



# Deep-Driving into an Accident-Free World

**ILAN KADAR**

# Solve the Problem of Car Collisions at Scale



**1.3 million**

road death in 2016



**95%**

accidents due to  
human error



**55%**

In death rates can  
reduce partial  
automation

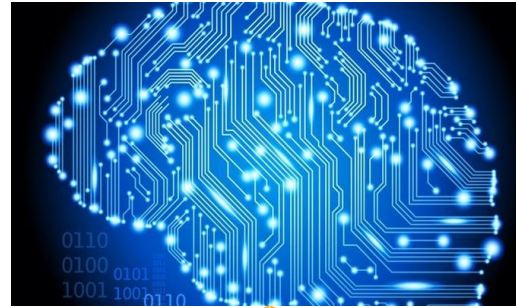


**15 million**

vehicles with  
automation ... by 2020

# Nexar's Approach to Solve the Problem of Car Collisions at Scale

## Deep Learning



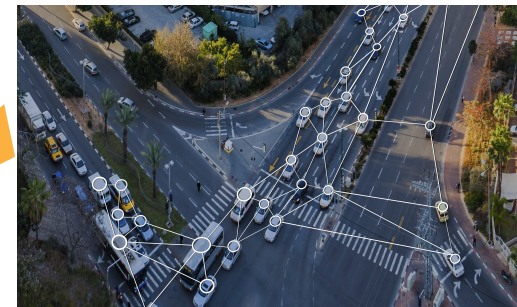
*Millions of Driving Miles  
Collected by Our Users*

## Nexar Dashcam



*Sensing*

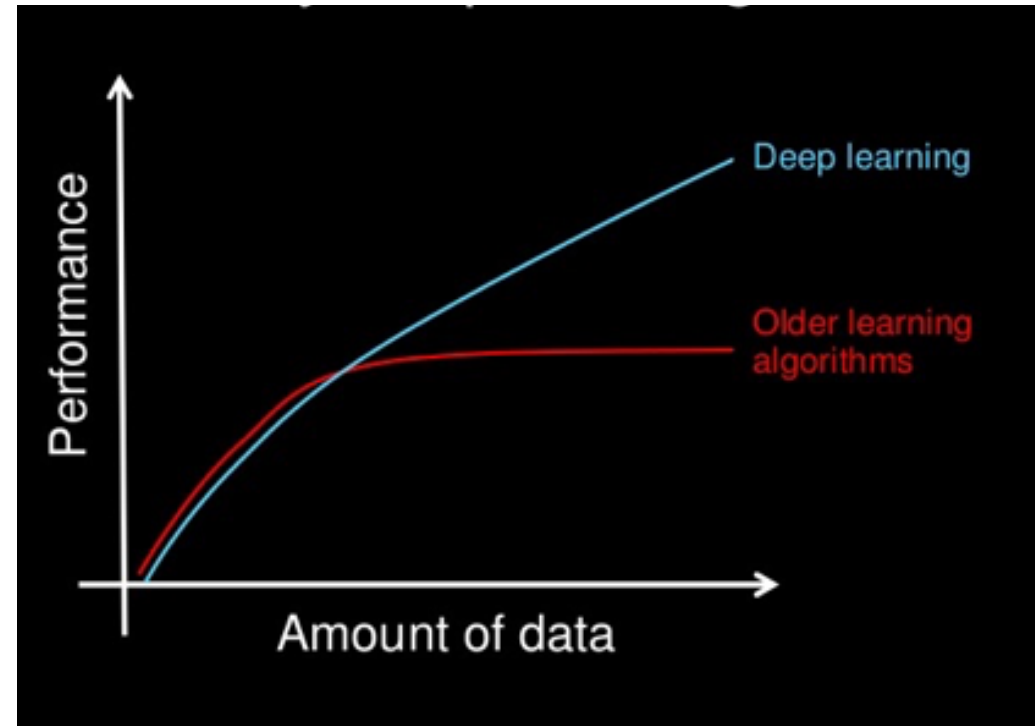
## Vehicle-2-Vehicle Network



*Sensing beyond line of sight*

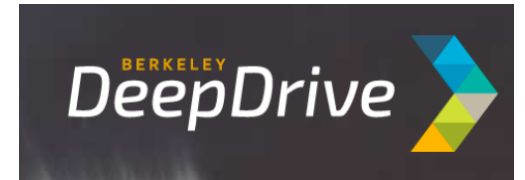
# Deep Learning

- What is the breakthrough of Deep Learning?
  - Deep learning is the first class of algorithms that is scalable.
  - “Data is the new Oil”
  - From Feature Engineer to Data Engineer
    - How do you collect your data?
    - How do you label it in efficient manner?
    - How do you build online system?

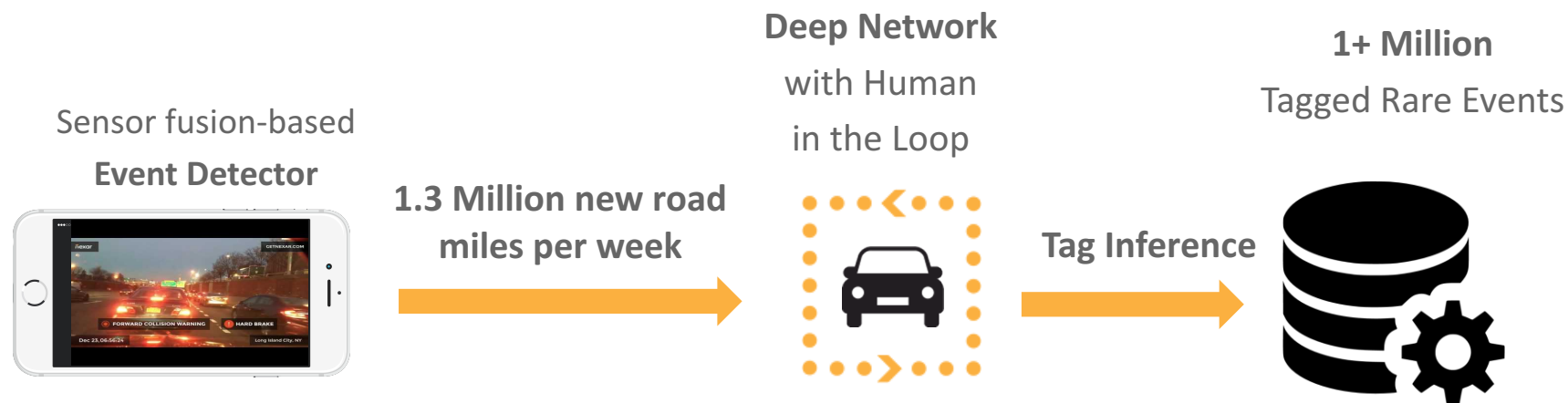


# Driver Assist Data: it is all about “corner cases” – rare events

- Rare events needed to be covered in your train data in order to reach from 95% to 100%
- Leverage Deep Learning for your Data-Collection:
  - Pipeline for efficient collection of corner cases



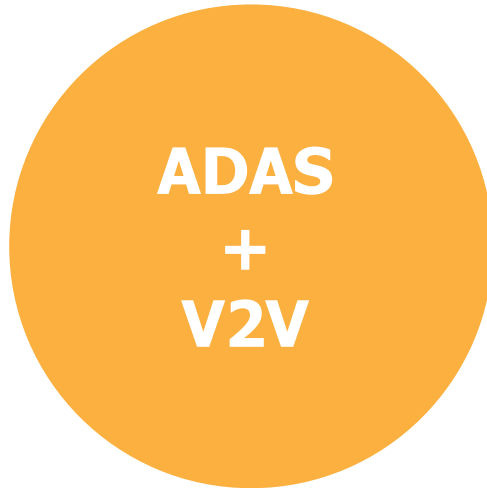
**HONDA**







# Today: Deep-Drive into an Accident-Free World



Forward Collision Warning  
Lane Departure Warning  
Pedestrian/Cyclist Warning  
Red Traffic Light Warning



# Advanced Driver Assistant System (ADAS)

ADAS

## Forward Collision Warning



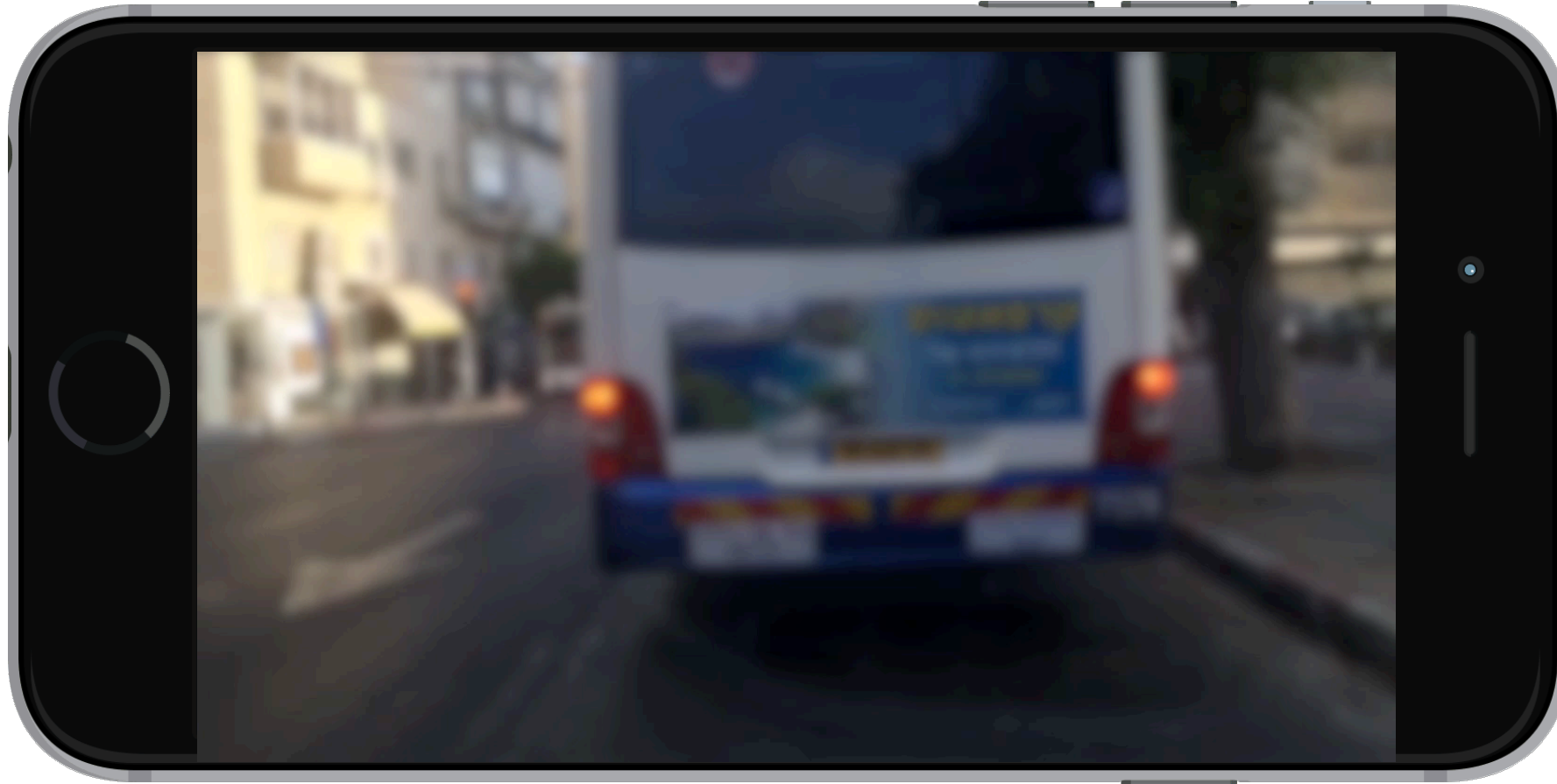
## Pedestrian Warning



# Red Traffic Light Warning

ADAS

- Red-light running is the leading cause of urban crashes



# Red Traffic Light Warning



## Red Traffic Light in Driving Direction

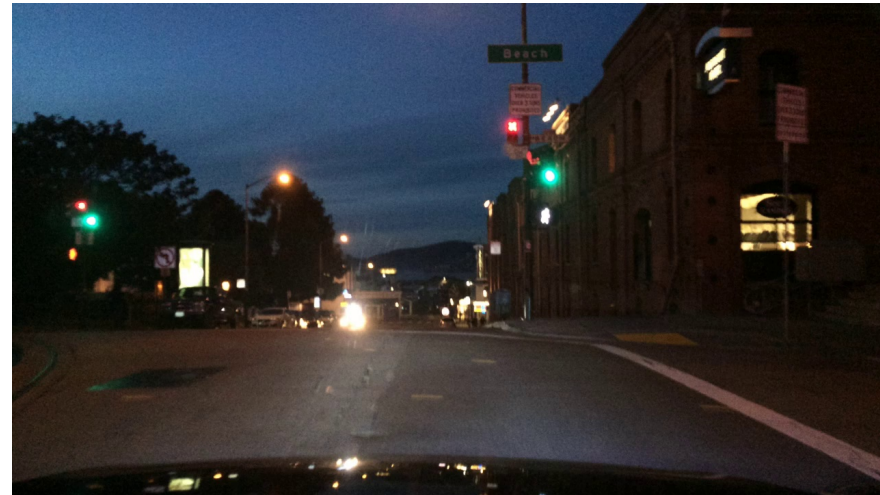


## Green Traffic Light in Driving Direction



# Traffic Light Challenge: Road Context is Important

ADAS



# The Traffic Light Recognition Challenge

ADAS

- Invited researchers to test their DL skills.
- 19K labeled images for training
- 500K unlabeled images for testing
- Scoring is based on the model's accuracy and size

## Introducing The Nexar Challenge: Deep-Driving into the Future

Use Deep Learning for Traffic Light Recognition, compete to win prizes and join our mission to make the road safer



# Traffic Light Recognition: Challenge Results and Demos

ADAS

- Winning model obtained 95% accuracy level with 8MB model size
- On-device app solutions (35ms/image on iPhone7 CPU)



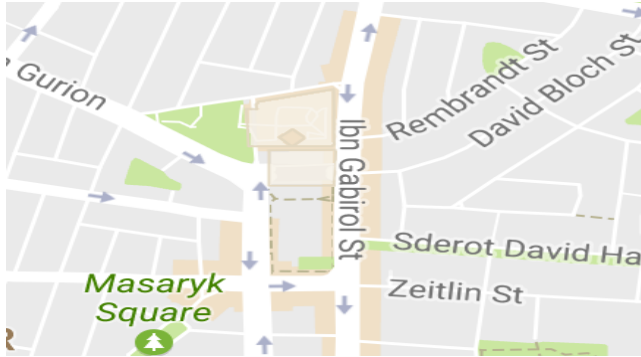
David Brailovsky, winner of the first Nexar Challenge: Using Deep Learning for Traffic Light Recognition

## Nexar's Deep Learning Challenge: the winners reveal their secrets

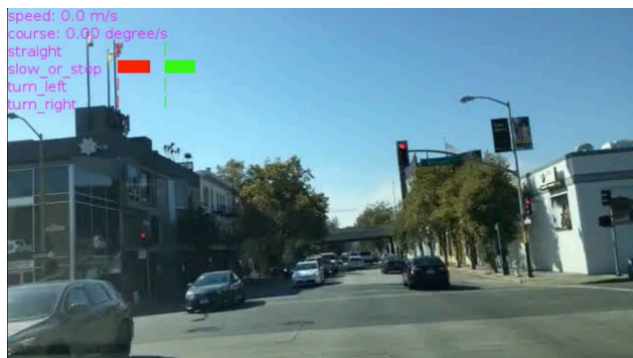
We challenged researchers with teaching deep networks to identify traffic lights, and now they share what they learned in the process. Read on for their insights and a look at their open-source models.

# NexTag: Traffic Light Recognition in Production

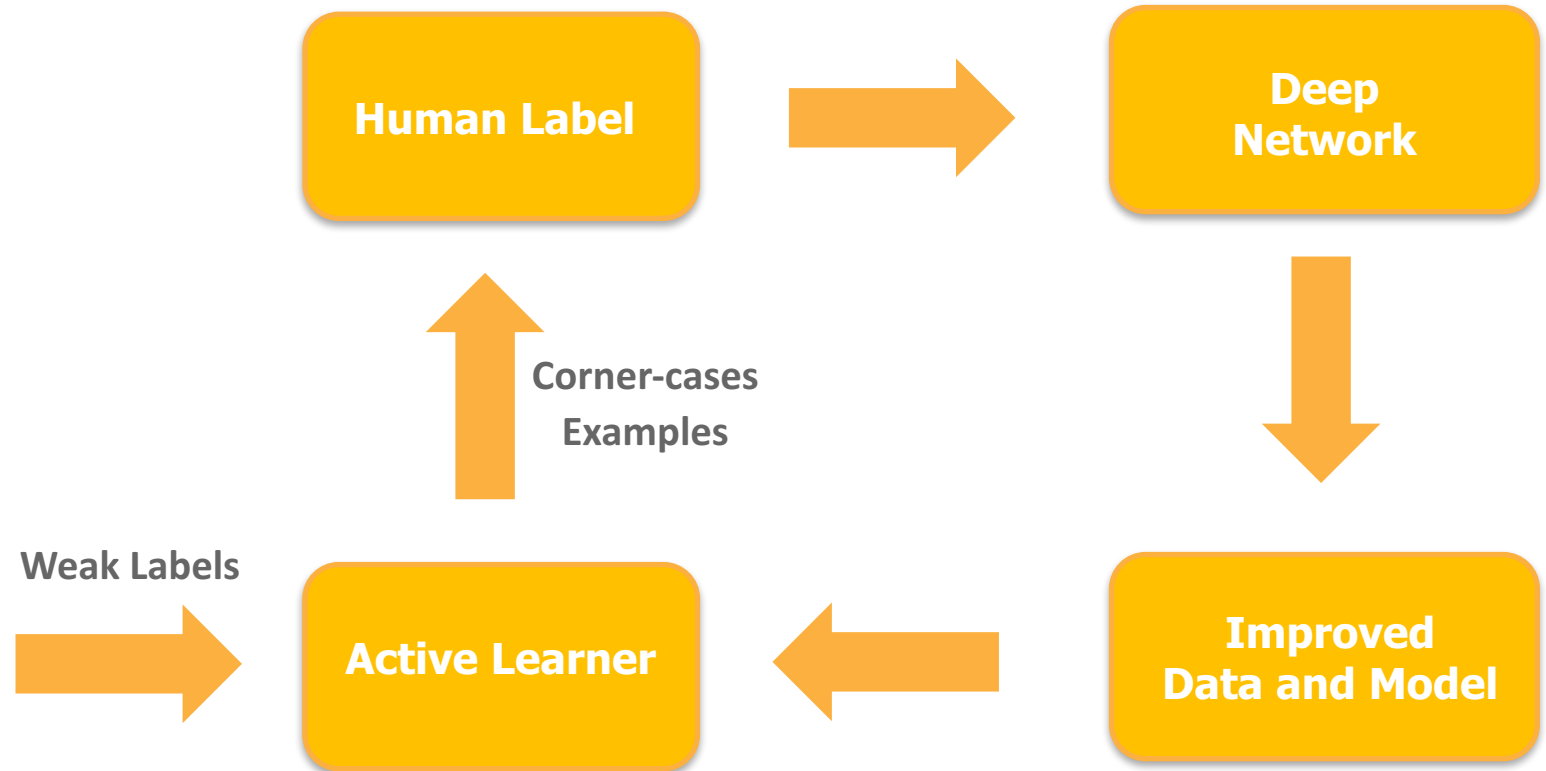
ADAS



Traffic Lights Map



Traffic Light Detector+Sensors



# ADAS+V2V: Forward Collision Warning at Nexar

ADAS  
+  
V2V



Forward collision alerts based on **Machine Vision**



Vehicle-to-Vehicle (V2V) forward collision alerts based on **network connectivity**

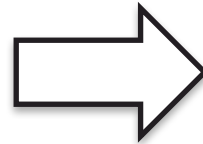
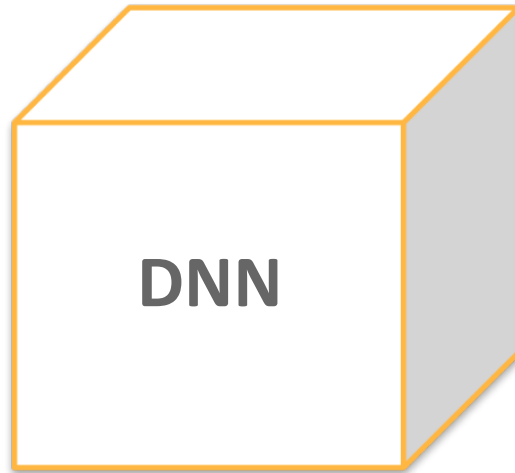
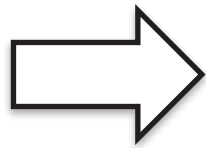


# Holistic Driver Assistant Model

HDAS

- End-2-End Learning of Driving Policies for Dangerous Detection

1M+ Tagged  
40sec Videos  
of Rare Events



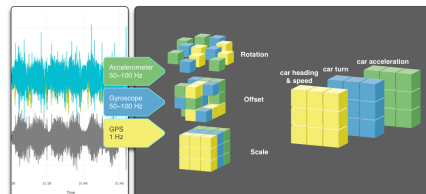
## Driving Policies (Actions)

**Accelerate**  
**Brake**  
**Turn Right**  
**Turn Left**

Visual Clues



Sensors

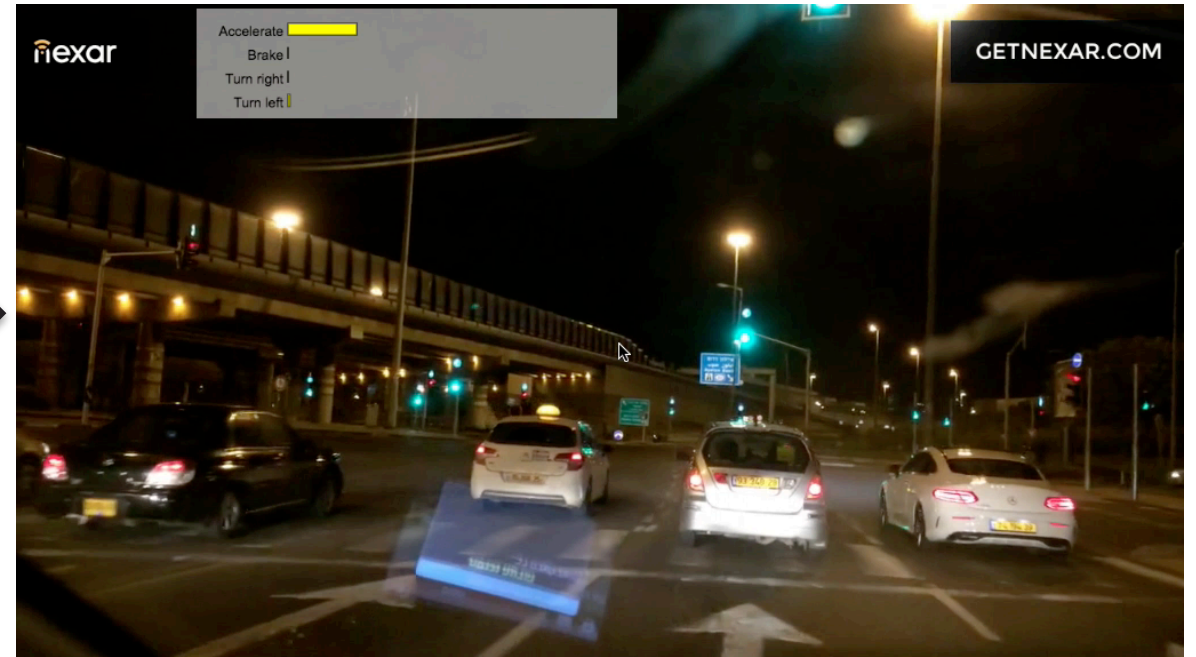
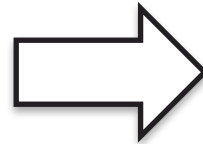
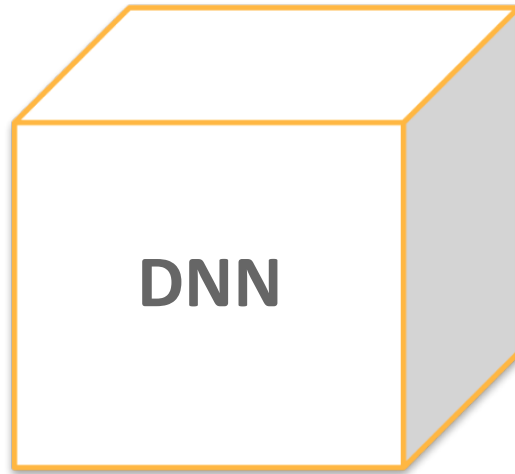
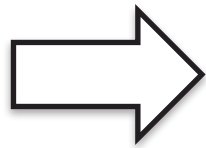


# Holistic Driver Assistant Model



- End-2-End Learning of Driving Policies for Dangerous Detection

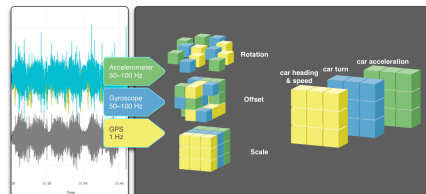
1M+ Tagged  
40sec Videos  
of Rare Events



Visual Clues



Sensors

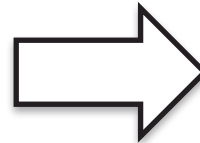
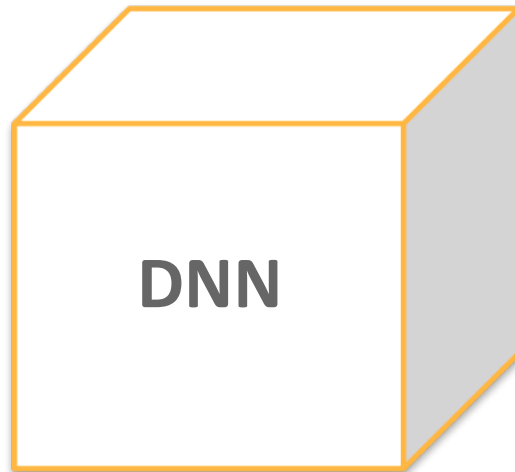
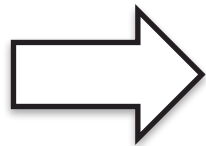


# Holistic Driver Assistant Model

HDAS

- Learning an holistic model to predict warnings from good drivers actions

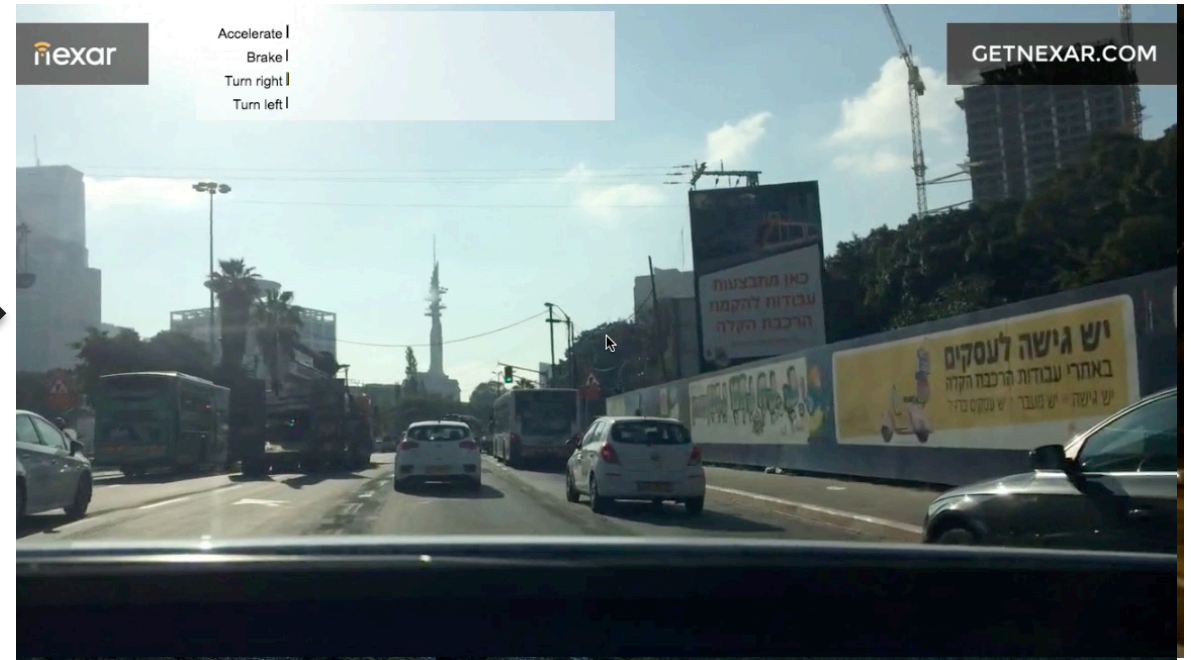
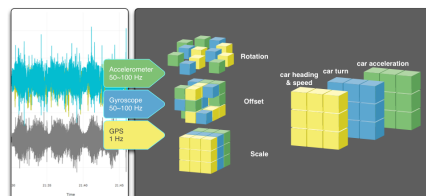
1M+ Tagged  
40sec Videos  
of Rare Events



Visual Clues



Sensors



# Berkeley DeepDrive (BDD) Consortium

- End-to-end Learning of Driving Models from Large-scale Video Datasets (CVPR 2017)



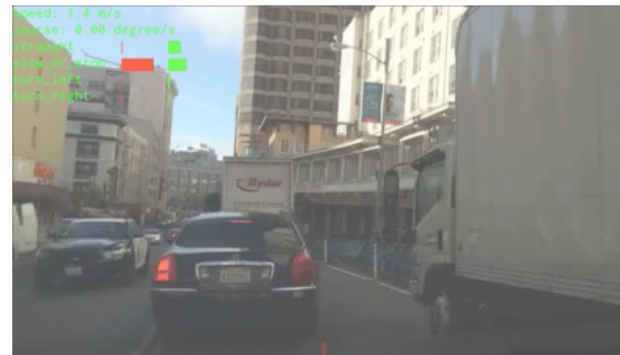
Prof. Trevor Darrel, Berkeley  
Chief Scientist at Nexar



(a) go at yellow light



(b) stop at red light



(c) stop & go equal weight at medium distance



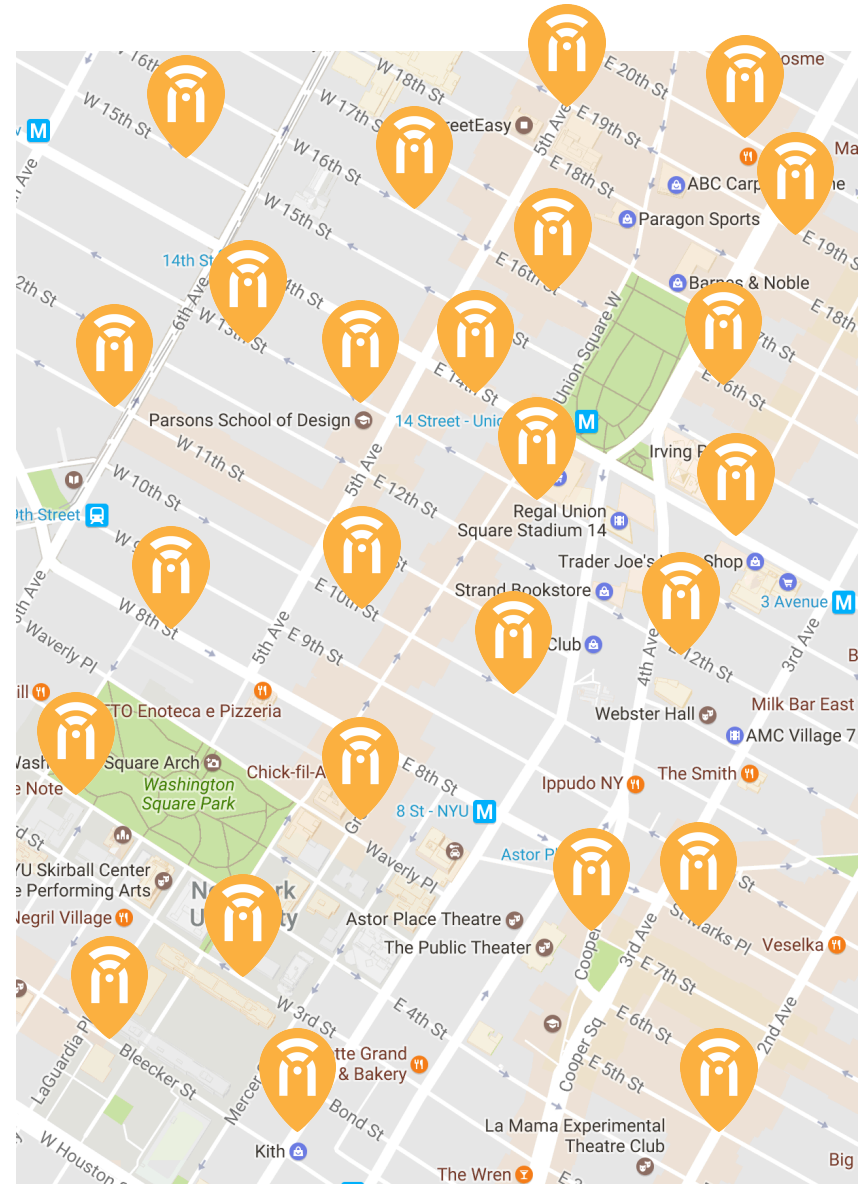
(d) stop when too close to vehicle ahead

# Solve the Problem of Car Collisions at Scale



1.3 million

Lives saved



# Nexar Team



# Nexar Team



**Join us to make the road safer!**

**Thank You!**