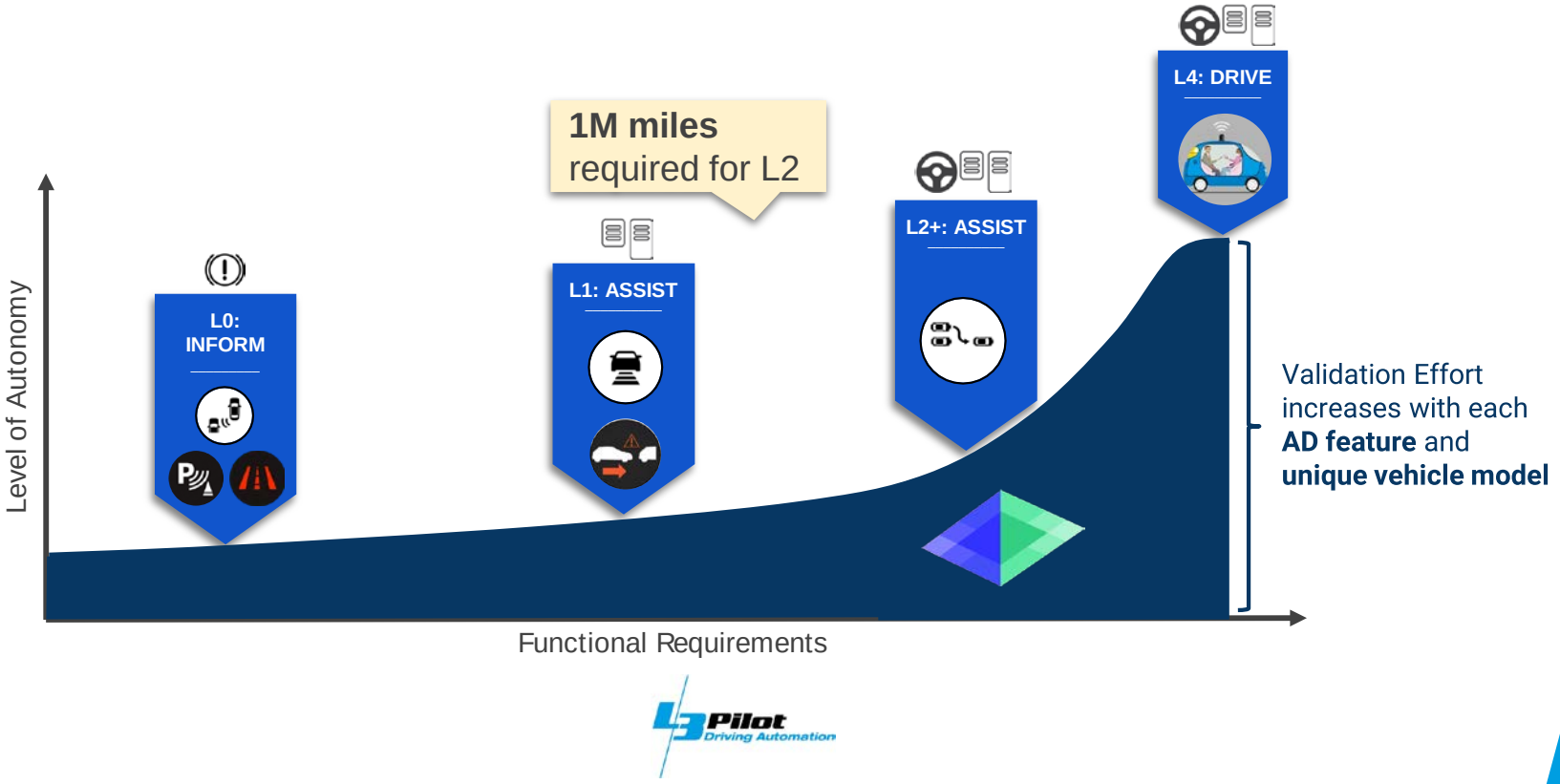
Deep Neural Networks based Simulation for Next Generation AD Virtual Testing

Virtual, 9 -10 September

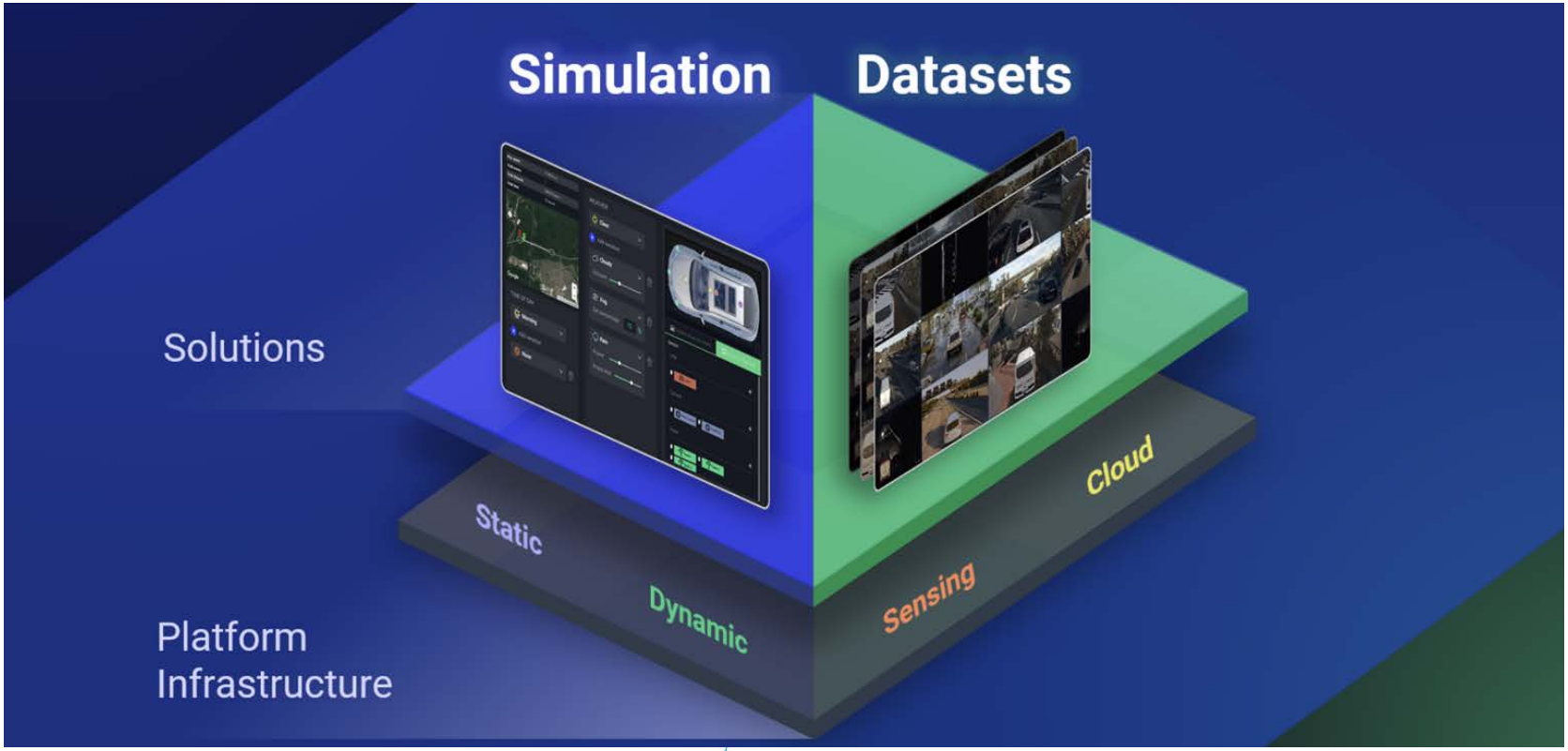
SUMMER SCHOOL 2020

Heikki Laine, VP Product
Cognata

ADAS/AD Validation is Data Heavy



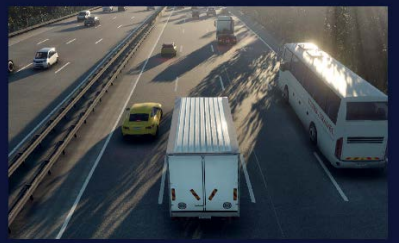
Cognata Solution Platform: Realism at Scale



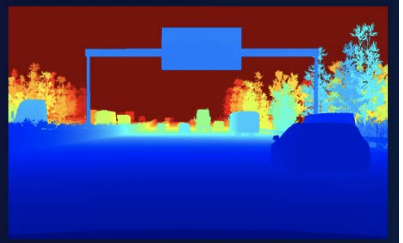
4 Layers of Technology

Static
3D World

Dynamic
AI & Traffic Models



Sensing
Emulation



Cloud
and Analytics

L3Pilot Driving Automation

Deep Neural Networks to Improve Fidelity

source : IDC 2019

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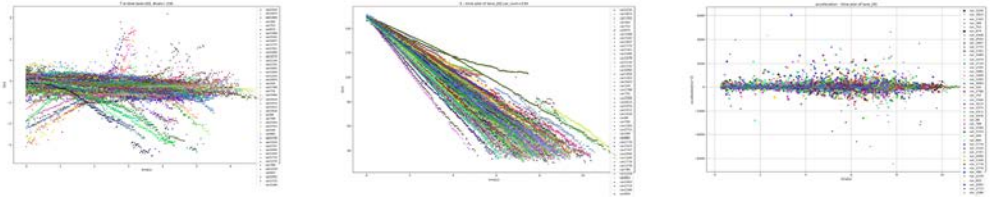
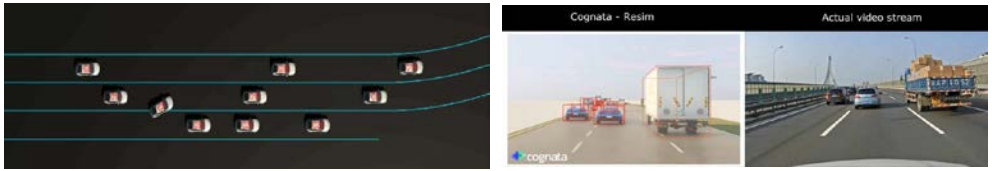
AI-based Traffic Model

1 Computer vision over camera feeds

2 Big Data analysis and DNN training

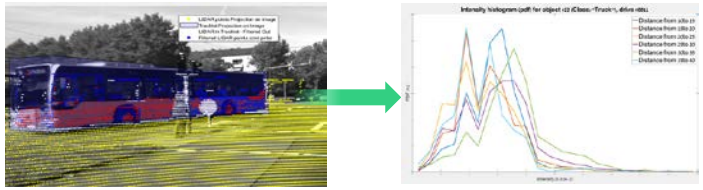


3 AI Based traffic model and Re-Simulation

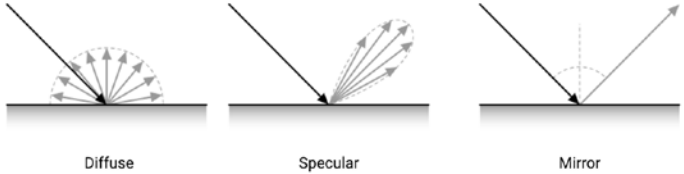


Extending Physical Sensor Rendering with Deep Neural Networks

1 Data collection and analysis



2 Physical modeling



3 AI Based rendering of Camera and Point Clouds

System in Action

source : IDC 2019

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A Library of 10,000x of AD/ADAS Scenarios with Millions of Permutations and Auto-Generation capability

Scene	
Map:	T-junction
Actor:	Pedestrian
Static object:	Occluded view

Scenario	t=0	Ego at Junction	Ego post junction	End of simulation	Notes
Ego					
Lateral position	Right lane				
Longitudinal location	25 meters before function	Junction	After junction		
Lateral activity	Going straight	Turn right	Going straight		
Longitudinal activity	Driving forward				
Speed	Variable #1: [Vego]				
Acceleration	0				
Actor					
Direction	Same as ego				
Lateral position relative to Ego	Right of Ego				
Lateral offset from junction	Variable #2 : [Dact]				Refers junctio nearest edge to Actor
Longitudinal position relative to Ego					
Longitudinal distance from Ego					
Activity	Standing	Walking			
Speed	0	Variable #3: [Vact]			
Acceleration		0			
Analysis on Ego					
Lateral position			Right lane	Right lane	
Relative distance to Actor			No crush	No crush	
Analysis on Actor					
None					

L3Pilot Driving Automation

Flexible KPI Analysis with Python API

HeadwayCheckRule

Name *

HeadwayCheckRule

Description *

Fail if the headway to collision with front car is less than acceptable, otherwise pass.

```python
import cognata.dynamicAnalysisRules
import cognata.dynamicAnalysisRules.models as models


# Function marked as on_frame() will be called for every frame. Must be implemented
@cognata.dynamicAnalysisRules.on_frame()
def frame(frame_data: models.FrameData, *, acceptable_headway: float = 1.0) -> models.Result:
    status = models.RuleStatus.NO_DATA
    msg = ""
    try:
        speed = frame_data.gps.speed
        distanceToCollision = frame_data.surroundings_info.distance_to_nearest_target
        headway = distanceToCollision / speed
        if abs(headway) >= acceptable_headway:
            status = models.RuleStatus.PASS
            msg = ""
        else :
            status = models.RuleStatus.FAIL
            msg = f"The headway is: {headway} which is less than acceptable headway: {acceptable
    except AttributeError as e:
        msg = f"{e}"
    return models.Result(status, msg)

```

HeadwayCheckRule : Headway Check Rule 1

Fail if the headway to collision with front car is less than acceptable, otherwise pass.

Rule Definitions

Rule ID

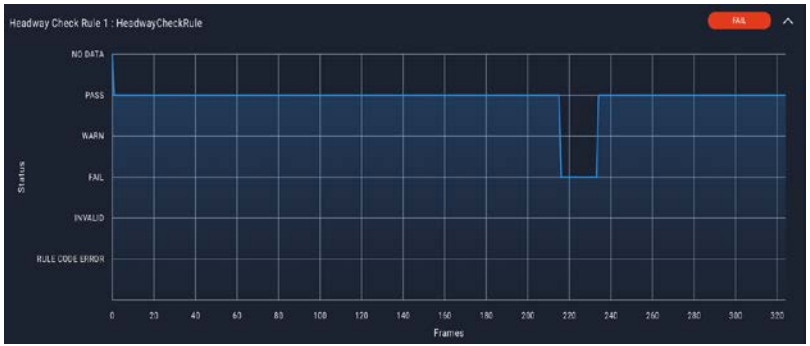
Headway Check Rule 1

acceptable_headway

1 {x}

Testing a Feature - End to End

AEB ON



Scenario

DNN Rendering

KPI Analysis with Scale (Cloud)

Cognata at a Glance

Founded	Employees	Team
2016	45 and hiring	HARMAN, SAMSUNG, GE, Honeywell, Mobileye

Raised	Investors	Partnerships
>$23M	SCALE Venture Partners, GiTV, E-MERGE, MANIV MOBILITY, AIRBUS VENTURES	DASSAULT SYSTEMES, NVIDIA, Microsoft, ZF

Thank you for your kind attention.

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Colours

Primary colours

R 0 G 158 B 255	R 109 G 207 B 246	R 199 G 234 B 251
R 0 G 0 B 0	R 109 G 110 B 113	R 230 G 231 B 232

Secondary colours

R 0 G 105 B 145
R 198 G 63 B 57