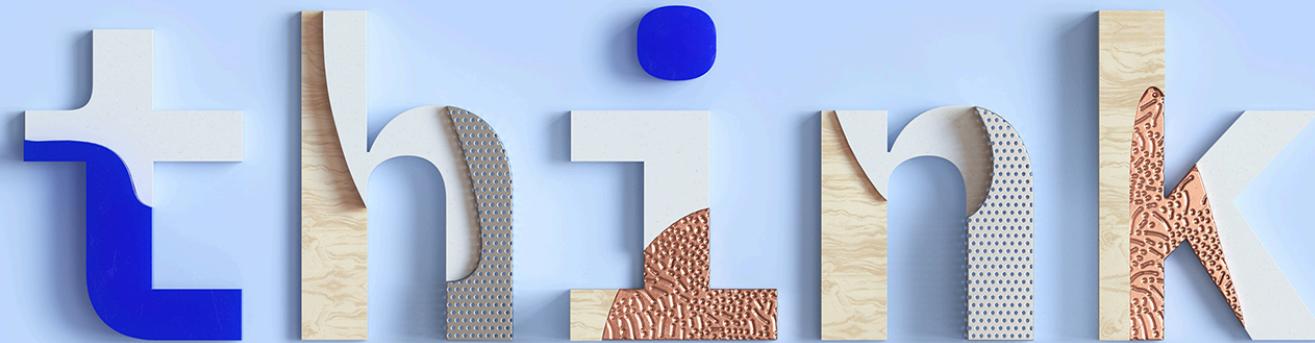


# New Driver Assistant System from HASCO VISION:

## IBM AI Technology Enables AI for Car



Kangyuan Chen   Lizhai Li, HASCO VISION

Job Title

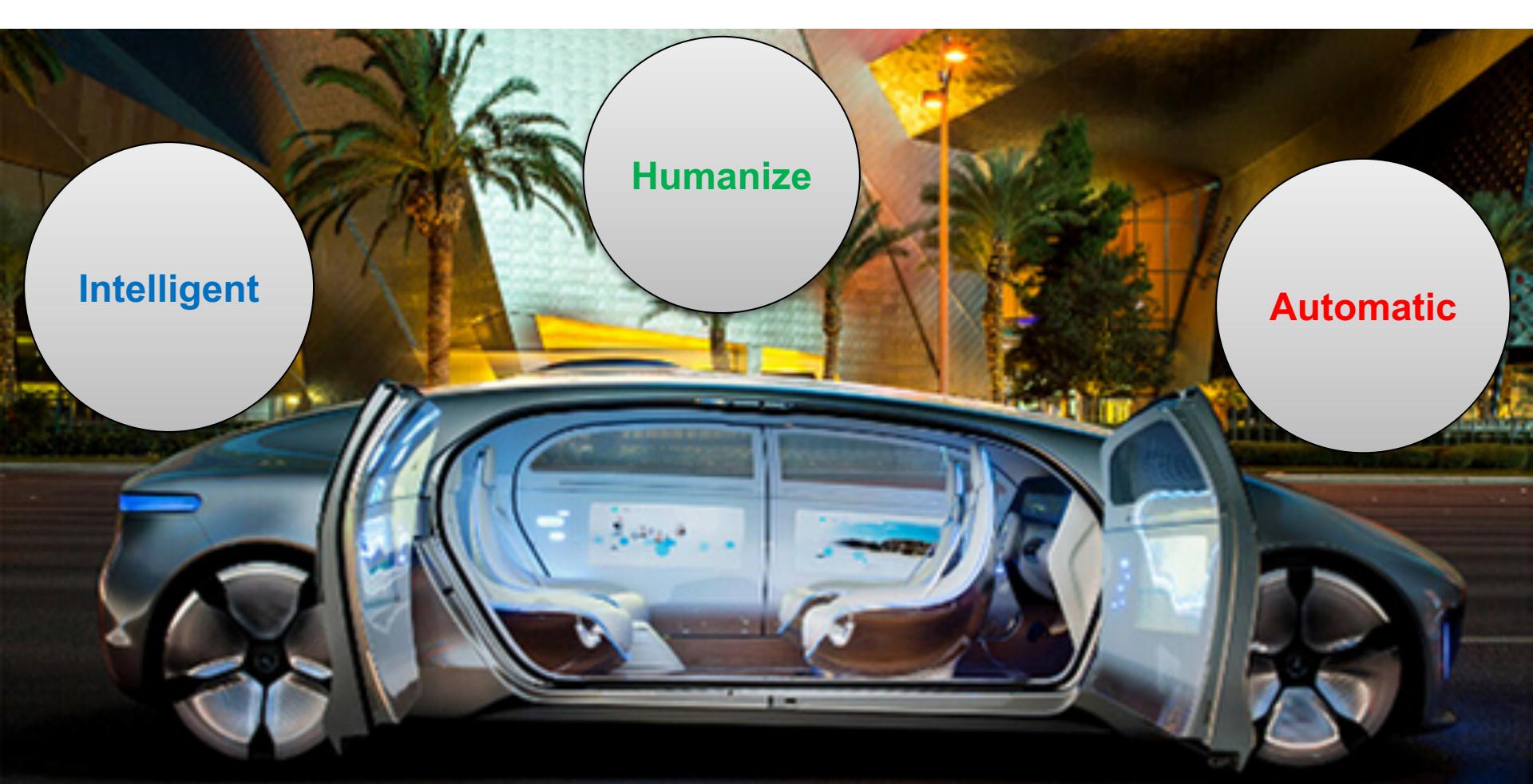
Job Title

Yonghua Lin, IBM Research

Distinguished Engineer,  
Leader of AI System and Vision

# Outline

- **Vehicle industry and HASCO VISION**
- **New generation ADAS: Expectation, Requirement and Challenges**
- **IBM AI technology (PowerAI Vision) helps HASCO VISION**
- **Future Expectation.**



# Leadership in Market

Introduction of HASCO VISION

1989	• Shanghai Koito Established	2016	• H.A Germany Office started to use
1996	• Access into Jiading District		
2002	• R&D center Established	2017	• The second stage of Wuhan Branch in plan
	• US office Established	2018	• <b>Hasco vision technology Co., Ltd.</b>
2005	• Chongqing Branch Established		
2006	• Shanghai new plant Established		
2009	• Yantai Branch Established		
	• North-East Office		
2010	• Jinlin Branch Established		
	• Changzhou Branch Established		
2011	• Wuhan Office		
	• Frankfurt Office		
2012	• Wolfsburg office		
	• Wuhan branch Established		
2015	• H.A company Established		

# 14

## Global Footprints

Manu. Plant



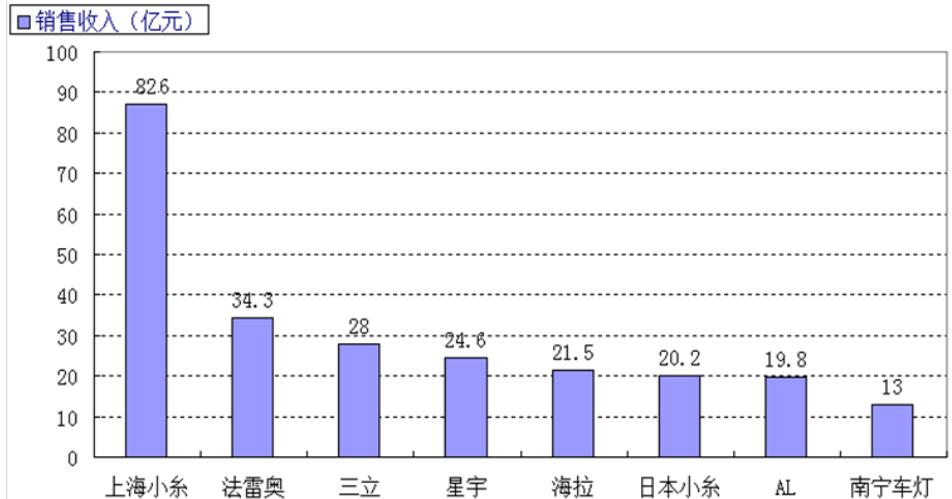
R&D OFFICE





## ■ 行业地位和竞争力

主要车灯企业销售收入



- 销售额在整个行业内连续二十年以上稳居第一，且遥遥领先于第二名销售业绩。
- 2016年销售从规模上在全球也已挤入前6名。

### 行业产销排名的说明

上海小糸车灯有限公司：

你公司在二零一六年汽车灯具总产值 851411 万元，销售总金额  
959226 万元，在中国汽车灯具行业中产销额均为第一名。

特此说明

中国汽车工业协会车用灯具委员会



# HASCO VISION Leadership in industry

**1999**

1<sup>st</sup> LED HSL  
On SATANA in China



**2004**

1<sup>st</sup> AFS  
On Reiz in China

**2009**

1<sup>st</sup> 2-color Lens Mold Tooling  
On Q5 in Asia



**2014**

1<sup>st</sup> Full LED CHL  
On ROWAE 950



**2016**

1<sup>st</sup> FVCM with whole IP  
On ROWAE e950 in China



**2000**

1<sup>st</sup> Constant Current Motor  
On POLO CHL in China



**2007**

1<sup>st</sup> D1 xxx  
On ROWAE 750 in China



**2013**

1<sup>st</sup> LED FFL  
On Lacrosse in China



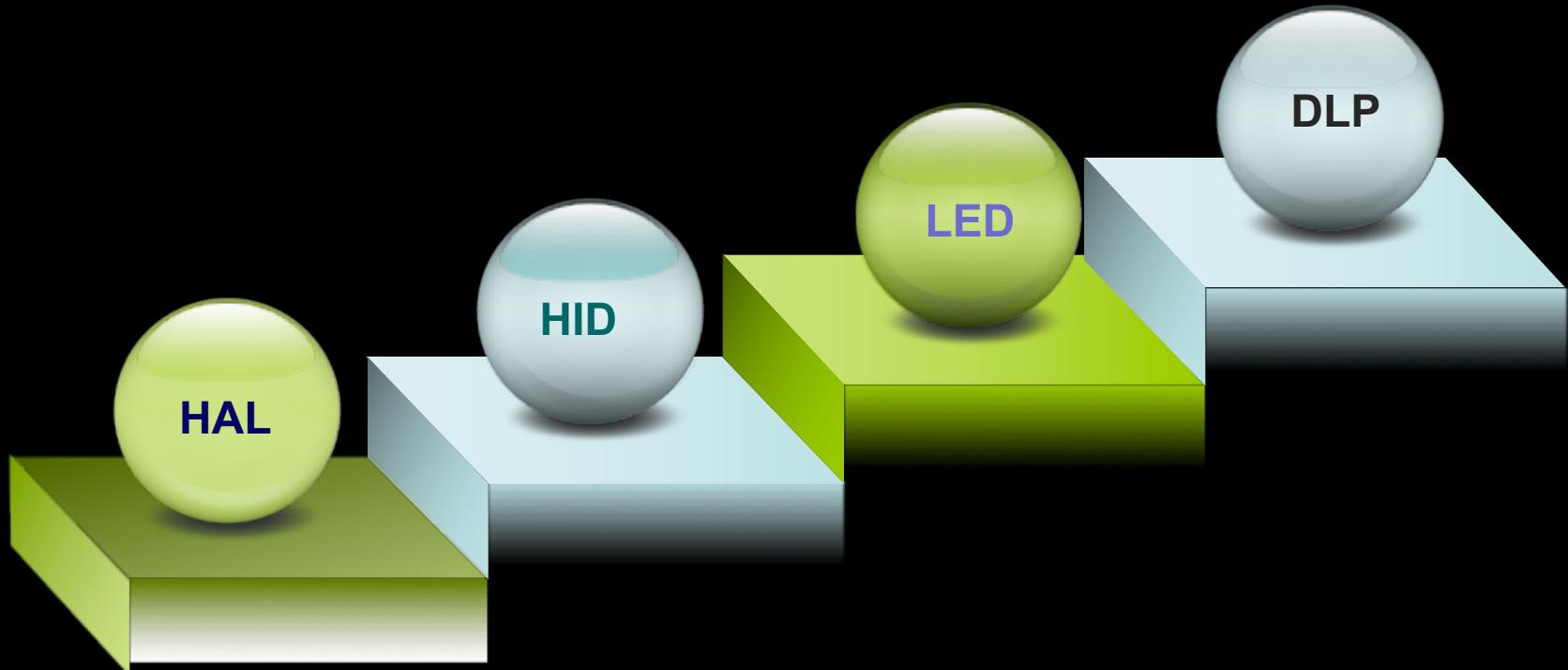
**2016**

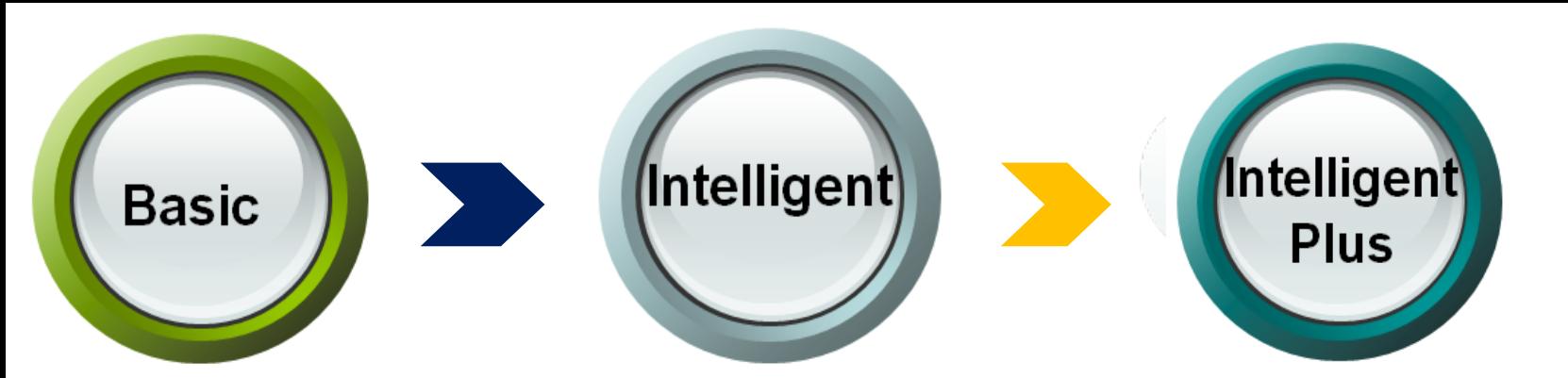
1<sup>st</sup> Full LED MATRIX Headlamp  
Supporting High Intelligent ADB  
On ROWAE e950



# New Generation Lamp System and ADAS with AI

Expectation, Requirements, and Challenges





- **IHC**-Adaptive High Beam Control
  - **All Basic Features**
  - **+**
  - **LBC**-Light block control for following & meeting Vehicle
  - **CLE**-Crossing light enhance
  - **CLS**-Curve light automatic steering
  - **Glare Prevented**-Glare prevented for ground water, traffic sign
- **All Intelligent Features**
  - **+**
  - **LBP**-Light block precisely (Front/Rear windshield, rearview mirror)
  - **LPR**-Light remind for Pedestrian
  - **IDP**-Intelligent driving information projection

2013

## ADAS advance research

Research on the technical implementation of vehicle light combined with intelligent driving



2016

## FCM1.0 2016/04 SOP of SAIC E950

Basic on Matrix LED for ADB

- ◆ Function : ADB,LDW

## FCM2.0 advance ADB(support vehicle control)

Function target

- ◆ Intelligence ADB (block control for following & meeting

Vehicle, Crossing light enhance, Curve light automatic steering and etc)

- ◆ Support LKA、AEB-city、data fusion

today

&

next

## FCM3.0 Base on Deeping learning

Category	For Regular ADAS	Special Needs of ADB (~ Night ~)
<b>Vehicle</b>	<ul style="list-style-type: none"> <li>• Type</li> <li>• Position</li> <li>• Motion</li> </ul>	<ul style="list-style-type: none"> <li>• Position of windshields</li> <li>• Position of external mirrors</li> </ul>
<b>Road Lane</b>	<ul style="list-style-type: none"> <li>• Type</li> <li>• Position</li> <li>• Curvature</li> </ul>	<ul style="list-style-type: none"> <li>• Zebra</li> <li>• Guide</li> <li>• Stop</li> </ul>
<b>Pedestrian</b>	<ul style="list-style-type: none"> <li>• Type</li> <li>• Position</li> <li>• Motion</li> </ul>	<ul style="list-style-type: none"> <li>• Position of Head</li> <li>• Focus of eyes</li> <li>• Orientation, Gender etc.</li> </ul>
<b>Traffic Sign</b>	<ul style="list-style-type: none"> <li>• SPI</li> </ul>	<ul style="list-style-type: none"> <li>• Country</li> <li>• Category</li> <li>• Meaning</li> <li>• Position</li> <li>• Optical Properties</li> </ul>
<b>Misc</b>	N/A	<ul style="list-style-type: none"> <li>• Water Pool</li> <li>• Road Trend</li> <li>• Street Lamp</li> </ul>

# Technical challenges for computer vision

- Detection for traffic sign as far as possible and in night time: Extremely small object detection
- Different weather situation (raining, snowing, and foggy, etc.)
- Shape distortion due to the angle between the camera and sign.
- A large number of categories:
  - Only for traffic signs -- hundreds of types for China, Germany and US.

Ideal case



A possible image may appear in  
ImageNet or COCO

Real case



Bad Weather Condition



Shape distortion



Complicated illumination



Extremely small object

# Enable AI from Data Center to Vehicle

IBM AI Technology: PowerAI Vision

When enterprises going into AI area ...

VALUE

TALENTS

DATA

ECONOMY

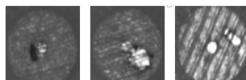
# Enable AI capability for enterprise

## Enterprise R&D

### Enterprise DATA



**VIDEO**

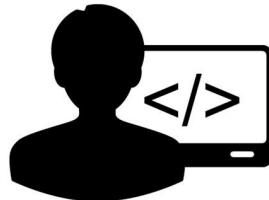
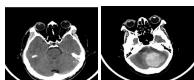


**TEXT**

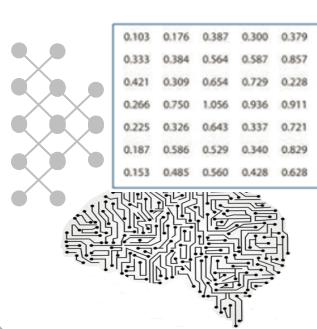


**AUDIO**

**PICTURES**



### Machine Knowledge

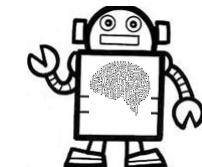


## Enterprise Production Environment

### AI Execution



### AI in edge



# Enable AI capability for enterprise

## Enterprise R&D

### Enterprise DATA



### PowerAI Vision: Development Pipeline



ML & DL Libraries & Frameworks

Container Cloud with GPU

Data Lake & Data Stores



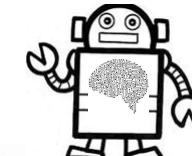
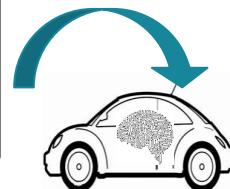
PowerAI Accelerated Servers

Storage

## Enterprise Production Environment

### AI Execution

### AI in data center



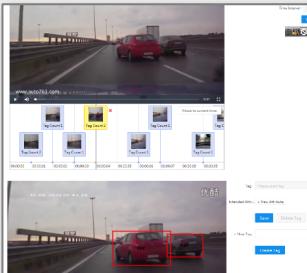
### AI in edge



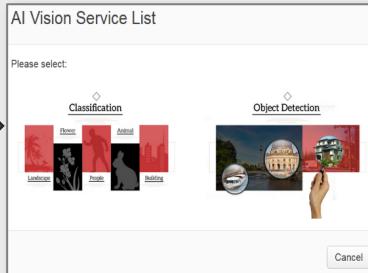
# Enable the AI from Datacenter to ADAS in Car

With PowerAI Vision, automotive enterprise could build an end-to-end deep learning development platform for ADAS.

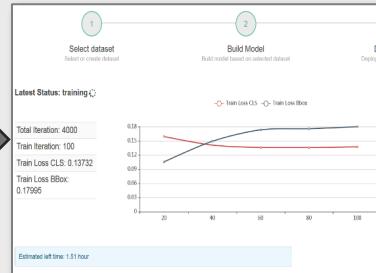
1. Data labeling for traffic sign, vehicle, or pedestrian



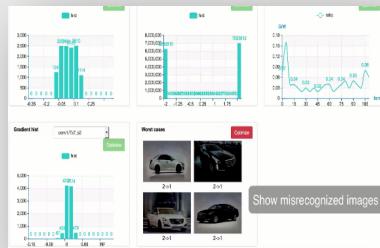
2. One-click to start the new object detection training



3. Visualize the training progress



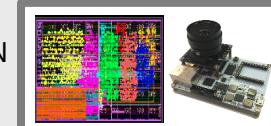
4. During the training, developer could get the training analysis from DL Insight



5. One-click to deploy the new model for ADAS simulation testing in data center with Minsky cluster



6. One-click to generate the DNN accelerator and download into ADAS FPGA chip for road-test



7. Road-test with DNN accelerator in the car



ADAS DNN module prototype

Real-time display the road-test result

# Technical challenges for computer vision

- Detection for traffic sign as far as possible and in night time: Extremely small object detection, 12pixels\*12pixels, should detect ahead 70m, to achieve high reliability (precision >0.9, recall>0.9, under IOU=0.8).
- Different weather situation (raining, snowing, and foggy, etc.)
- Shape distortion due to the angle between the camera and sign.
- A large number of categories: Only for traffic signs -- hundreds of types for China, Germany and US.

## Ideal case



A possible image may appear in ImageNet or COCO

## Real case



Bad Weather Condition



Shape distortion



Complicated illumination



Extremely small object

Object detection with  
Tracking technology

Transfer Learning

Data Augmentation

Auto Machine Learning

# Enable AI models into embedded system in vehicle



## Different architecture

Difficult for coding

## Tiny resource

Need highly optimization for computation and memory

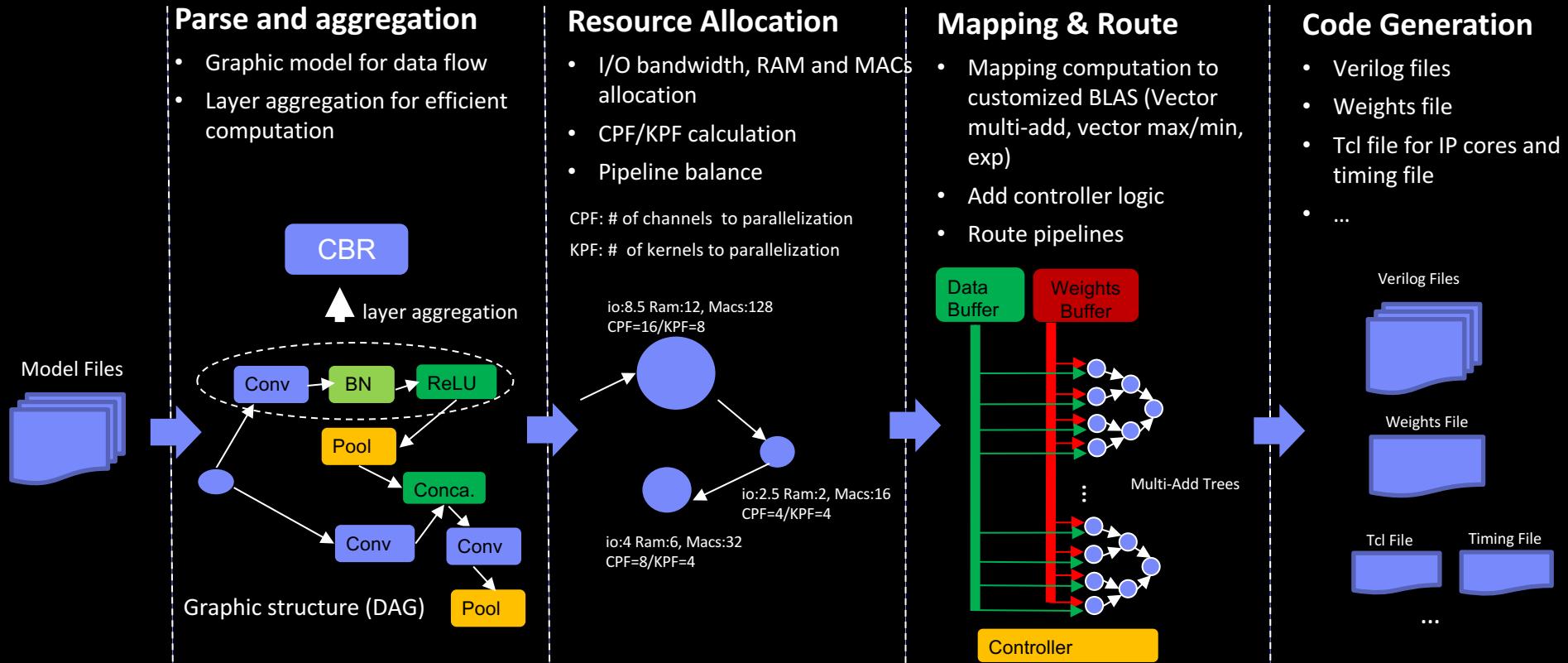
## Real-time performance

Design for throughput and extremely low latency

## High accuracy

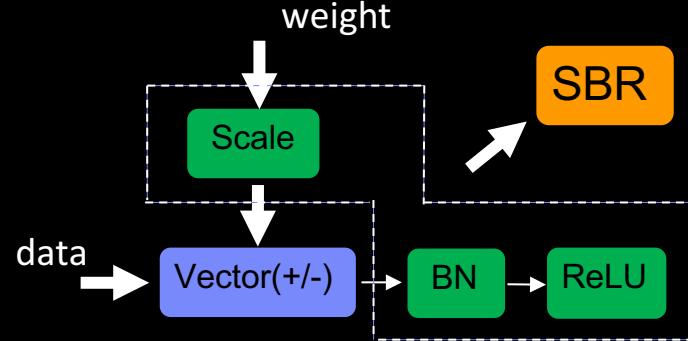
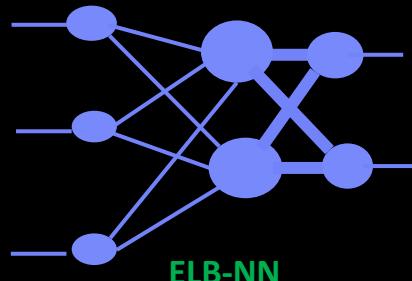
Keep the same accuracy as that in data center

# IBM PowerAI Inference Engine : Generate AI accelerator without programming -- Release time for innovation



# System Efficiency: Extremely low bit-width neural network (ELB-NN) (5~10x)

- Balance accuracy and throughput.
- Use relatively high precision weight (4/8bits), ternary and binary weight in hybrid way according to the layer attribute.
- FPGA oriented hybrid quantization scheme, the activation of each layer could be quantized to different bit-width (1/2/4/...) through optimization search by considering layer attribute, accuracy loss and throughput requirement.
- Aggregate weight scale, batch norm and ReLU to a single SBR operation.
- The pipeline and network structure oriented AccDNN could implement ELB-NN in FPGA in an very efficient way.



# Demo video for traffic sign detection

(here, there will be 3 video streams embedded)

Our Next  
(here, we will embed the annimation)

# HASCO VISION: Future Roadmap

# *Video*

*dlp | fvcm | digital | interior ...*

# Thank you

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