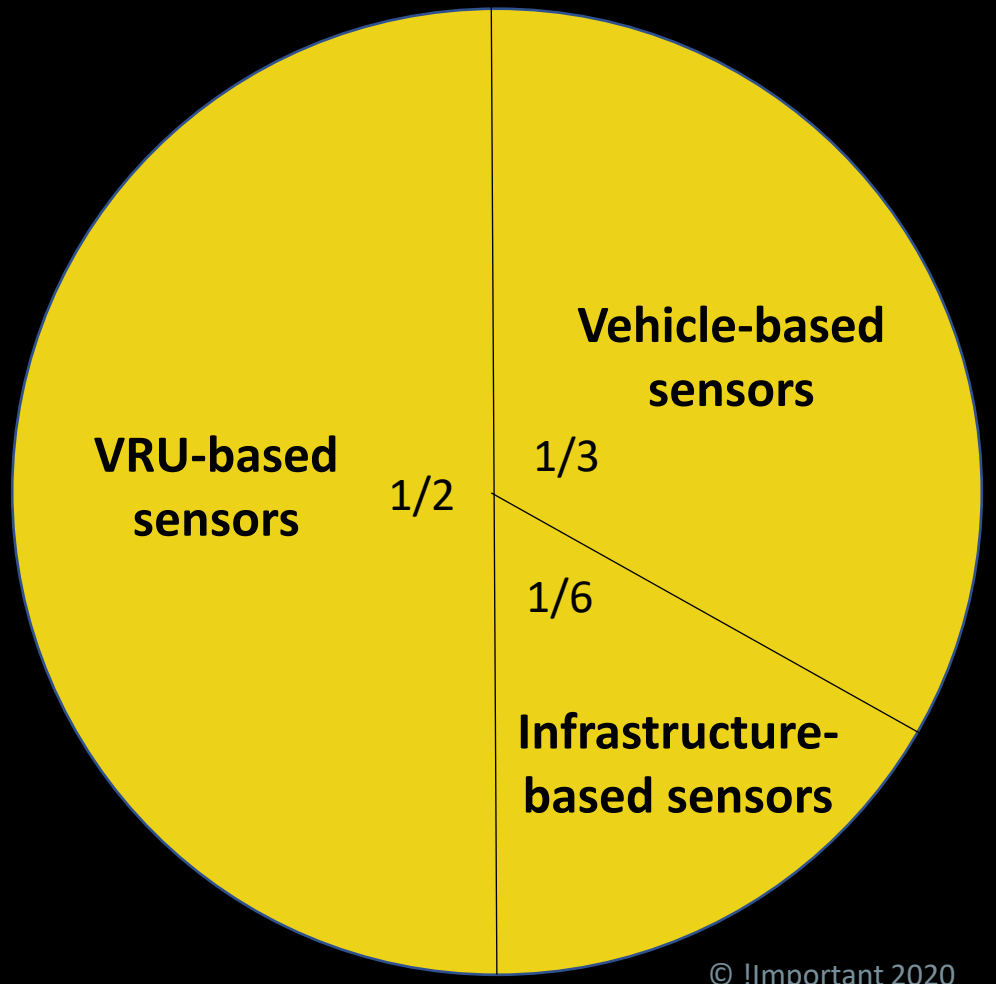
Drivers are responsible
(Speed, not attentive, alcohol, etc.)

Visual blockage
(Object blocking view, parked vehicle, blind spot, etc.)

Unpredicted pedestrian behavior
(Running, changing course abruptly)

External conditions
(Weather, bad visibility, darkness)

Sisters Of Safety (S.O.S.)



Together covering 100% of pedestrian fatality scenarios

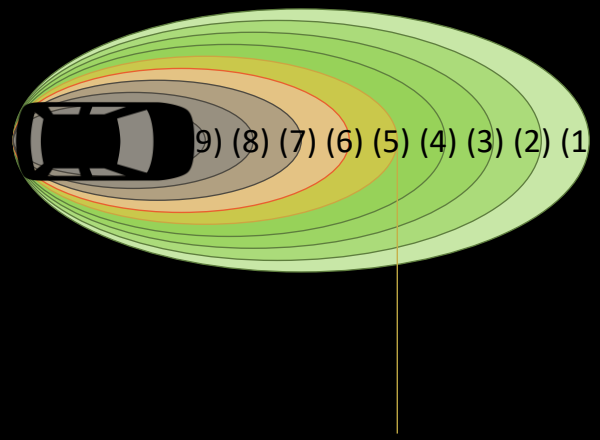
Takeaways

1. **The « Sensor Tech Stack » needs to extend out of vehicles.**
   All sensors are necessary: on vehicles, on infrastructures, on VRUs.
   V2X capabilities should be mandatory.

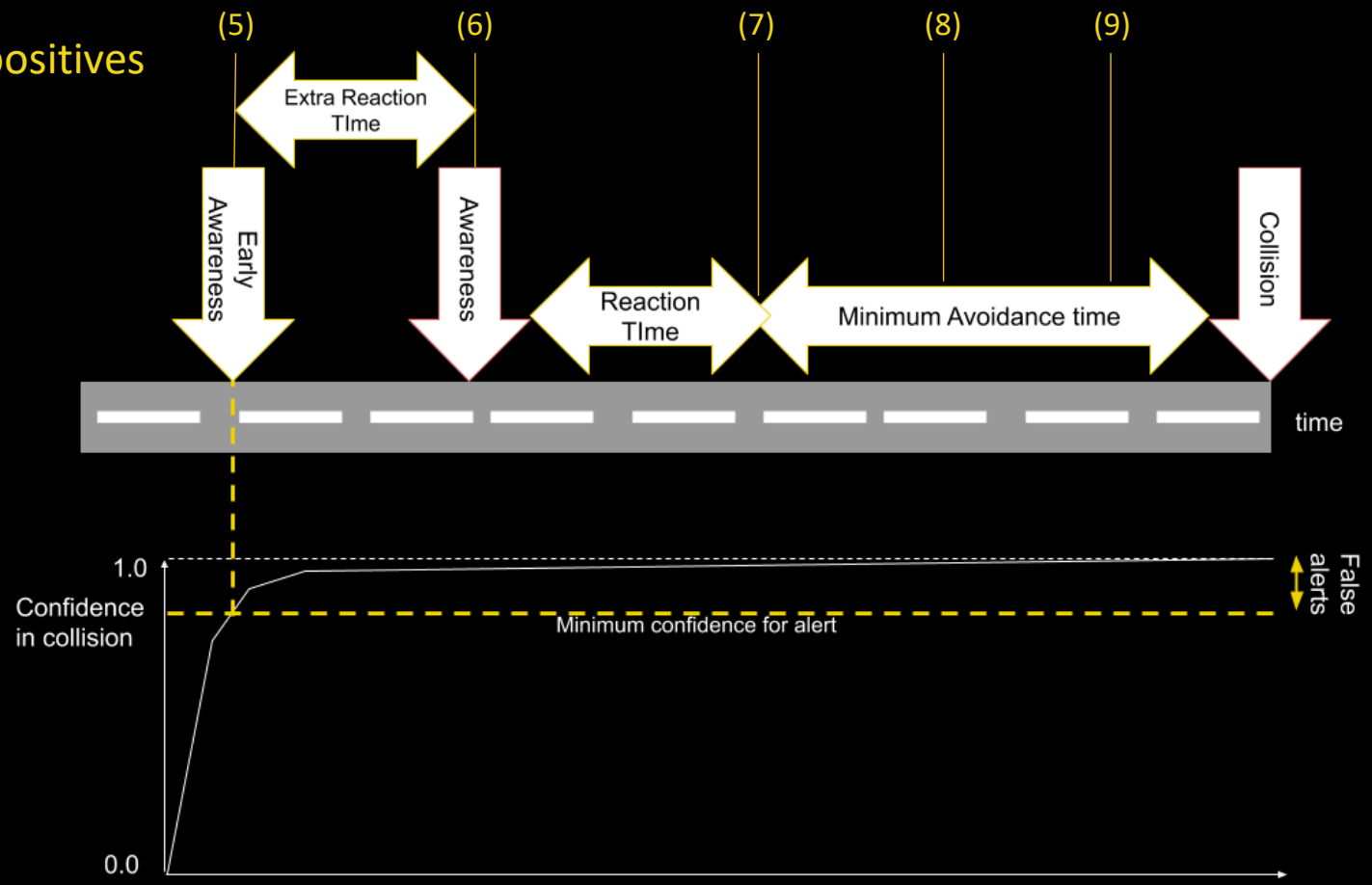
2. **Only the cloud solves the Trolley Problem.**
   Indirect communications must take place
   between VRU and vehicles/drones.

Collision Avoidance System

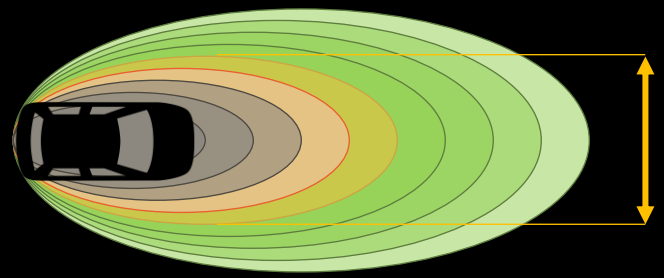
Ellipse based decision to reduce false positives and augment the confidence

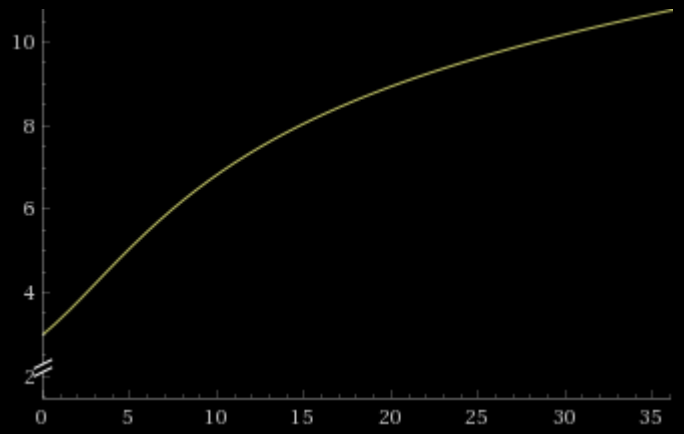


Warning



False Positive Management





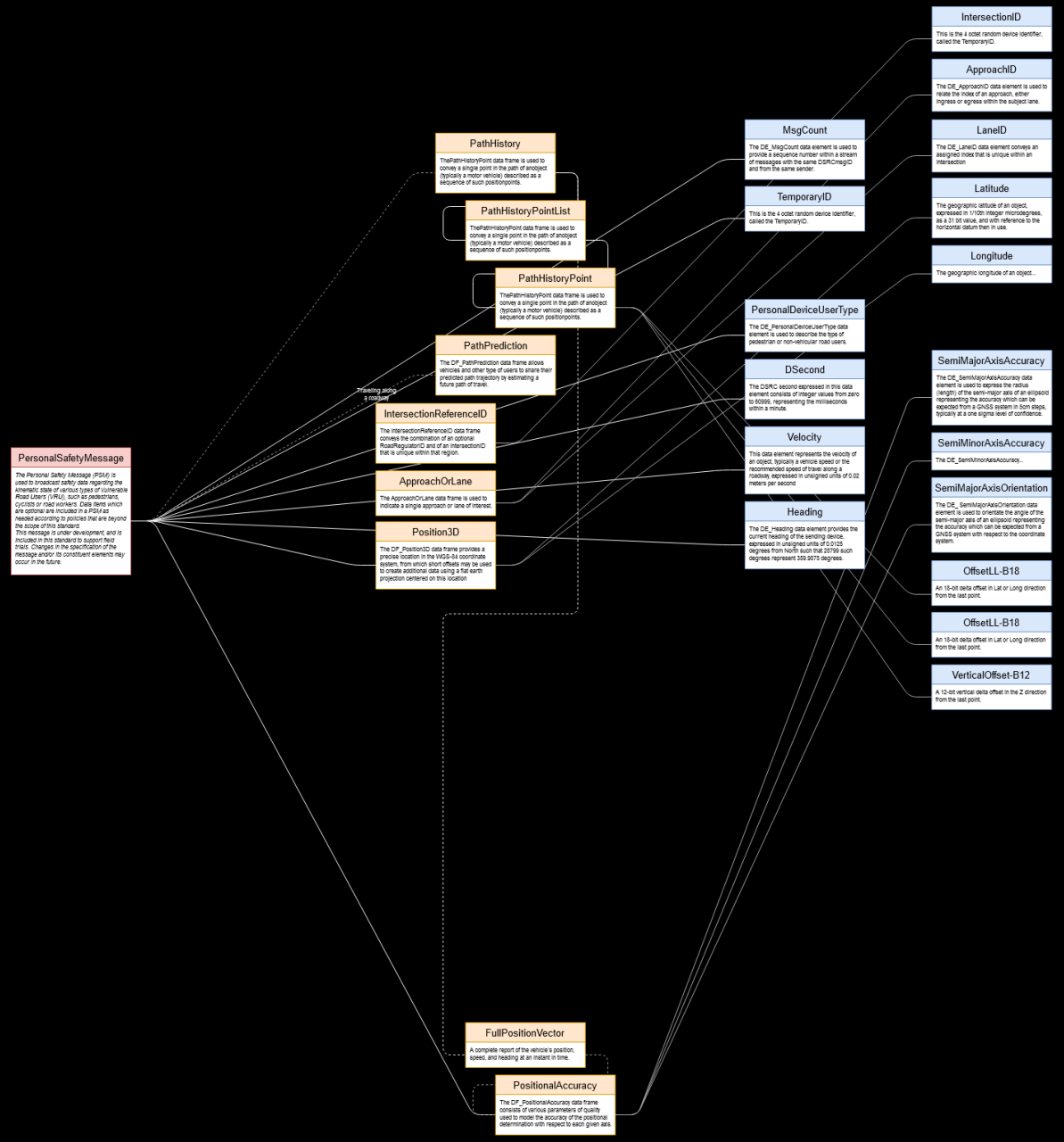
Width adapts with speed to limit false positives

Width is 3.5m at 0km/h, 6.31m at 30km/h, 7.82m at 50km/h, 9.63 at 90km/h and 10.77m at 130km/h.

SAE Standards

We are compliant with J2735 Standard

All our data (including the confidence factor), can be transmitted *via* a standard ITS formatted PSM.
Only the Risk Factor is added to the feed.



Compatible DSRC/C-V2X


```
[
  {'messageId': 32,
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         'accuracy': {'orientation':0,'demiMajor':0,’semiMinor':0},
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         'id': '\x00\x00\x00\x00',
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         'riskFactor':0,
         'secMark':29345
         'speed':178
      }
  {'messageId': 32,
   'value':
  [...]
  }
]
```
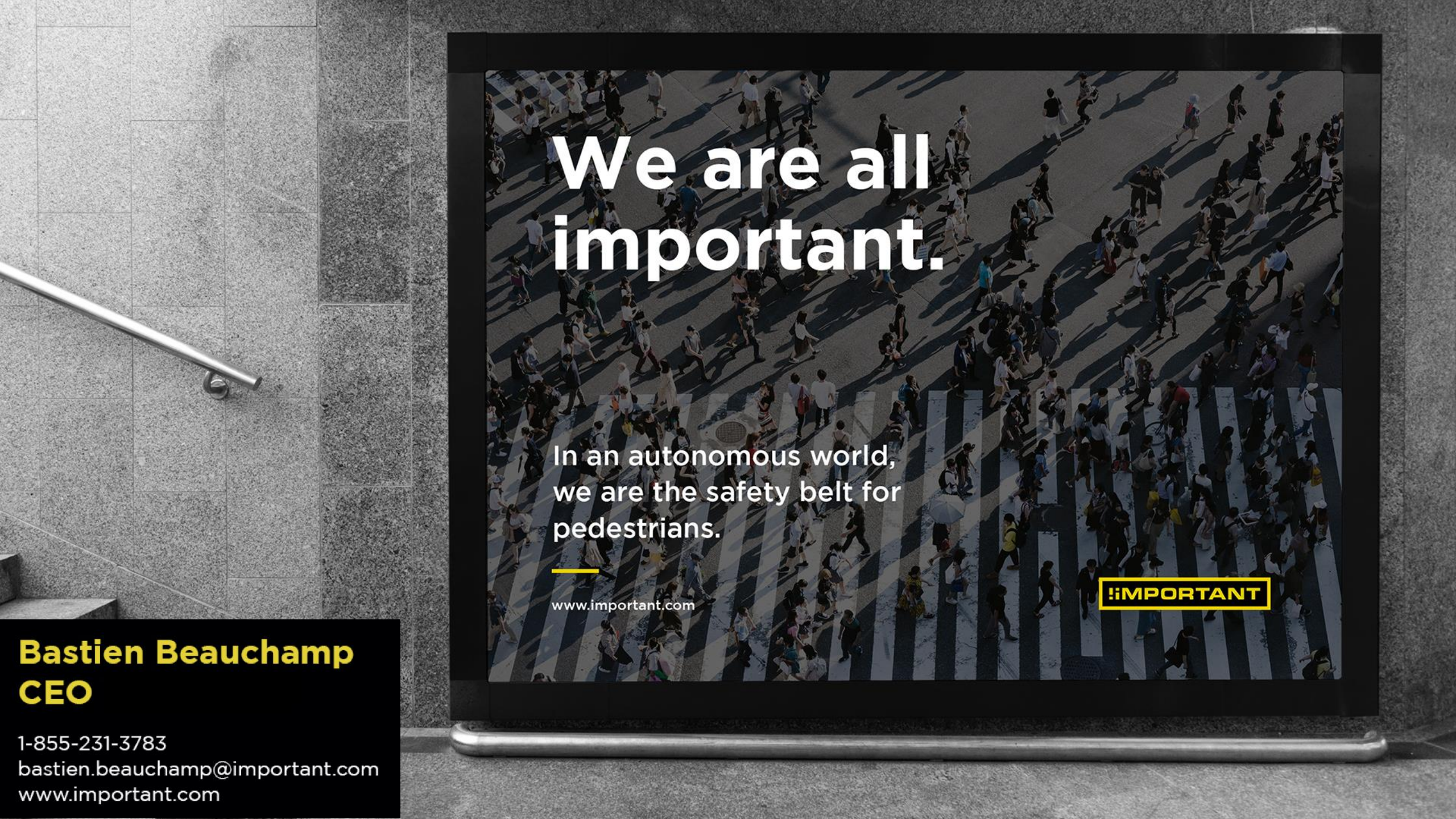


Risk Factor: !important Collision Probability

Reflects the ellipses, and so the probability of collision is calculated on !important side and sent to the OEM as a provision of danger notification

Confidence: OEM’s Decision Helper

Generated from: accuracy, GPS swing, # of connected GPS, Dual Frequency availability, GNSS frequency
To help the OEM consider our signal in its sensor fusion (like a SNR of internal sensors)



Bastien Beauchamp
CEO

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Time for a short break ...

Let's Go……


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City of Marysville

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Thank you for joining us today

Edgar Avila

Executive Vice President at AAA Northwest Ohio

AAA Club Alliance, Inc.

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