Empowering Citizens. Smarter Societies.

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Understanding traffic through video analytics from instrumented vehicles

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European Regional Development Fund

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Instrumented Vehicles Projects

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Cloud-LSVA

CloudLSVA
Large Scale Video Analysis

Large-**S**cale **V**ideo **A**nalytics

Annotation & search of video data for ADAS & cartography

H2020 ICT “Big Data”

VI-DAS

VI-DAS

Vision **I**nspired **D**river **A**ssistance **S**ystem

Object tracking & path prediction for safer driving

H2020 Mobility

YouTube

~15-20 TB/day
~300 hrs /minute

Lossy content
Large amount of files
Worldwide upload points

ADAS Context
Open-road Acquisition

~10-50 TB/day/vehicle
~8 hr collection window

Lossless content
Reduced amount of files
Limited upload points

Big Data

Volume
Velocity
Variety

Visual Analytics for Instrumented Vehicles

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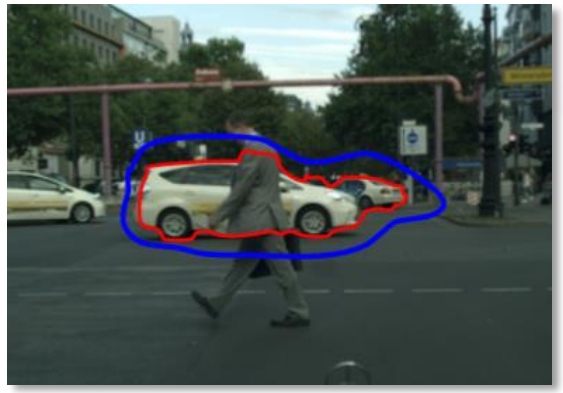
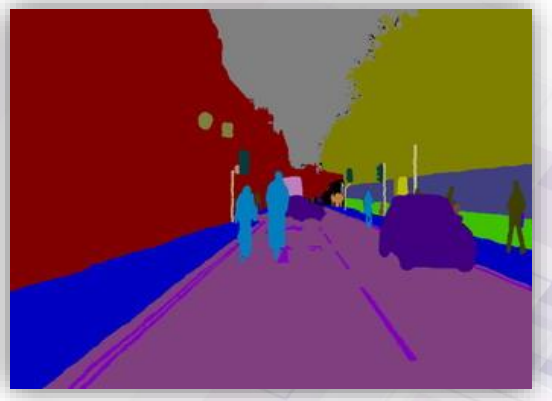
Augmented Segmentation

Semi-automatic Annotation

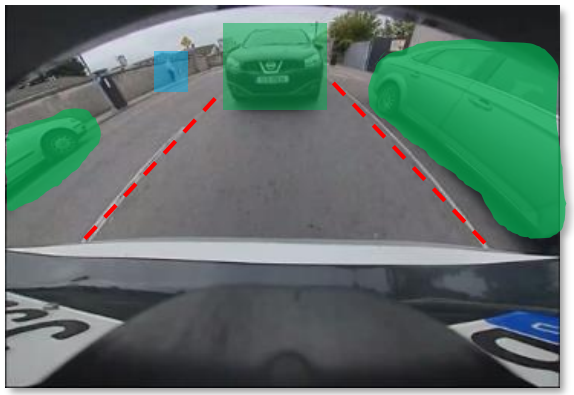
Semantic Segmentation





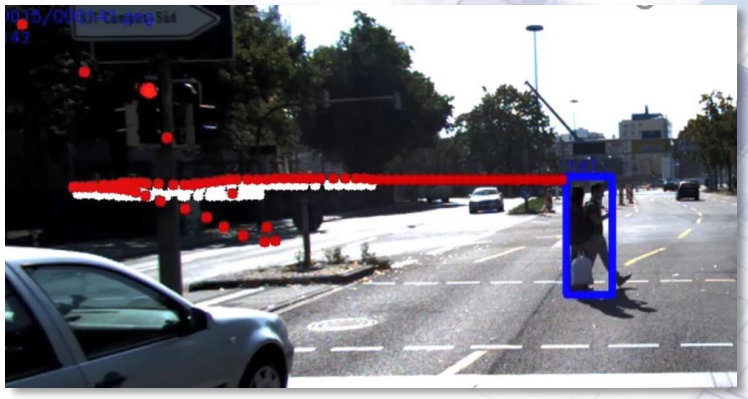
Object Detection, Classification & Tracking

Path Prediction



Situation Assessment

Semantic Search

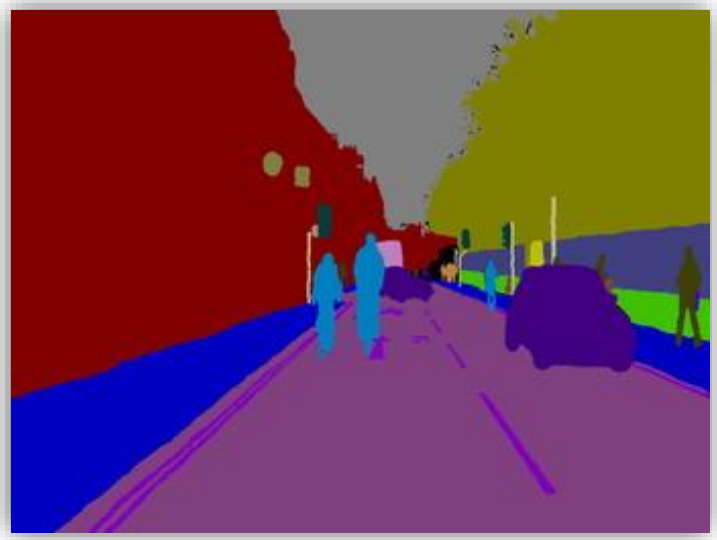


Understanding high-volume, high-speed multimedia data – a computer scientist's view

- Big data in ADAS means fully manual annotation is infeasible
- Data that's not annotated is not usable
- Annotation via Machine Learning?
- Deep learning: a step change in computer vision

Annotating Video

Road scene

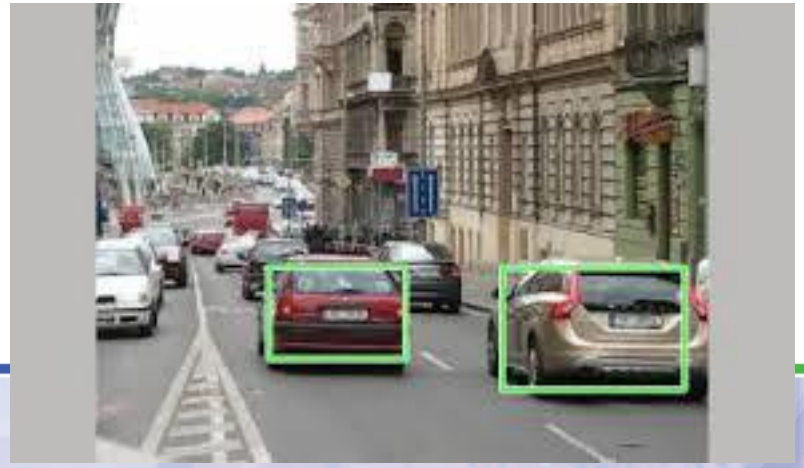


Ground-truth

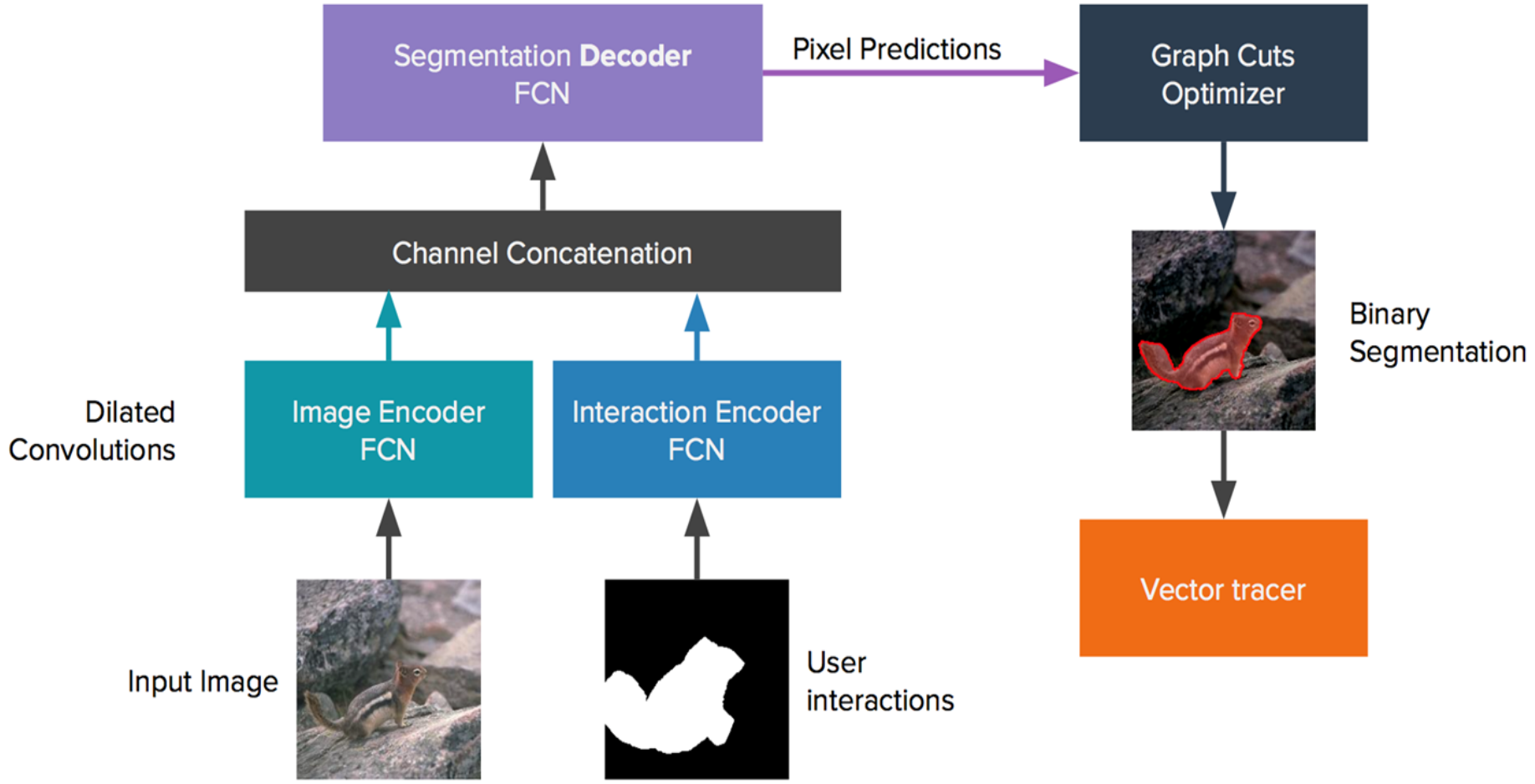
Scene level
Static Objects
Dynamic Objects
Background
Actors
Vehicles

Void	Building	Wall	Tree	VegetationMisc
Fence	Sidewalk	ParkingBlock	Column_Pole	TrafficCone
Bridge	SignSymbol	Misc_Text	TrafficLight	Sky
Tunnel	Archway	Road	RoadShoulder	LaneMkgsDriv
LaneMkgsNonDriv	Animal	Pedestrian	Child	CartLuggagePram
Bicyclist	MotorcycleScoote	Car	SUVPickupTruck	Truck_Bus
Train	OtherMoving			

Classes

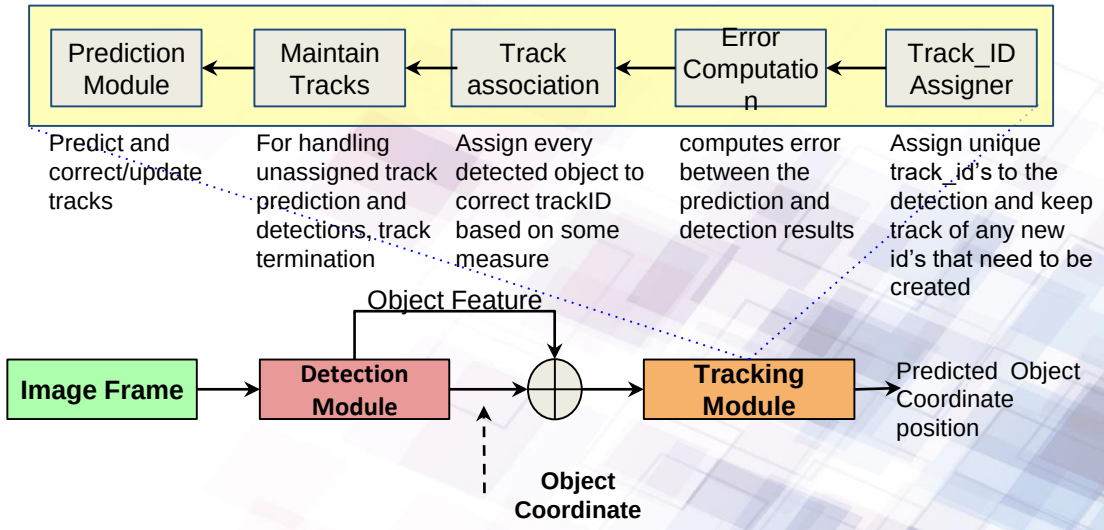


Interactive Segmentation

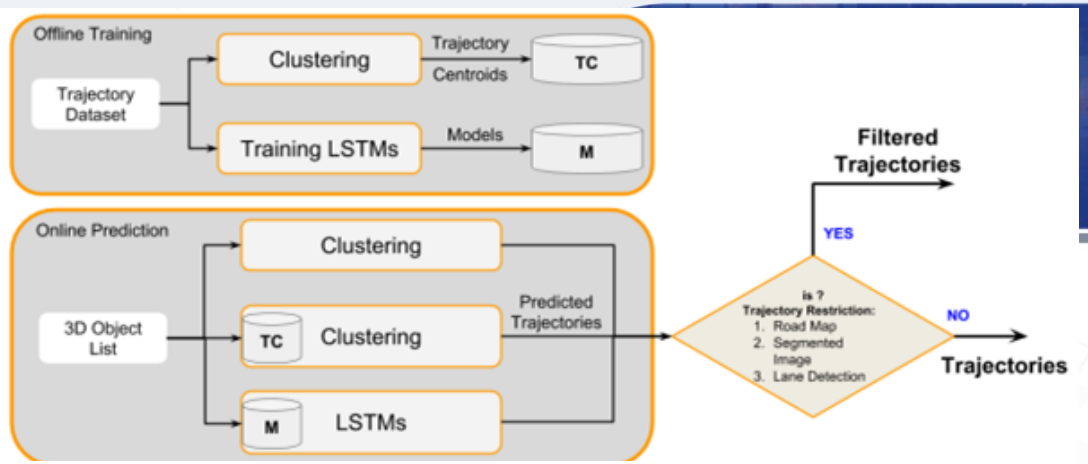


Ack: Dr Kevin McGuinness

Object Tracking



Path Prediction



Prediction in autonomous vehicles is all about how the ego vehicle is going to predict the trajectory or path of the other vehicles or pedestrians

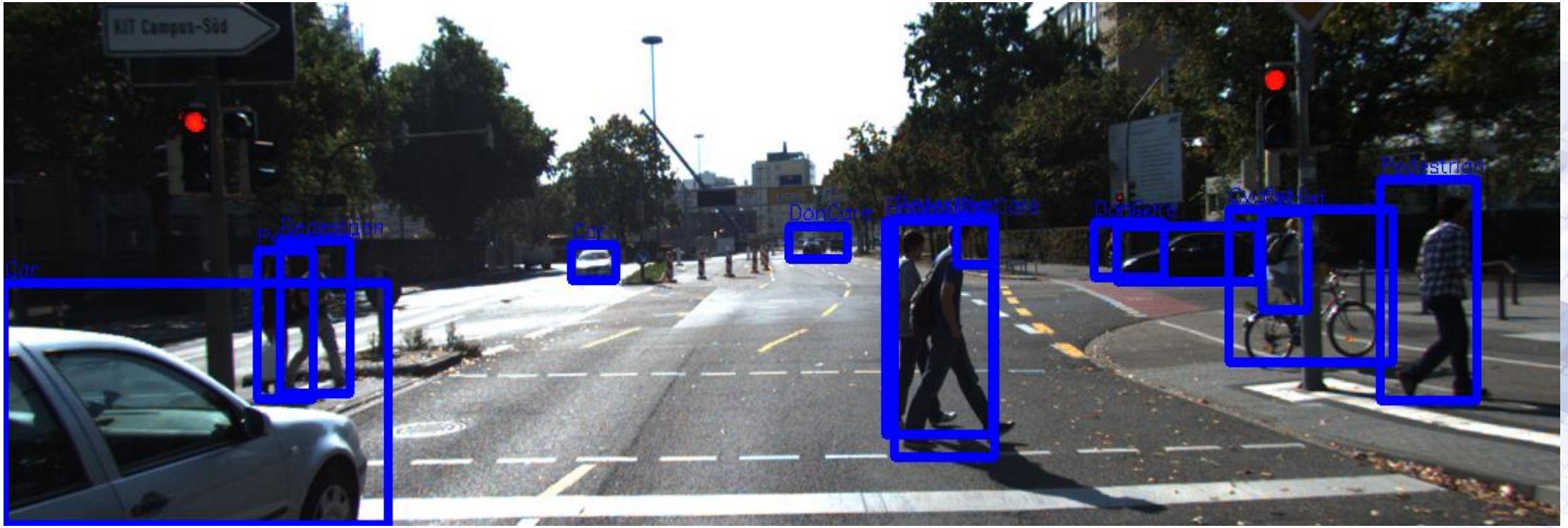
Ground Truth Tracklets

Prediction

Ground Truth Tracklets

Prediction

Dynamic Object Path Prediction



Public perception of what drivers do in semi-autonomous vehicles

Driver Behaviour Prediction

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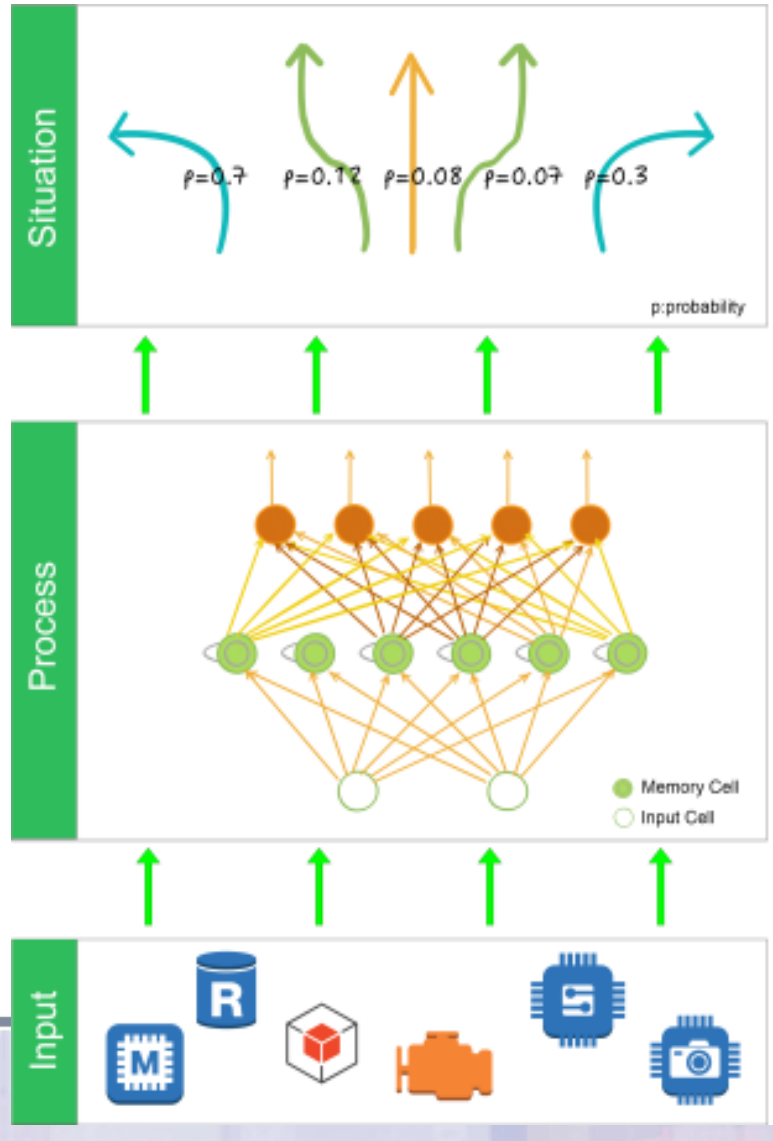
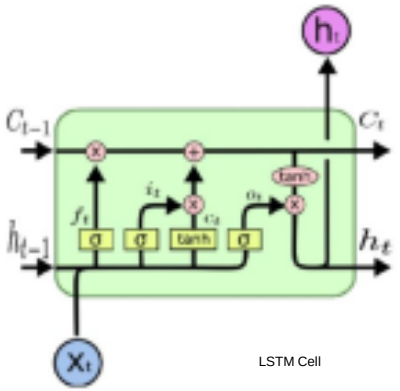
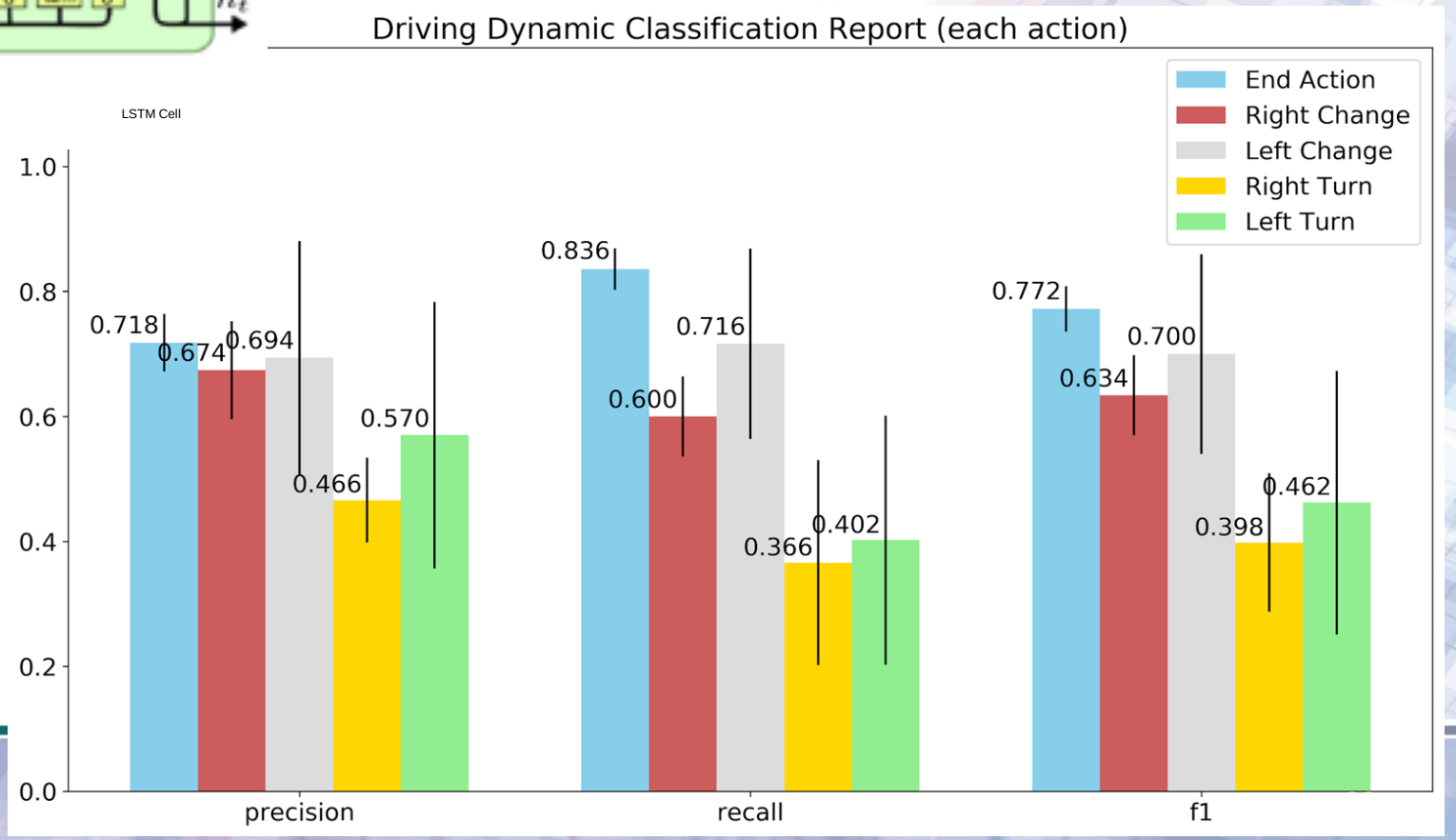




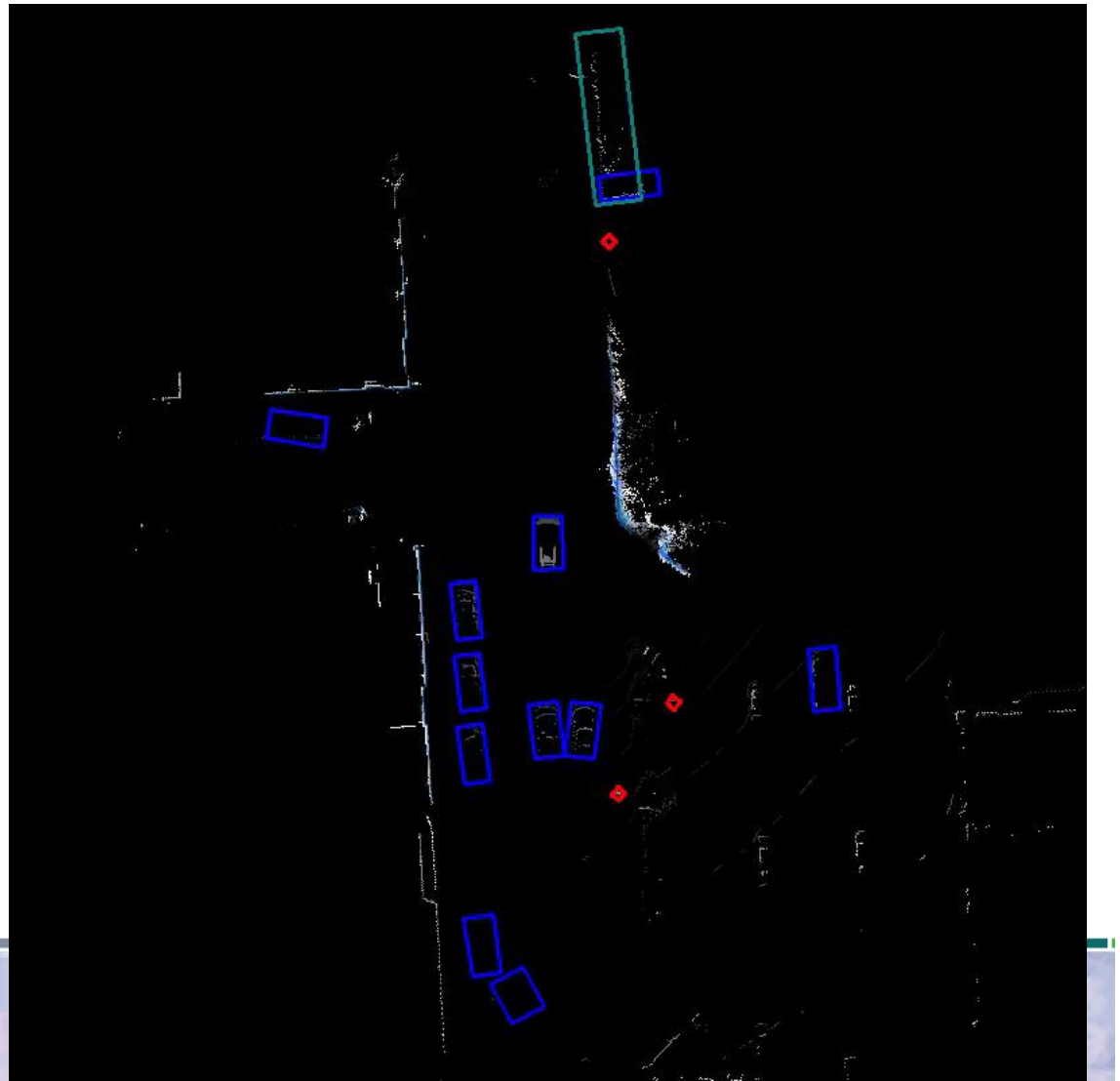


Demo – Right Turn

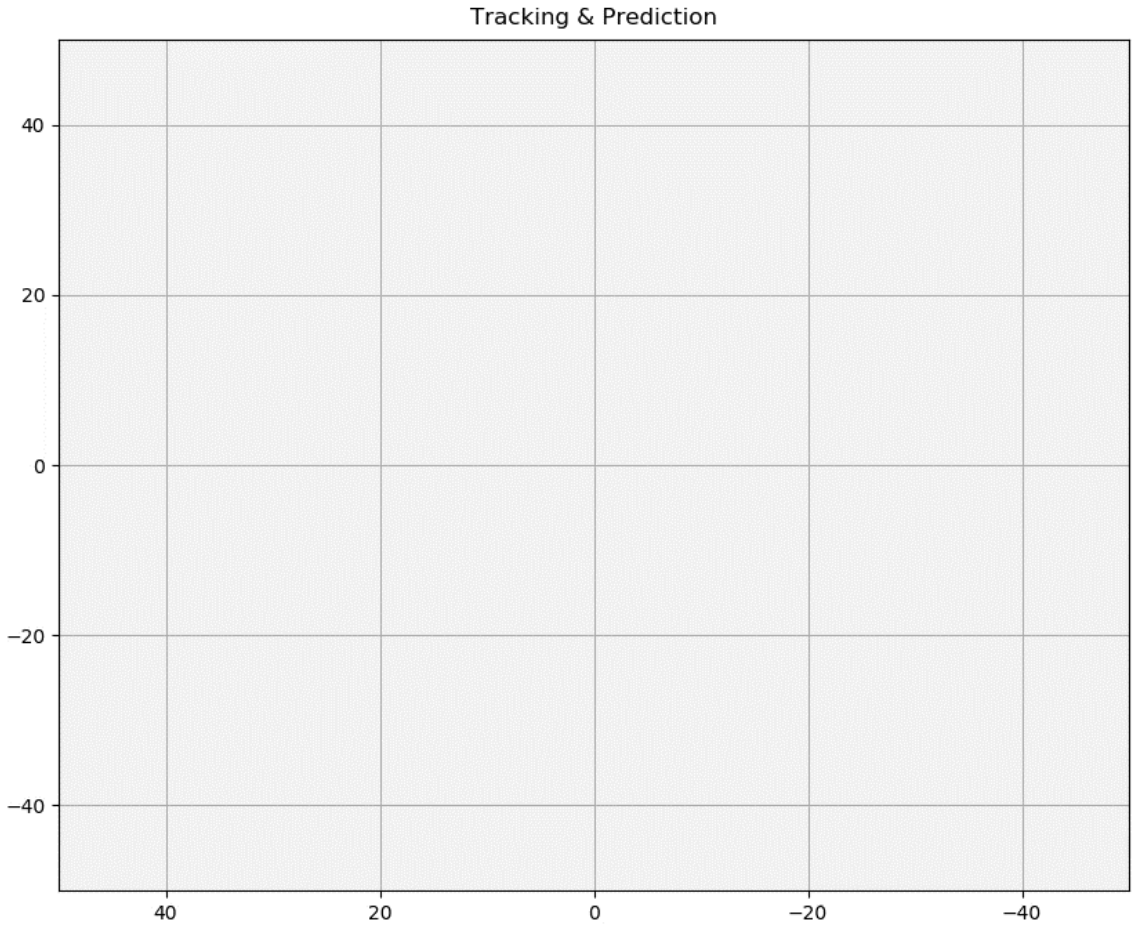
Demo – End Action

Scenario Detection/Classification

LIDAR point cloud Data



Tracking and Prediction Results - Car Only



Visual Analytics for Instrumented Vehicles

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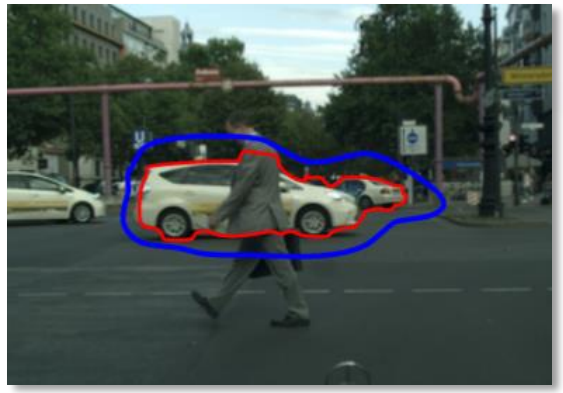

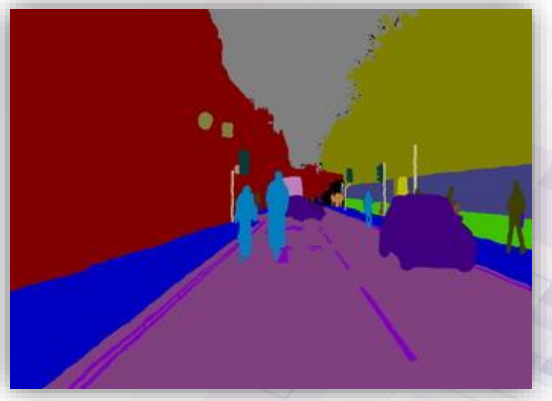

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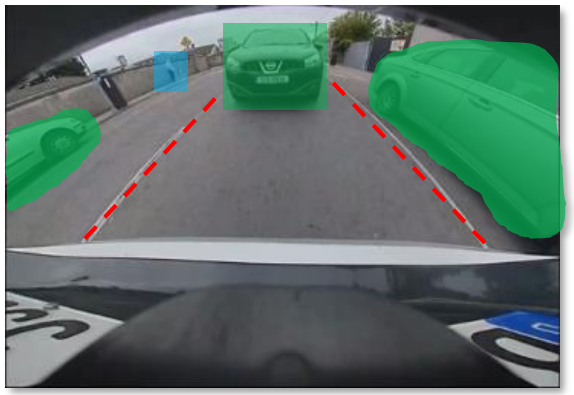

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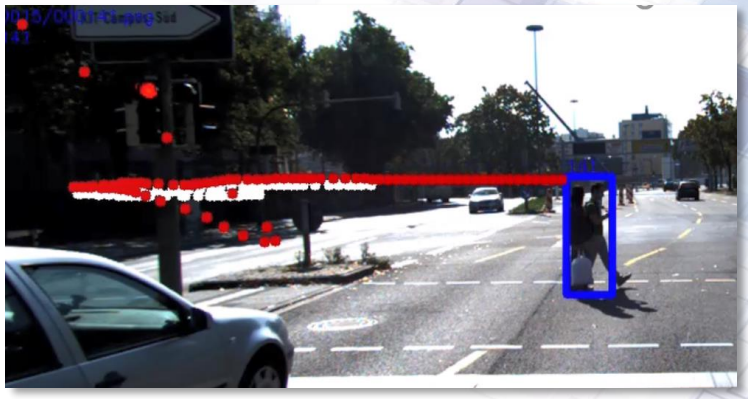

Data?

- Availability
  - Good academic datasets: KITTI, NuScenes, CityScape, DeepDrive
  - NVidia AI City Challenge (https://www.aicitychallenge.org/)
- Annotations
  - Not always available
  - Not always sufficiently detailed (tracks, bounding box vs pixel-level segmentation)
- Variety
  - Synchronised Sensor Data (LIDAR, telemetry, GPS, etc.)
  - Context …

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Saleh, K., Hossny, M., & Nahavandi, S. (2018). Effective vehicle-based kangaroo detection for collision warning systems using region-based convolutional networks. *Sensors*, *18*(6).

Volvo's driverless cars 'confused' by kangaroos

27 June 2017 Share

There are more than 20,000 kangaroo strikes each year in Australia

Volvo's self-driving technology is struggling to identify kangaroos in the road.

https://www.bbc.com/news/technology-40416606

Key challenges

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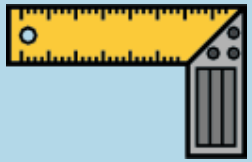
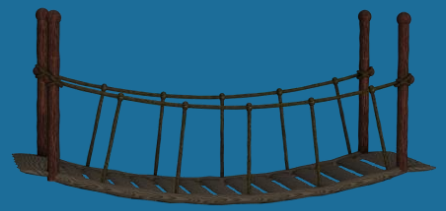
Multimodal

Scalable





Transferable

Contextual

Thanks to …

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