

Video Analytics to Classify Movements and Vehicles

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Video Cameras Are Widely Deployed

The screenshot shows the NYC DOT Real Time Traffic website. The browser tab is labeled "NYCDOT - Real Time Traffic". The URL is "dotsignals.org". The page header includes the NYC DOT logo and navigation links: "Printer Friendly", "E-mail This Page", "Translate This Page", "Set Text Size", and "Sign-up for DOT". A sidebar on the left contains a "Home" button and a list of categories: "About DOT", "Pedestrians", "Bicyclists", "Ferries & Buses", "Motorists & Parking", "Infrastructure", and "Contact DOT". The main content area features a "Real Time Traffic" section with a "Cameras List" link. Below this is a map of Manhattan with numerous blue camera icons overlaid on the street grid. Landmarks such as Lincoln Center, Central Park, and Times Square are visible.

This screenshot shows a video camera feed from a specific location. The browser tab is "6 Ave @ 57 St - Mozilla Firefox". The URL is "dotsignals.org/google_popup.php?cid=414". The video title is "6 Ave @ 57 St" and it shows a "Facing South" view. The timestamp is "05/18/2017 12:10:19 PM". The video shows a busy city street with heavy traffic, including cars, buses, and large trucks. The caption below the video is "NYC DOT SEM".

This is a detailed map view of Manhattan, New York City, showing the locations of video cameras. The map is centered on the area between 11th and 23rd Streets. Numerous blue camera icons are scattered across the street grid, indicating the locations of the cameras. Key landmarks and streets are labeled, including Times Square, Central Park, and the East River. The map interface includes standard navigation controls like zoom in (+) and zoom out (-) buttons.

Video Cameras Are Widely Deployed

PacTrans STAR Lab Research on Video Analytics



Image source: http://www.roadtraffic-technology.com/uploads/storefront/transdyn/2_picture_0062.jpg

Video Analytics for Data Collection



+ Video Analytics =



Surveillance video

Video Image Processor (VIP)

Source: <http://www.metroactive.com/papers/metro/02.06.97/traffic-camera-9706.html>
<http://www.iteris.com/rs/products.html>

Video Analytics Partnership

PacTrans STAR Lab Research on Video Analytics

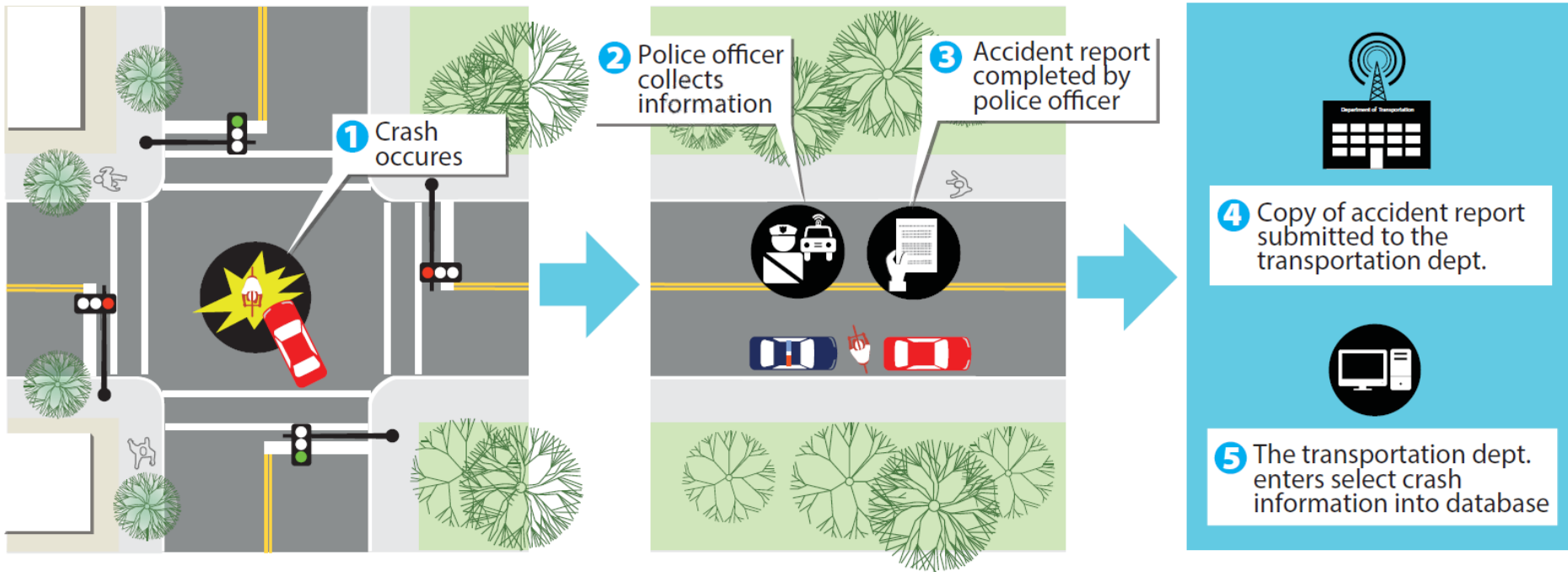


Microsoft

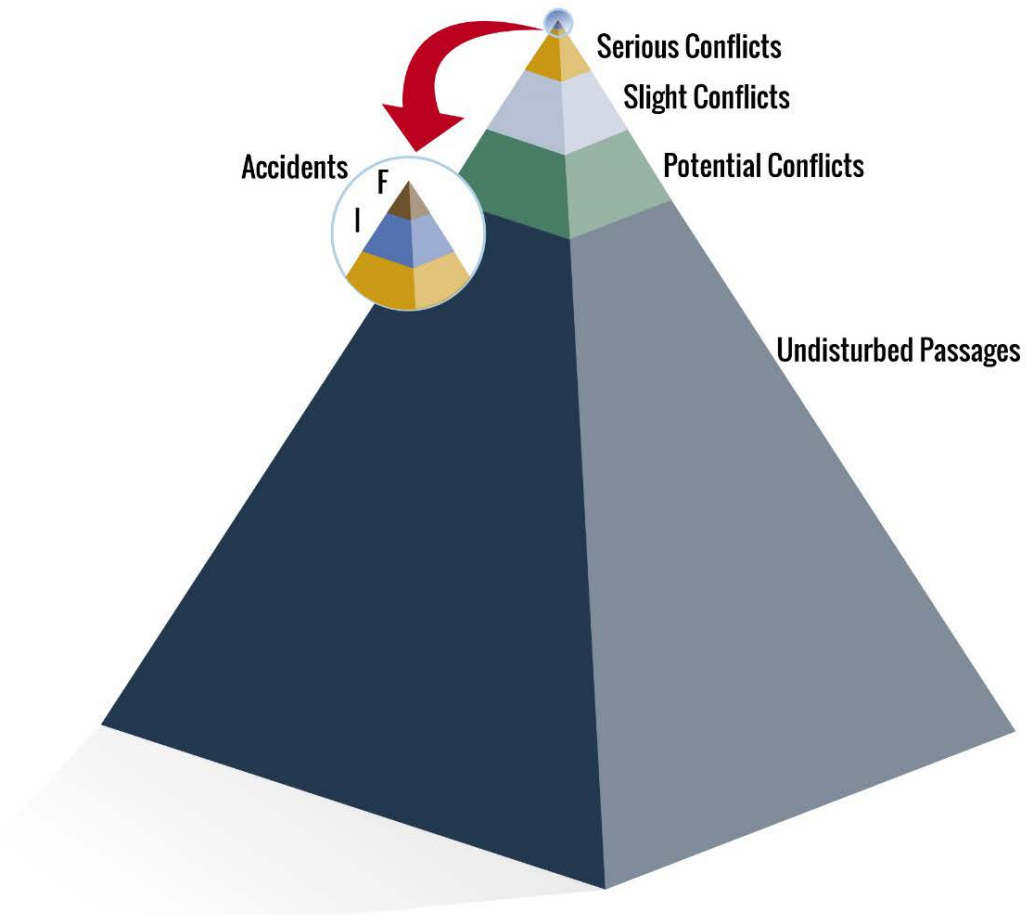


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WASHINGTON

Crash Data and Report Challenges



Near Miss Is an Indicator of Crash



Hyden's Safety Pyramid (adapted from Hyden, 1987)

Near Miss Is an Indicator of Crash



BELLEVUE PEDESTRIAN & BICYCLE IMPLEMENTATION INITIATIVE
Making Bellevue a great place to walk and bike.



HOW YOU CAN HELP:

- 1 Click on "Add Point"
- 2 Select the type of issue
- 3 Place your point on the map
- 4 Answer a few questions, submit comments

Refer to the "Instructions" for more help

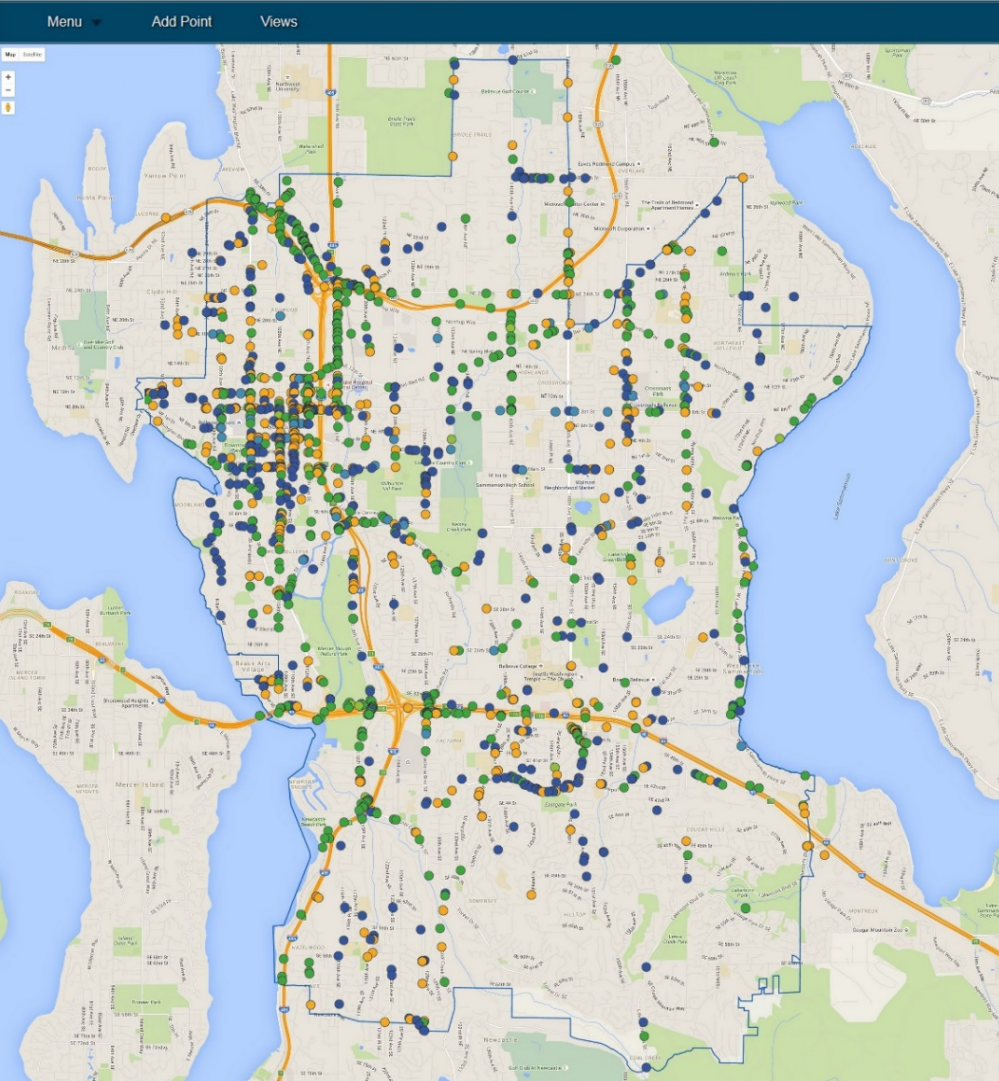
MAP LEGEND

Unsafe Accomodations for People...

- Walking (Blue circle)
- Bicycling (Green circle)

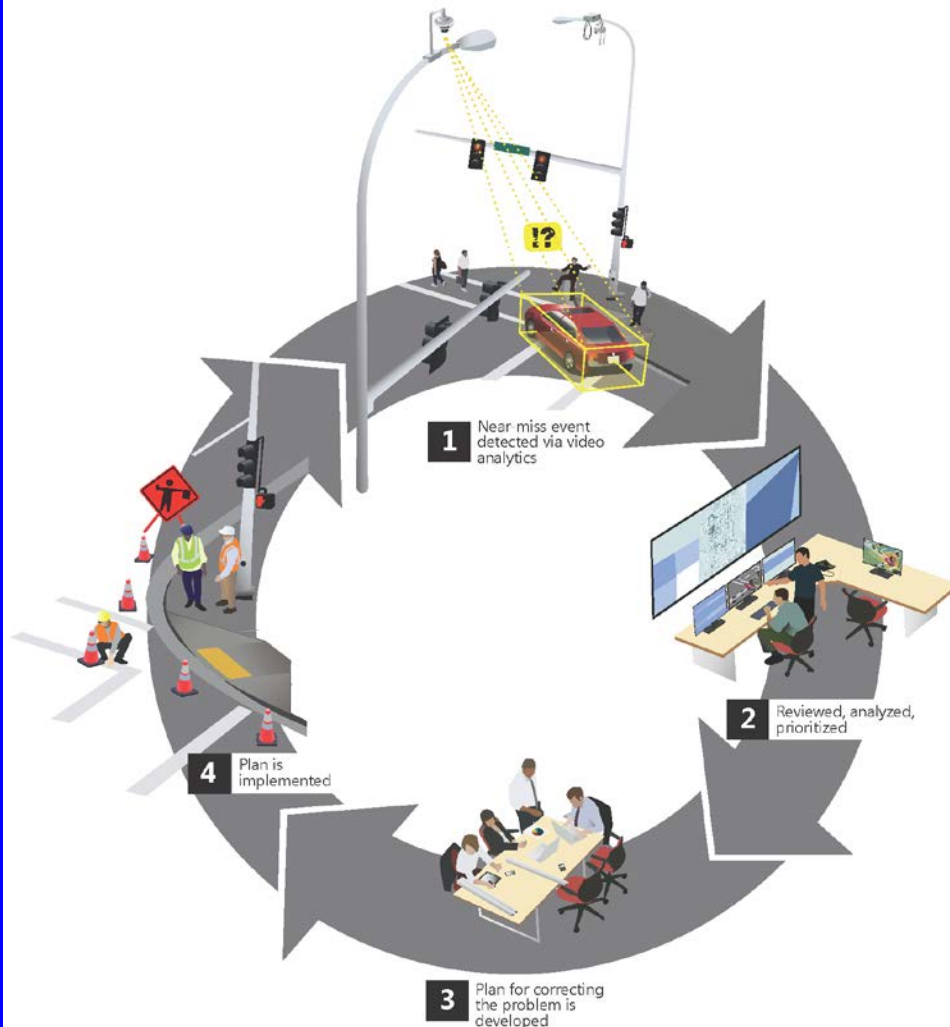
Unsafe Behaviors by...

- People Walking (Light Blue circle)
- People Bicycling (Light Green circle)
- People Driving (Orange circle)



	Total Points Placed	
Ped Facilities	514	32%
Bike Facilities	573	35%
Ped Behaviors	57	4%
Bike Behaviors	22	1%
Car Behaviors	452	28%
Total	1618	

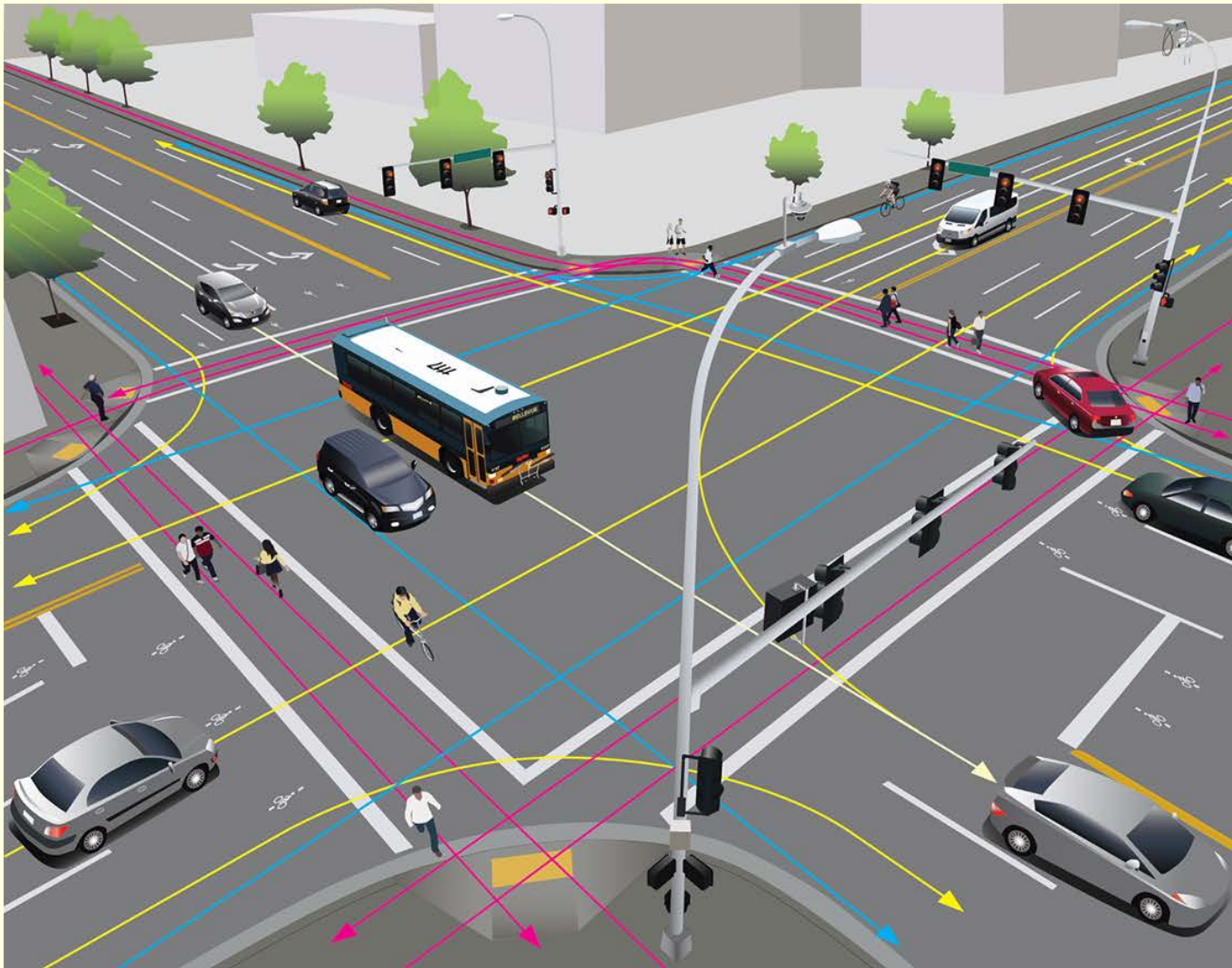
Near Miss Detection



Leverage existing traffic camera system to simultaneously:

- monitor counts and travel speed of all road user groups
- document the directional volume of all road user groups as they move through an intersection; and,
- assess unsafe “near-miss” trajectories and interactions between all road user groups.

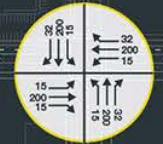
Trajectory Detection and Turning Movement Counts



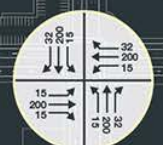
VEHICLE TURNING MOVEMENTS

MONTH: MAY, 2016
DATE: 5.1.2016 - 5.2.2016

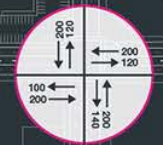
CARS



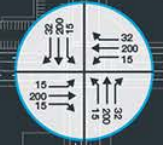
BUSES/TRUCKS

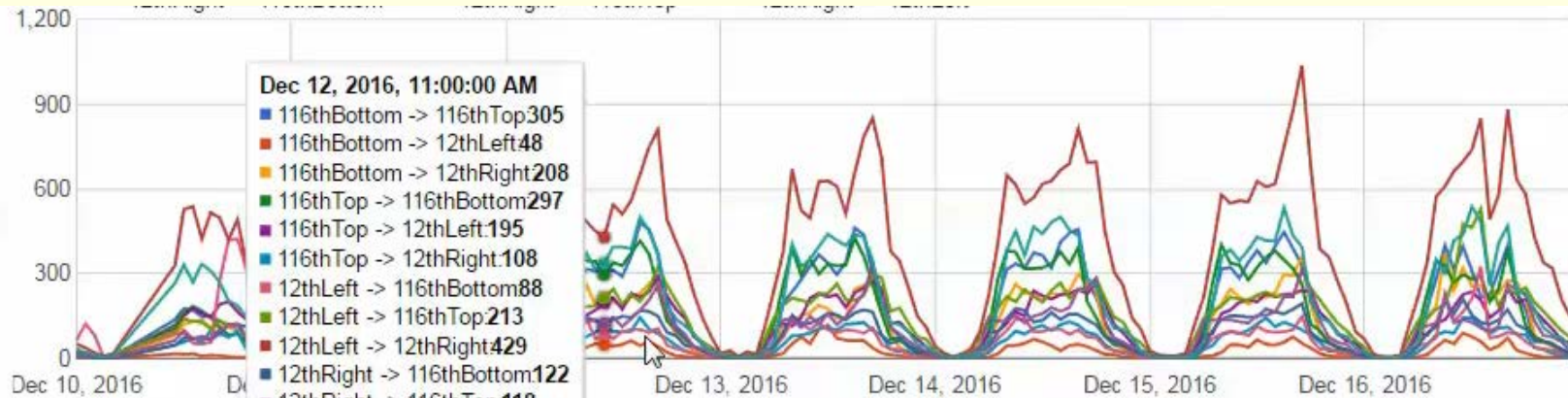


PEDESTRIANS

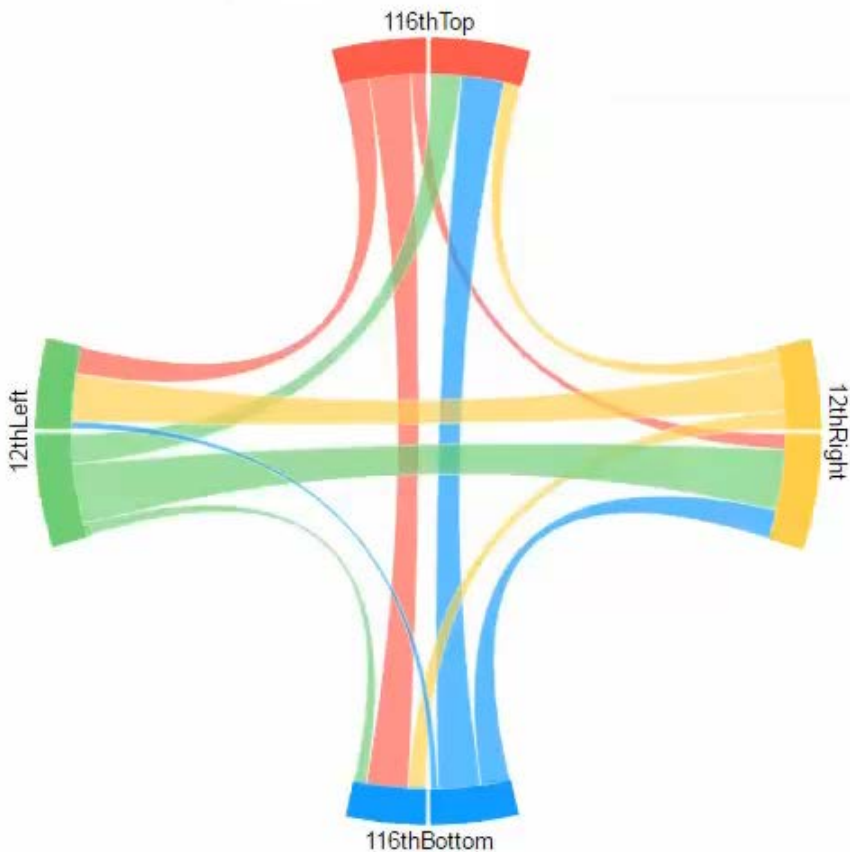


BICYCLISTS

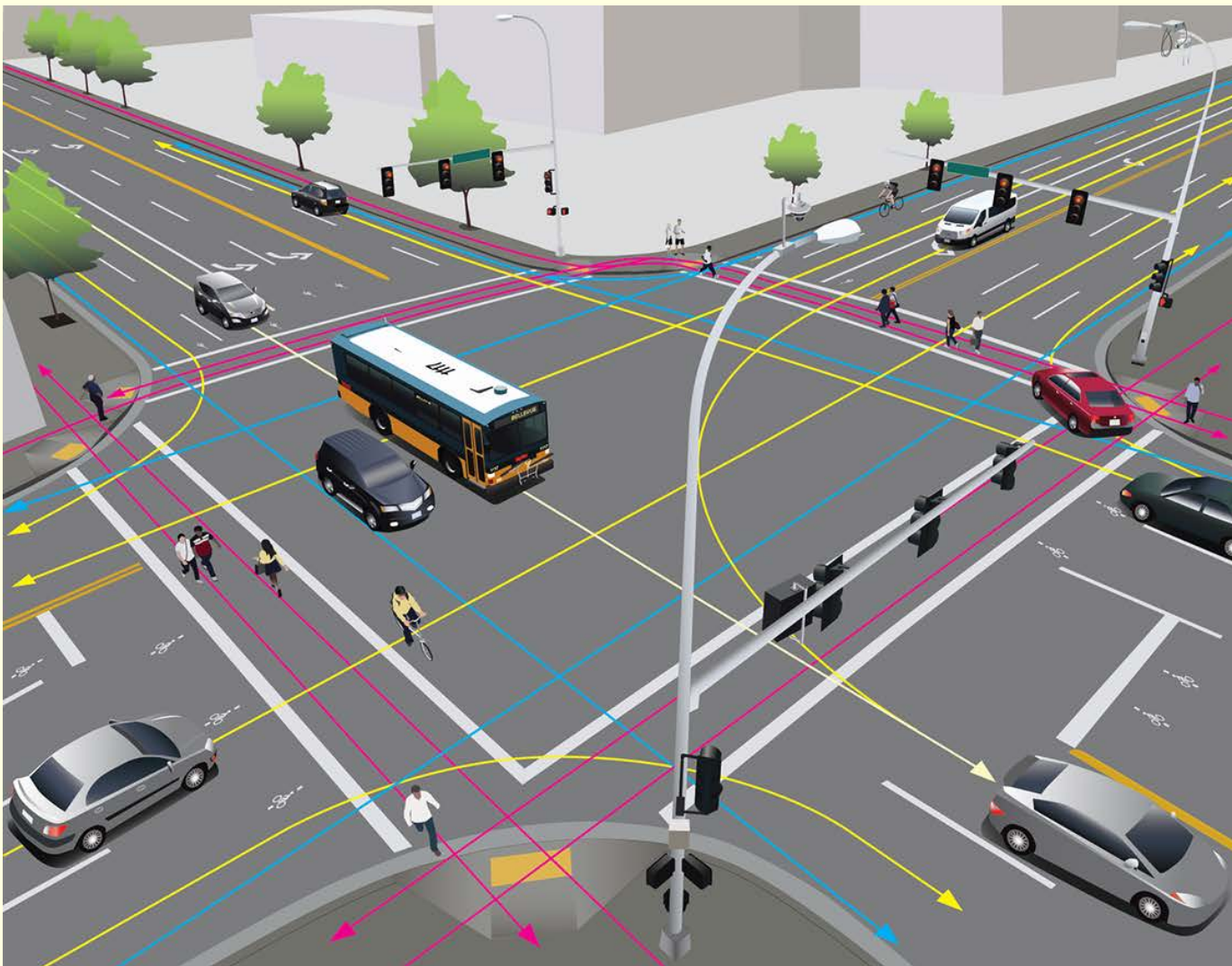




flow diagram for Mon, 12 Dec 2016 11:00:00



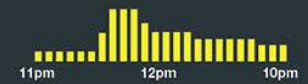
Vehicle Classification and Count



VEHICLE DISTRIBUTION CHARTS BY TIME OF DAY

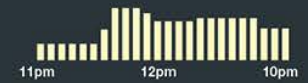
MONTH:	MAY, 2016
DATE:	5.1.2016 - 5.1.2016

CARS



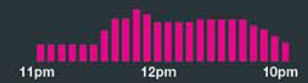
30,000 cars/day

BUSES/TRUCKS



400 buses & trucks/day

PEDESTRIANS



1,000 pedestrians/day

BICYCLISTS



100 bikes/day

Vehicle Classification and Count

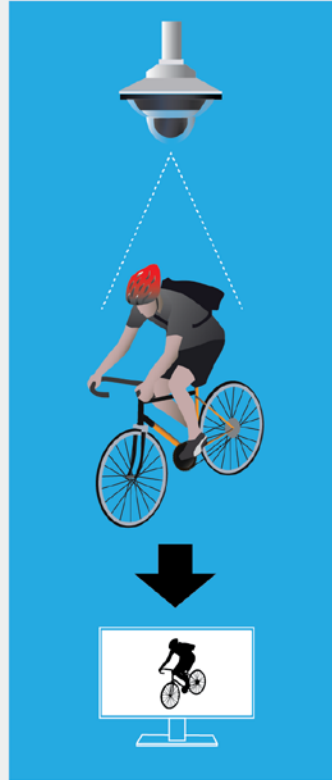
training

during the training phase, a neural network is fed thousands of labeled images of various objects, learning to classify them



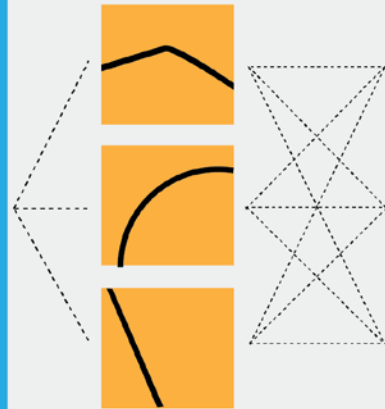
input

new image is shown to the pretrained network



first layer

the neurons respond to simple shapes, like edges



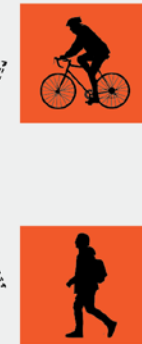
higher layer

the neurons respond to complex shapes



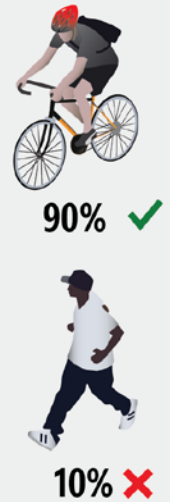
top layer

neurons respond to highly complex abstract concepts that we would identify as different objects

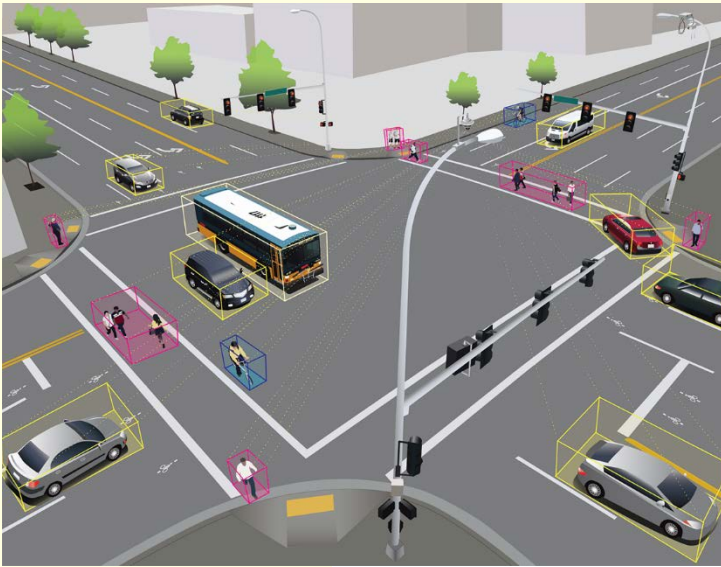


output

the network predicts what the object most likely is based on its training.



Vehicle Classification and Count

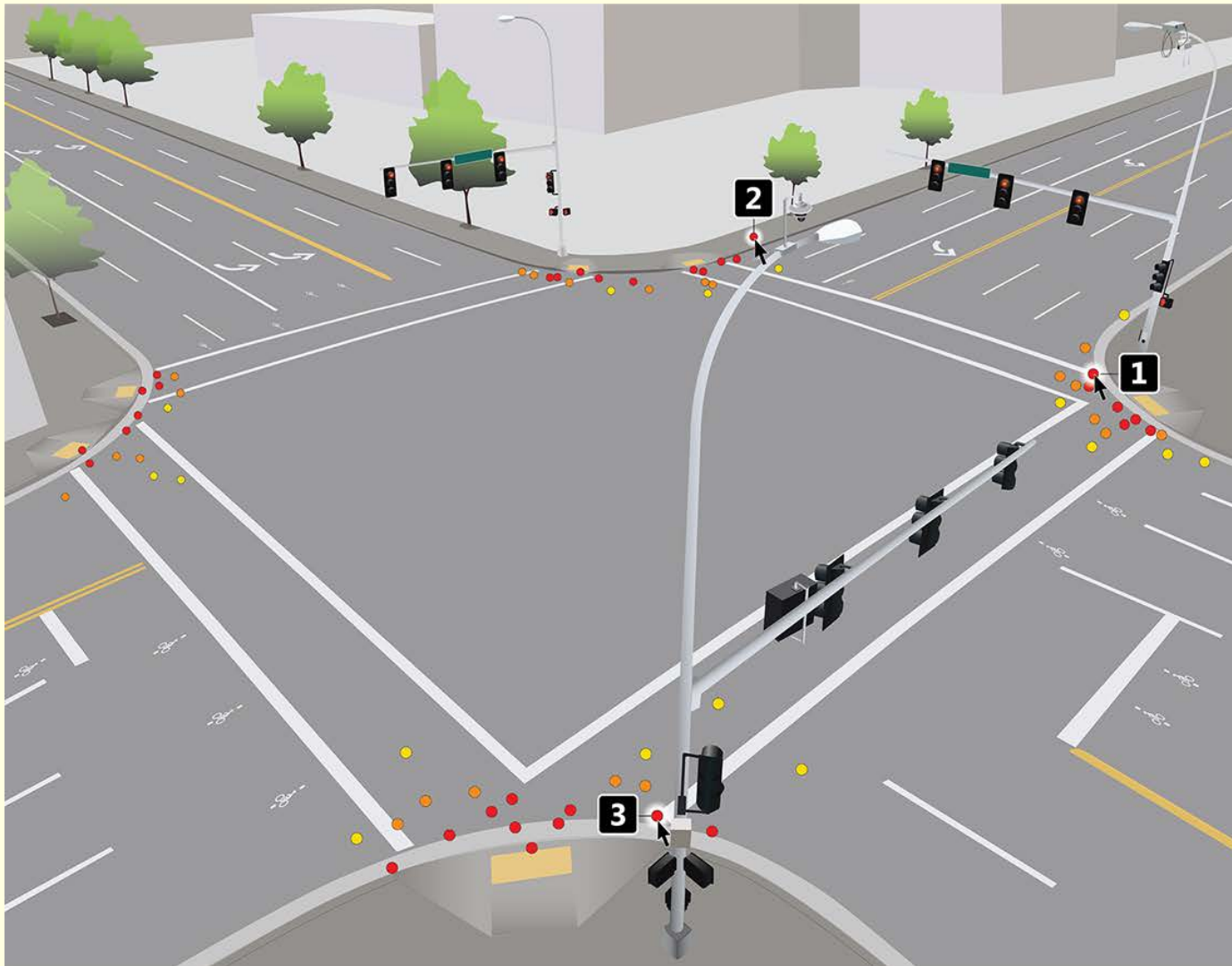


We recognized it as...

When it really is...

Classified-as → Truth ↓	<i>Vehicles</i>	<i>Bikes</i>	<i>Peds</i>	<i>None</i>
<i>Vehicles</i>	0.95	0.01	0.02	0.02
<i>Bikes</i>	0.08	0.67	0.16	0.08
<i>Peds</i>	0.15	0.15	0.73	0.05
<i>None</i>	0.09	0.03	0.11	0.81

Near Miss Detection



QUANTITY, LOCATION & SEVERITY OF NEAR MISS EVENTS

MONTH: MAY, 2016
DATE: 5.1.2016 - 5.31.2016



Near Miss Detection



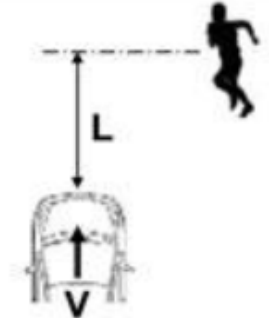
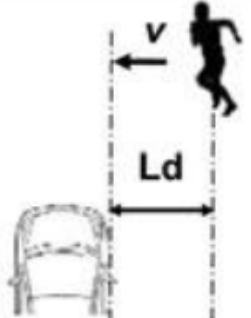
LUND
UNIVERSITY



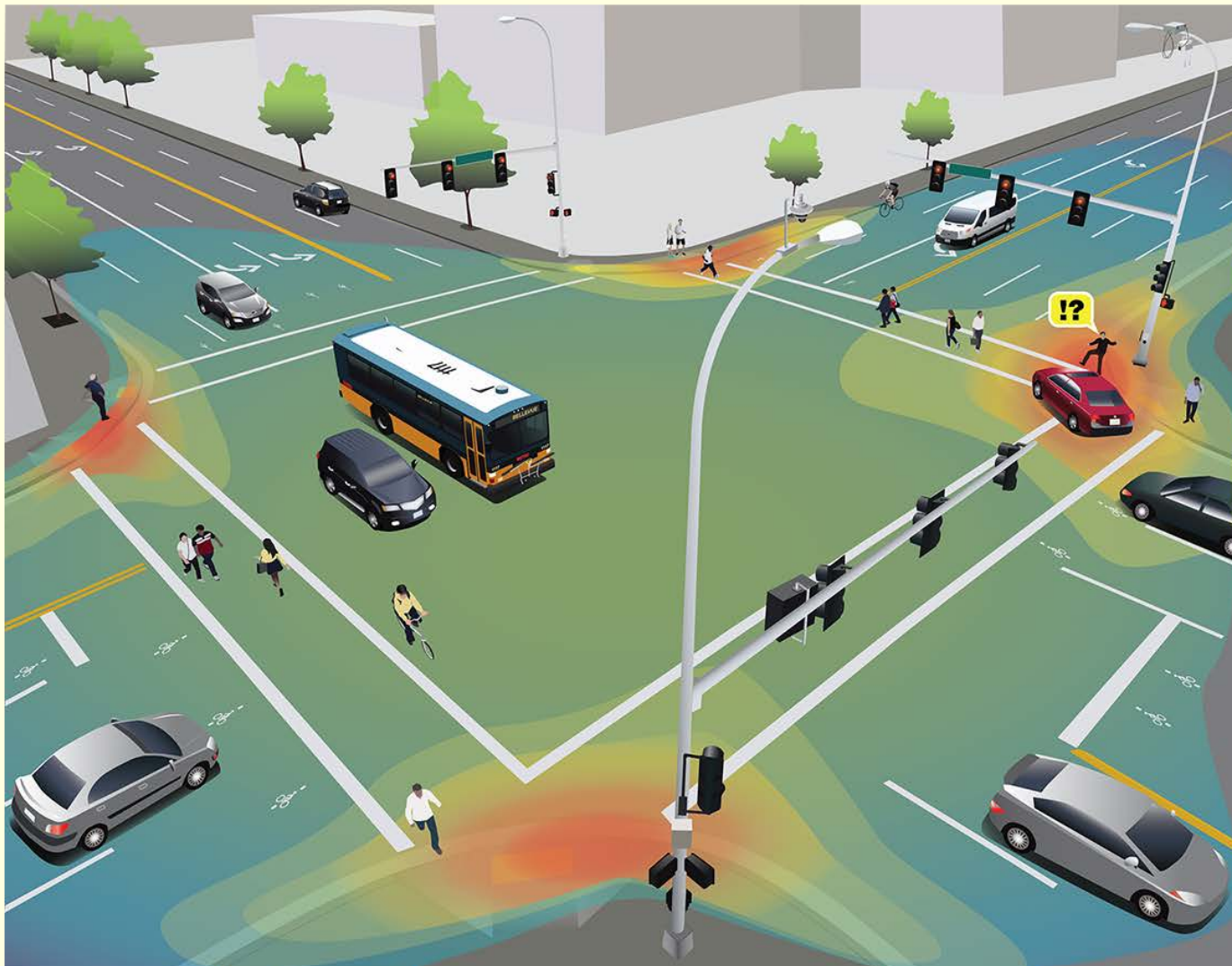
McGill



POLYTECHNIQUE
MONTRÉAL

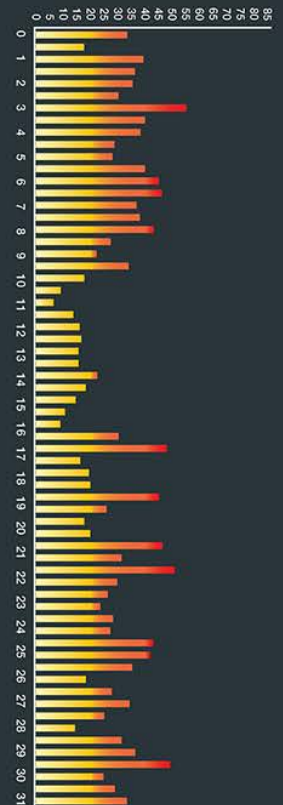
Focused object	Vehicle	Pedestrian
Time	<u>Vehicle</u> time to collision (Vehicle TTC)	<u>Pedestrian</u> time to vehicle (Pedestrian TTV)
Definition	 $\text{Vehicle TTC} = \frac{L}{V}$	 $\text{Pedestrian TTV} = \frac{Ld}{v}$
Study	Previous study (Matsui et al. 2011b)	Present study

Near Miss Hot Spots



QUANTITY, LOCATION & SEVERITY OF NEAR MISS EVENTS

MONTH:	MAY, 2016
DATE:	5.1.2016 - 5.31.2016



Popular Video Analytics Partnership

OVERSIGHT	  
GOVERNMENT	          
RESEARCH	   
NON-PROFIT	    

Video Analytics for Collision Avoidance

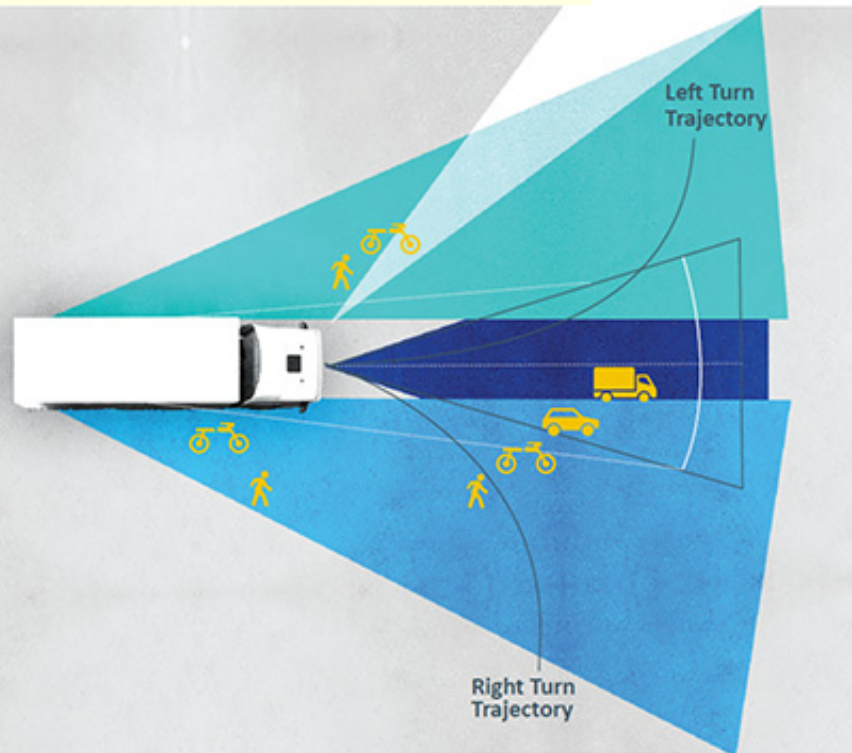
TRB Transit IDEA with WSTIP



Our system is equipped with

up to four strategically placed multi-vision smart cameras.

- camera 1
- camera 2
- camera 3
- camera 4



UAV Video Analytics for Traffic Monitoring



Video Analytics for Collision Avoidance



Thanks for your attention!

- To join the Video Analytics, please contact:



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