AI and Intelligent Vehicles Future Challenge (IVFC) in China: From Cognitive Intelligence to Parallel Intelligence

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The State Key Laboratory for Management and Control of Complex Systems

Institute of Automation, Chinese Academy of Sciences

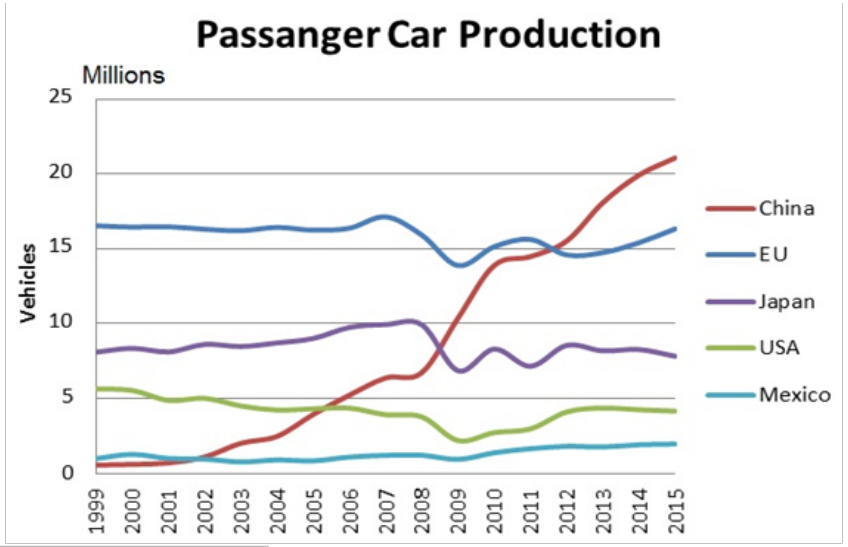
Qingdao Academy of Intelligent Industries, China

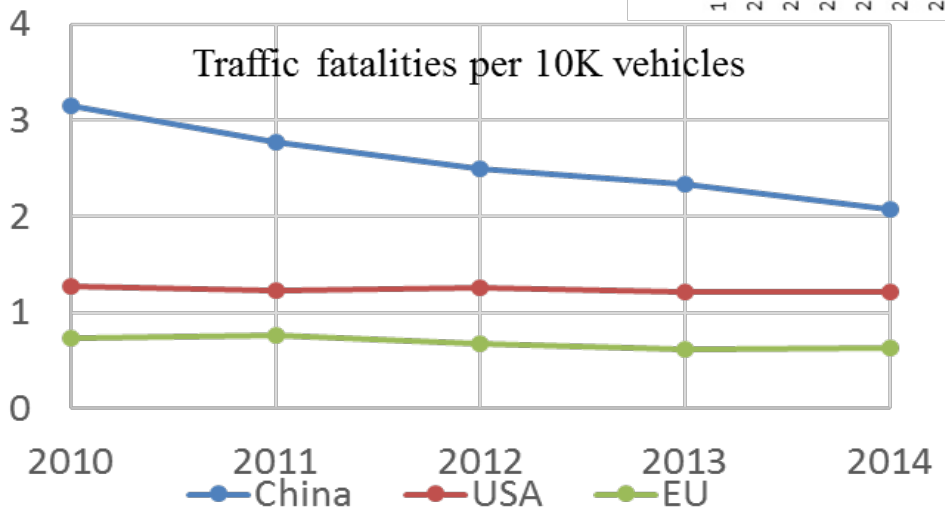
Nanjing, China, 28 November 2017

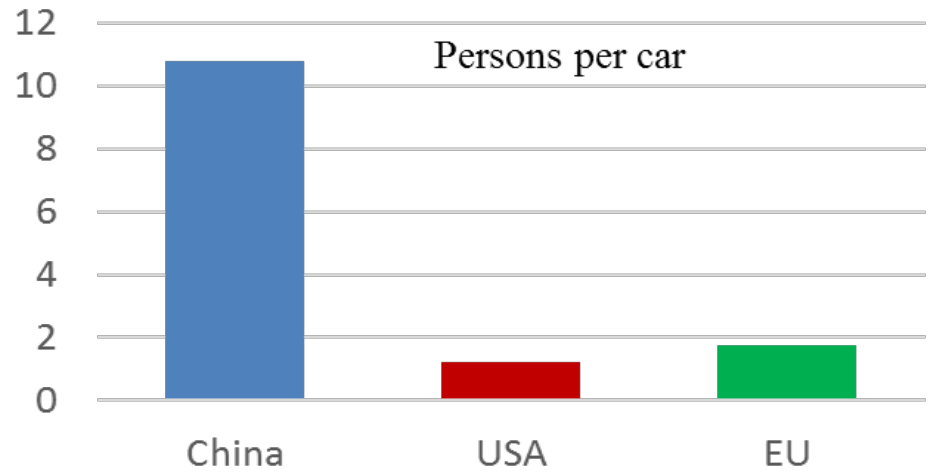
Outline

- Intro & roadmaps
- AI and Intelligent Vehicles Future Challenge (IVFC) in China
- Automated driving: From cognitive intelligence to parallel intelligence
  - Framework of cognitive intelligence
  - Framework of parallel driving
- The Future
- Welcome to IEEE IV'2018

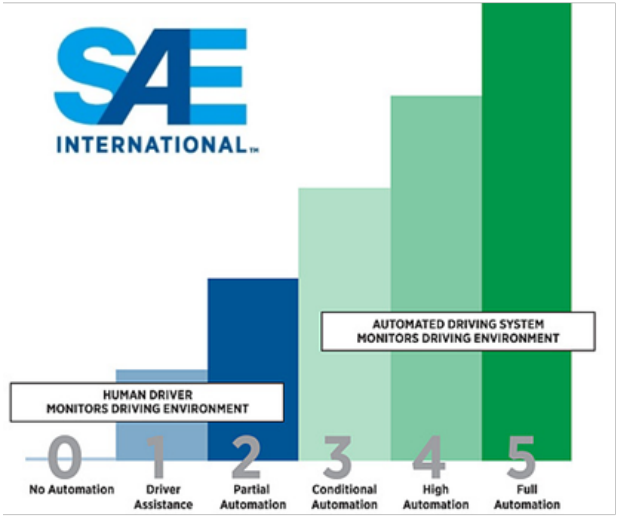
China: Largest Auto Producer, Yet a Long Way to Go





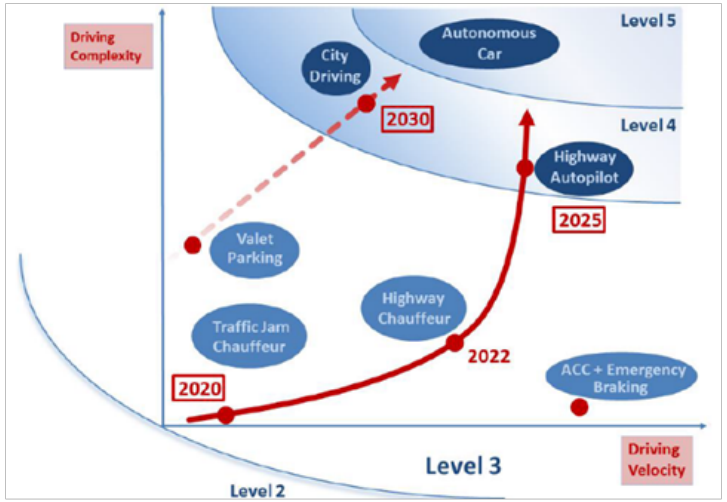


Vehicle Automation: Definitions & Roadmaps

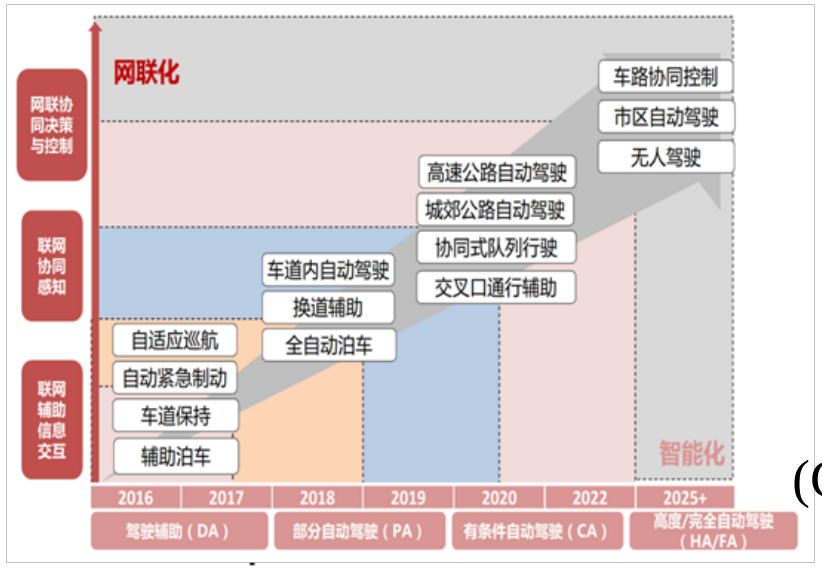


(US)

- By 2020: L3 at low speeds or less complex driving scenarios;
- By 2025: L4 on motorways;
- By 2030: L4 in cities (urban driving).

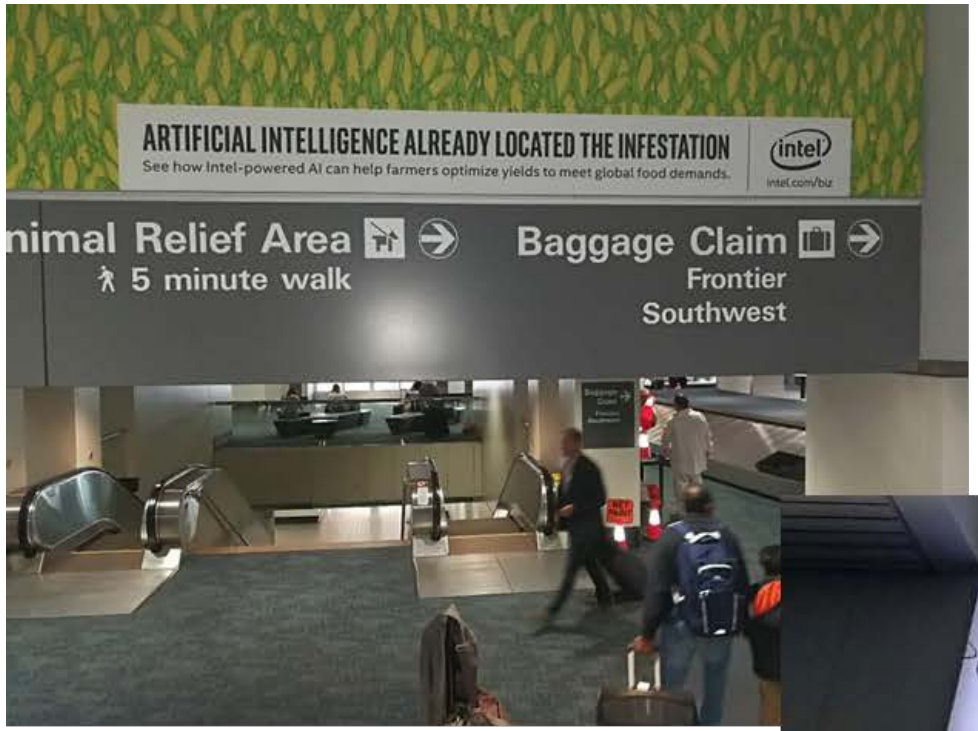


(EU)



(China)

New IT @ SFO Today



Down-stairing with Intel's AI

Up-stairing with Amazon's Clouds

News from Yesterday

- Vehicle sales will drop due to the proliferation of on-line ride-harling
- By 2040, 80% of the vehicles sold around the global, will still use some kind of petroleum fuel
- According to IHS Markit research, the sales of personal vehicles will drop significantly in the next 23 years
- In 2040, the sale volume will drop from 67 M (now) to 54 M (2040)

*A Simple Solution to A Complex Task……*If Vehicle Intelligence is Real!

Q&A

Old Wang:

How to achieve autonomous driving?

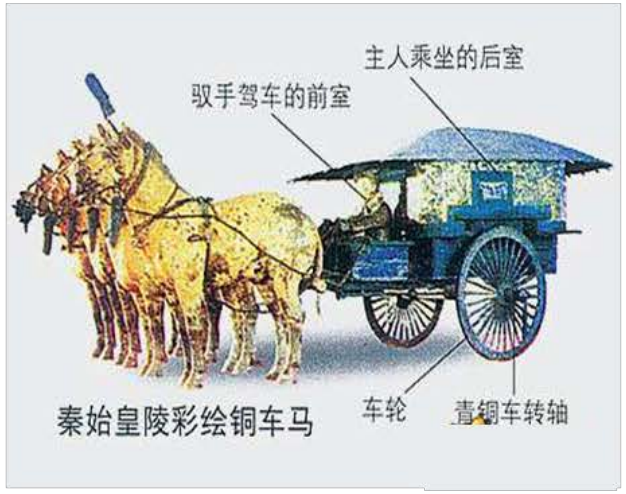
Smart Car:

No human-driven vehicles allowed on road!

A Lesson from Chinese History

A “Road” in Chinese is Called “马路” = Horse + Path

Horse



Path

Unearthed Chinese ancient “铜马车(Smart Royal Car)”, driving on Chinese ancient “秦直道(Highway)”, navigated by compass (~220 BC).

Where are the Horses Now?

Horses on road today…Standing!

Horses off road today…Racing!

In the past, everyone had a horse.
Today, only rich ones can afford it!

Where will Human-Driven Cars be in the Future?

Cars on road in the future…Parking!

Cars off road in the future…Exciting!

Today, everyone has a human-driven car.
In the future, only rich ones can afford it!

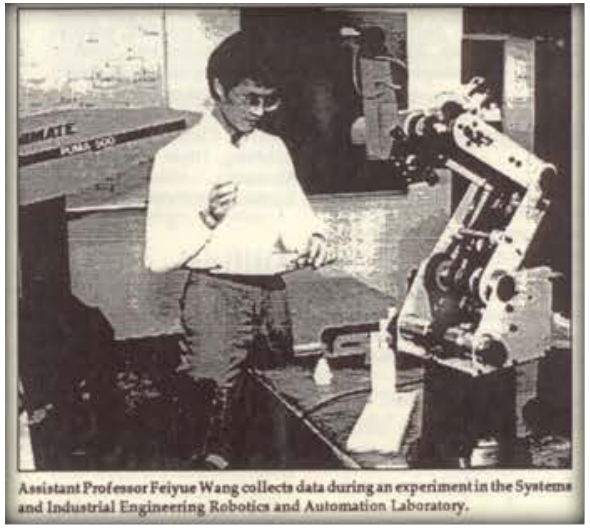
Understanding Change - the "Red Flag Act"

The Locomotives Act 1865 (Red Flag Act)
In the United Kingdom

A law that limited the speed of the new so-called *automobile* to 2 miles per hour in urban areas, and required them to always have a crew of three: a driver, a stoker, and a man who would walk ahead (60 yards) of the automobile waving a red flag.

It caused the inevitable technology shift to delay in United Kingdom, and therefore, the car industry of the United Kingdom lost considerable competitive edge against its foreign competition, being ten to fifteen years late into the game.

A Personal IV Journey, Phase One: Automated Driving
From Mobile Robots to Automated Vehicles


Assistant Professor Feiyue Wang collects data during an experiment in the Systems and Industrial Engineering Robotics and Automation Laboratory.

Mobile Robots
(NASA Center for Intelligent Robotic Systems for Space Exploration, 1980s)

Spiderobots for Lunar/ Martian Exploration
(NASA Center for In Situ Resource Utilization, 1990s)

Automated Mining Trucks
(Caterpillar AutoDig Project, 1990s)

VISTA Car
(Arizona DoT, 1990s – 2000s)

A Personal IV Journey, Phase One: Automated Driving
From Mobile Robots to Automated Vehicles

VISTA Car (automated driving)
(Arizona DoT, 1990s – 2000s)

ARIZONA DEPARTMENT OF TRANSPORTATION

ARIZONA TRANSPORTATION RESEARCH CENTER
1130 N. 22nd Avenue, Phoenix, Arizona 85009
Phone 602-255-6910 / Fax 602-256-6367

JANE DEE HULL
Governor

TOM SCHMITT
State Engineer

MARY E. PETERS
Director

May 3, 1999

TO: Dr. Fei-Yue Wang
University of Arizona
Systems and Industrial Engineering Department
P.O. Box 210020
Tucson, Arizona 85721-0020

FROM: Steve Owen - ATRC Project Monitor

SUBJECT: **Vehicles with Intelligent Systems for Transport Automation (VISTA) Program Public Demonstration – April 27 & 28, 1999**

Dear Dr. Wang:

Thank you very much for all of your hard work to successfully carry out the first Arizona test of the VISTA "Smart Car" Research Program on the Squaw Peak Freeway, SR 51, in Phoenix. This first public demonstration of the systems developed and integrated by your team from the University of Arizona and from Arizona State University represented an excellent effort by everyone involved. The event was certainly successful, and your help was very important to the final results.

Your research team put in many long hours of hard work for almost a week at the SR 51 testing site. Although ADOT and the ATRC did all we could to provide the equipment and services needed for this critical demonstration, it was your team's hard work, positive attitude and endurance, plus their relentless approach to refining the system performance, that really made the demonstration a success.

It is also very significant that the work was conducted safely, without any incidents or delays, despite working around contractors and third-party vehicles for the entire project duration. Your students and research staff were always alert to occasional traffic in the test zone, and they did a professional job of watching out for their passengers, themselves, and those around them.

Finally, credit is due to you, your colleagues and your students for working so effectively with the various media who attended the demonstration. Their ability to explain the concepts, communicate at the media level, and accommodate their special needs was a real asset. The resulting press coverage was very positive for ADOT and for the two VISTA partner universities.

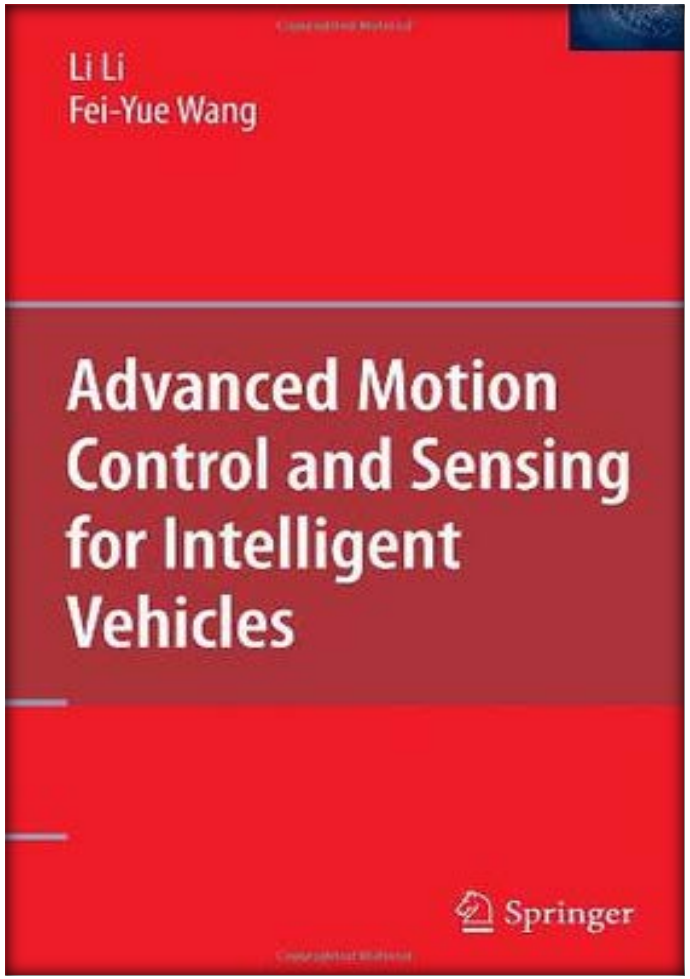
We at ADOT greatly appreciate your work throughout this project, and especially your ability to bring it all together in difficult circumstances. Thanks again for your efforts!

Stephen R. Owen, P.E.

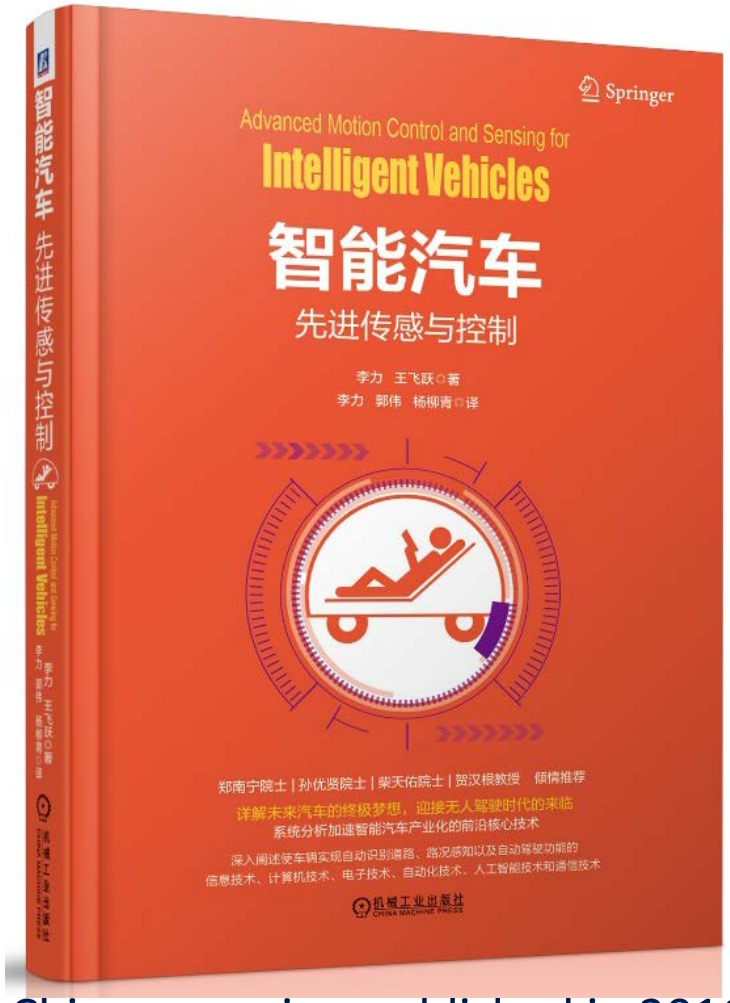
cc: Dr. Pitu Mirchandani, Tim Wolfe

+ HIGHWAYS + AERONAUTICS + MOTOR VEHICLE + PUBLIC TRANSIT + ADMINISTRATIVE SERVICES + TRANSPORTATION PLANNING

IV Renaissance: From Dead to Mad?



My Souvenir from IEEE IV'05 (Las Vegas)



Chinese version published in 2016

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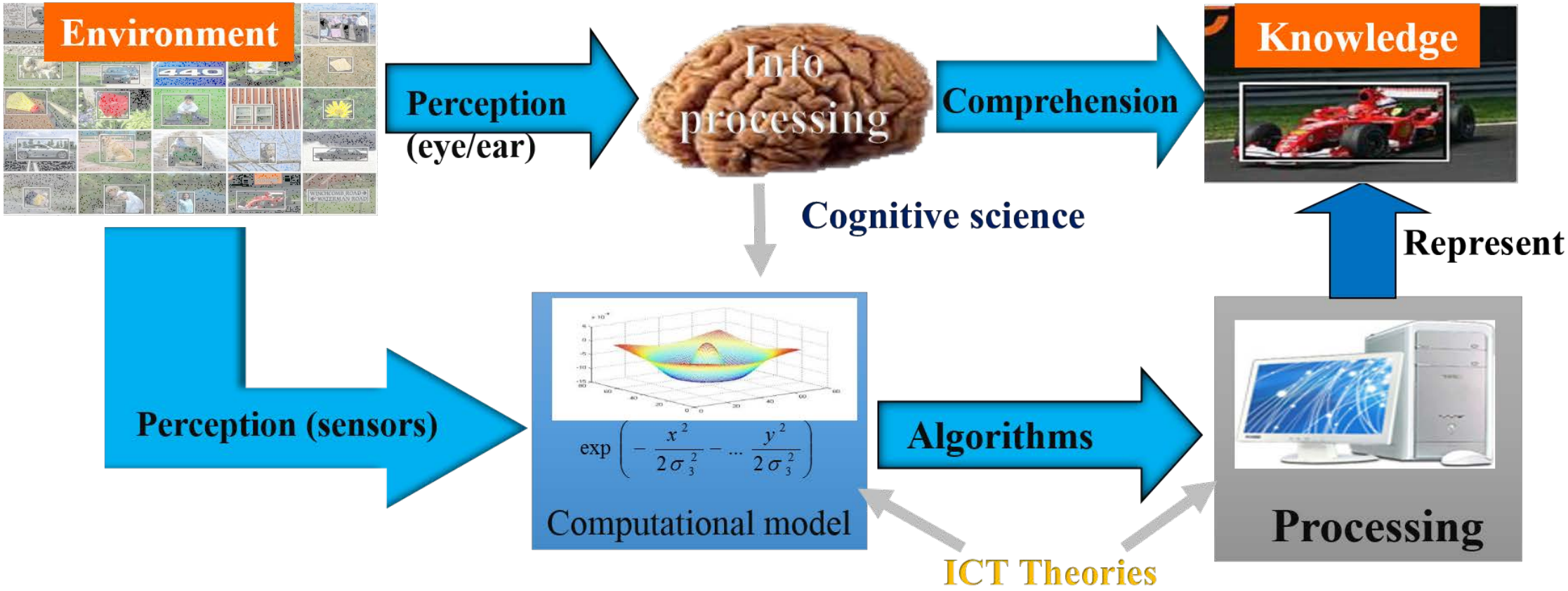
NSFC National Key Program on Cognitive Computing of Visual and Auditory Information

视听觉信息的认知计算



- 2008-2017: Funding: CNY ¥190M ~ USD $32M
- Program Director: Prof. Nan-Ning Zheng
- Verification Platform: IV (National Autonomous Vehicles Competition Starting in 2009)

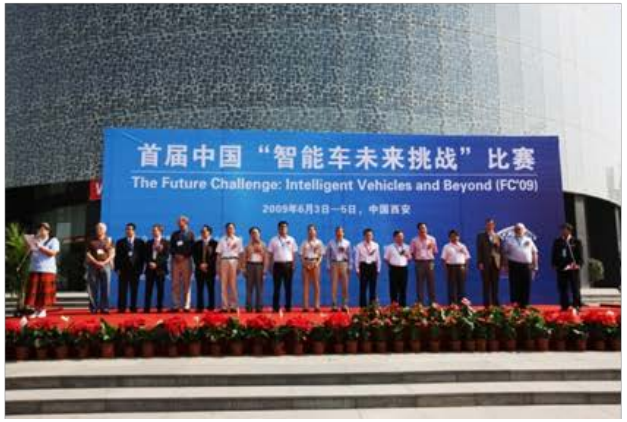
Future Challenge for IV (IVFC): 2009 - Now

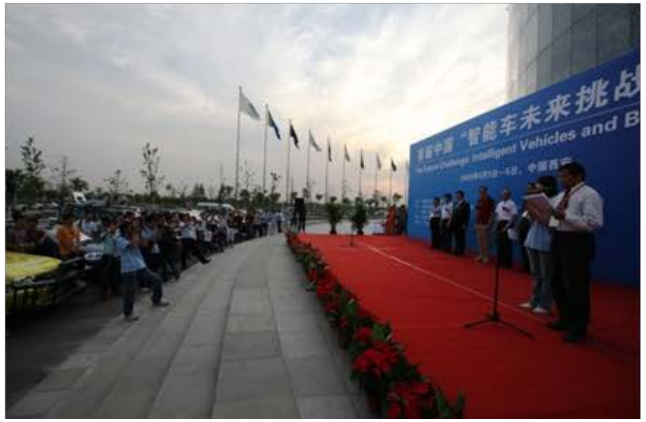
IEEE IV 09 and IVFC 2009: Both Held in Xi'an, China

June 3-5,2009, IEEE IV 09



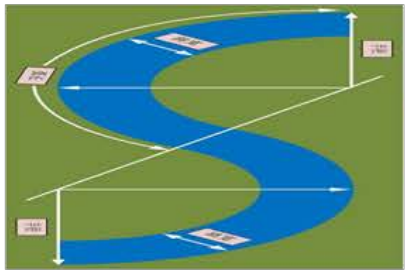
IEEE IV'09 Demo = IVFC 2009

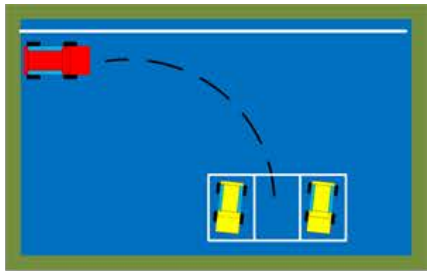


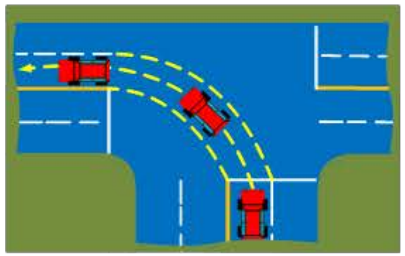


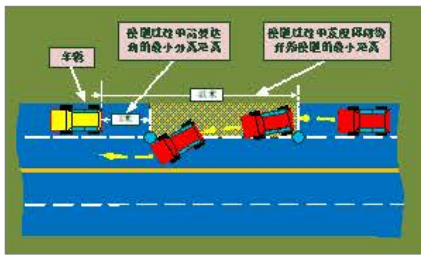

IVFC 2009: 6 Teams

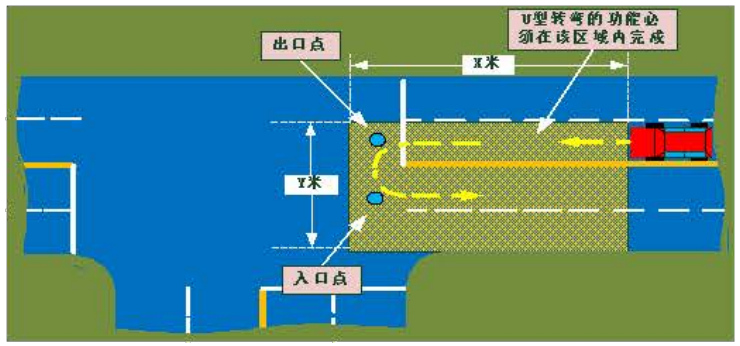
IVFC 2010: Selected Test Scenarios (within the Proving Ground)











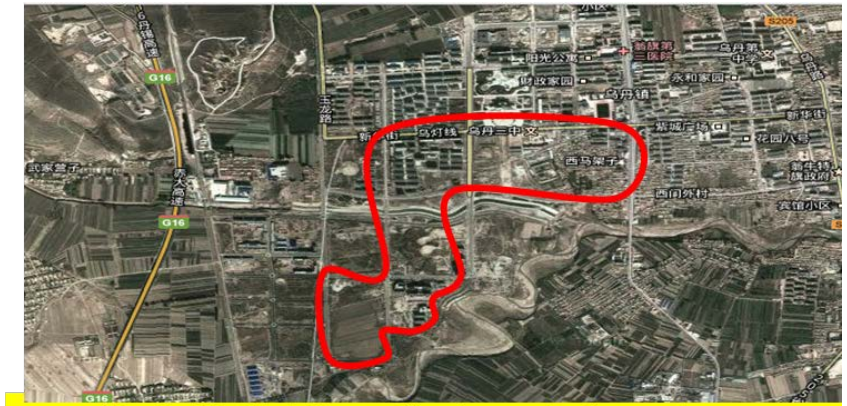
IVFC 2010: 10 Teams

IVFC 2011: Into Highways and Rural Roads, Mongolia

IVFC 2011: 9 Teams

IVFC 2011: First Time National Media Coverage

IVFC 2012: Deep Into the Desert, Still in Mongolia

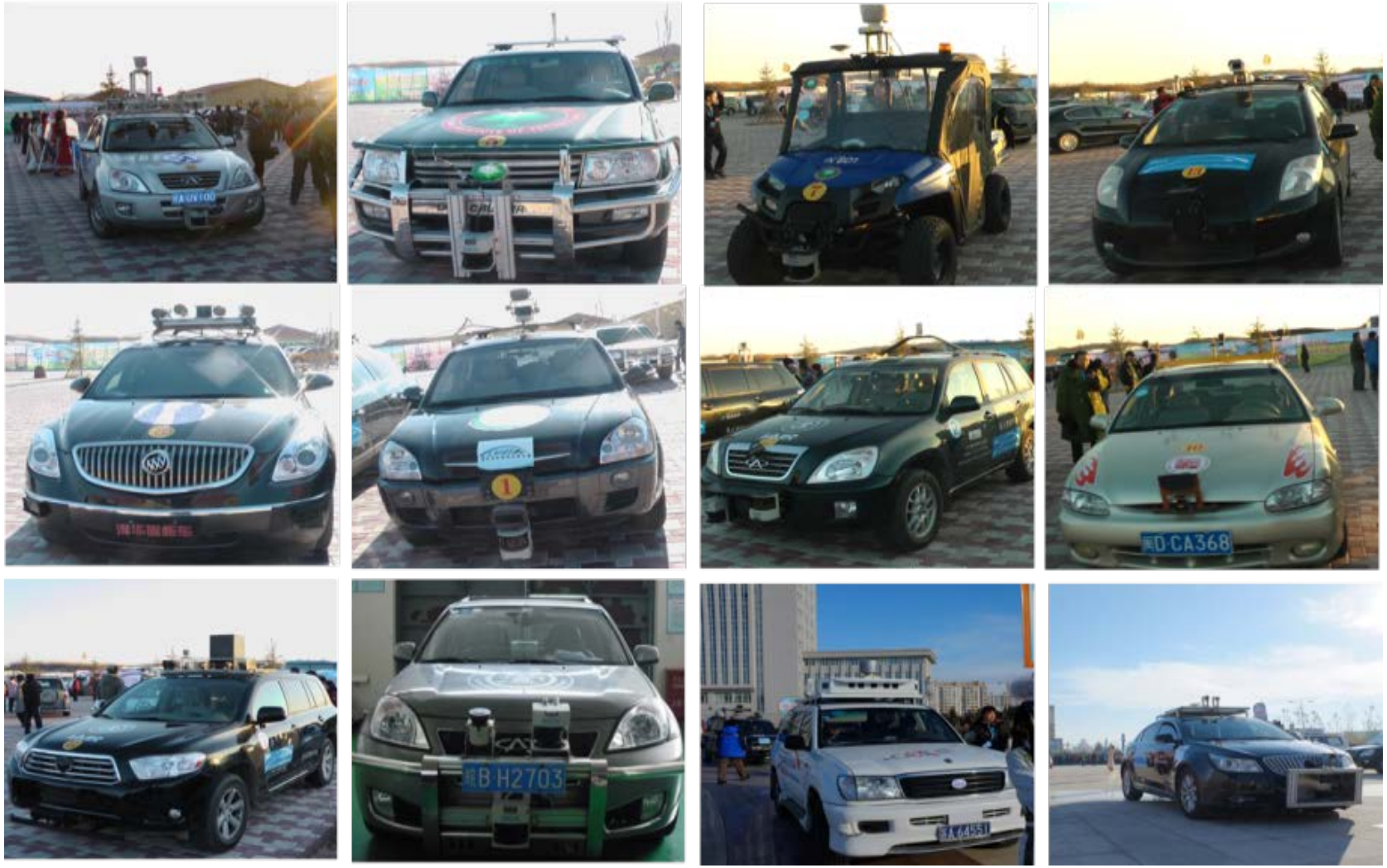


- 翁牛特旗城区道路：赛程7公里

- 玉龙沙湖乡村道路，赛程16公里

Oct. 31-Nov. 1, 2012, Chifeng, Inner Mongolia

IVFC 2012: 12 Teams



IVFC 2012: Prime Time National Media Coverage

IVFC 2013: Find the Home, Changshu, A Permanent Base

- 城区道路：赛程5公里

- 城郊道路，赛程18公里

Nov. 2-Nov. 4, 2013, Changshu, Suzhou, China

IVFC 2013: 18 Teams


















IVFC 2013: Snapshots

IVFC 2014: Growing Up at Changshu-22 Teams

See You @ IVFC 2018

IVFC 2014: Snapshots

IVFC 2015: IV Fever, Star-ups Emerged

- 2015年11月15日，常熟市城郊、城区道路

- 城区和城郊道路：赛程总计13.5公里

IVFC 2015: 20 Teams


















IVFC 2015: Snapshots

IVFC 2016: 27 Teams. The Climax? Not Yet!













IVFC 2016: 27 Teams. The Climax? Not Yet!












IVFC 2016: Snapshots

Highway Test

Urban Test

IVFC 2016: Testing Tasks and Criteria

高架快速道路赛程 – 安全要求

- 本赛程全程在高架快速道路上进行，高架下道路未封闭。
- 为确保安全，交警部门要求本次比赛中，所有车辆在高架路上速度不得超过60公里/小时。
- 裁判将责令超速行驶车辆退出比赛。

城区道路赛程 – 积水路面

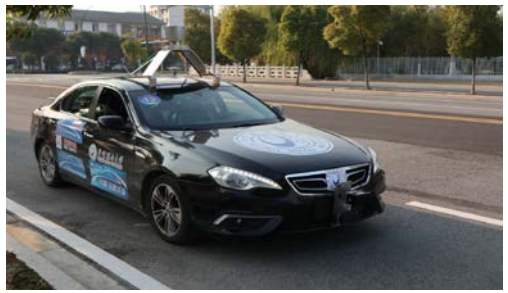
- 无人驾驶车辆的感知适应能力设置积水路面，考察无人驾驶车辆的道路适应能力，特别是激光传感器的环境适应能力；
  - 顺利通过计20分；

6 Testing Tasks for Highway
Total Score: 200

12 Testing Tasks Urban Roads
Total Score: 450

4S Criteria: Safety, Smoothness, Sharpness, Smartness

IVFC 2017: 29 Teams










IVFC 2017: 29 Teams






IVFC 2017: Snapshots

Autonomous Cars Developed by Chinese Companies

BAIC

DFAC

GAGC

Changan (Highway)

Changan (City Road)

Changan (Highway)

FAW

Baidu

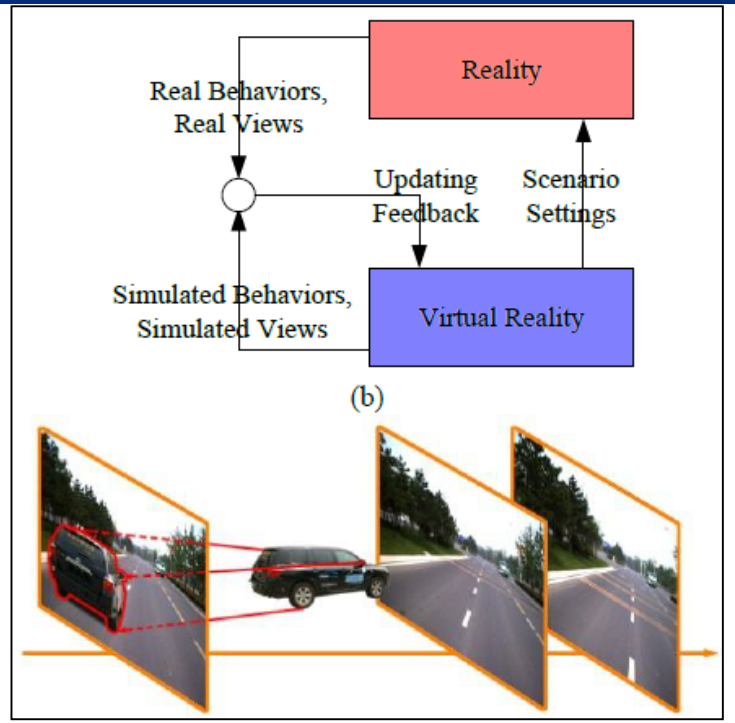
Baidu (Urban)

Intelligent Vehicle Proving Center (iVPC, 08/2015)

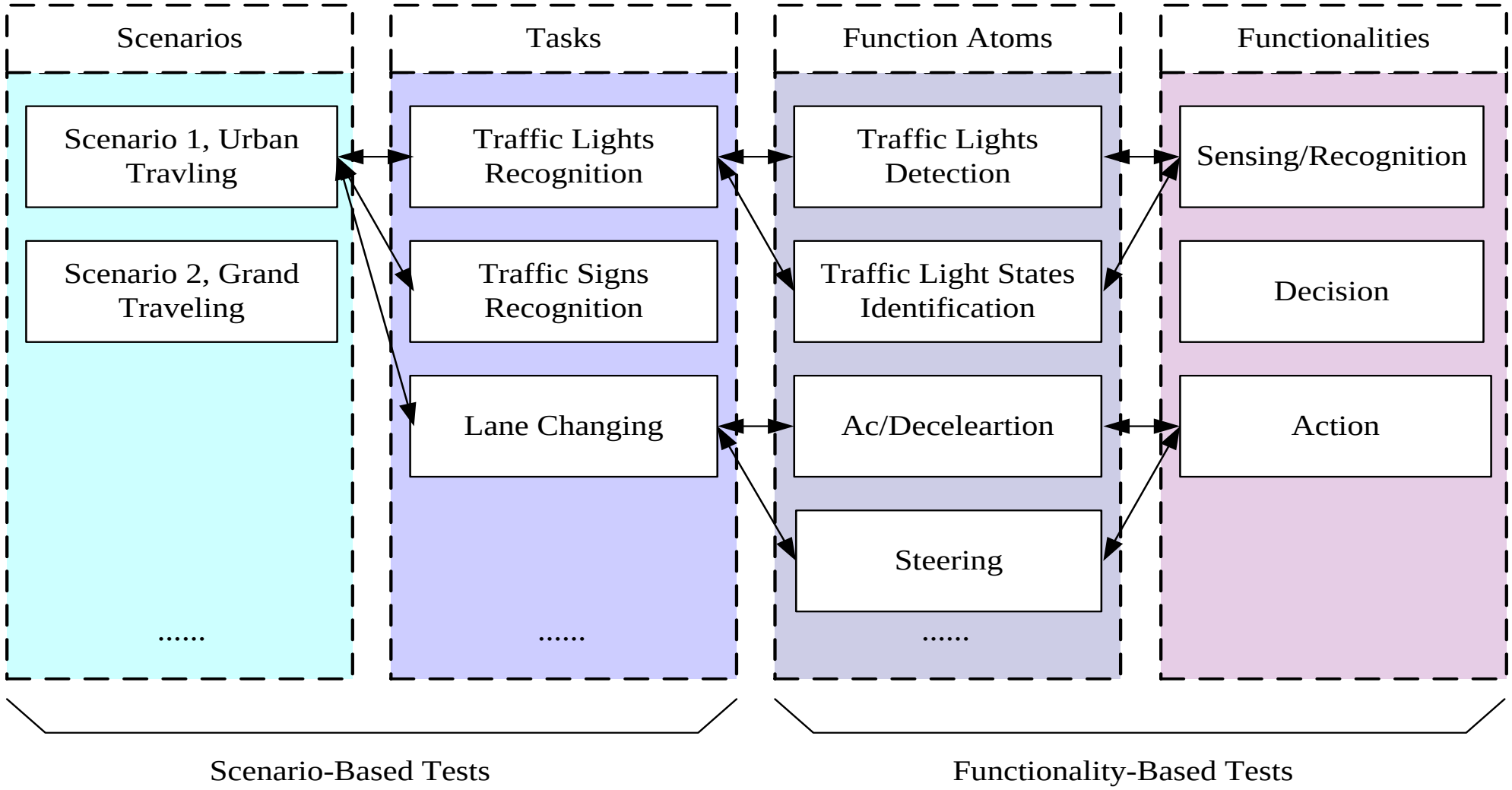
- CNY ¥150M investment in 3 years
- 20,000 m^2 static testing area
- 350,000 m^2 proving ground
- 2M m^2 expanded testing area

iVPC


中国智能车综合技术研发与测试中心
Intelligent Vehicles Proving Center (iVPC)
测试与研发中心大楼
静态测试实验室
传感器标定场地
智能汽车主题文化展示区
林荫道路路段
铁道路口通行路段
隧道通行路段
匝道驾驶测试
无人驾驶公交、的士测试与示范区
高架桥路段
施工路段交警指挥路段
无人驾驶物流测试与示范区
V2X车联网测试路段
小区驾驶测试区
泊车、静态障碍物测试区
行人安全测试路段
灯光照明测试路段
泥土、砖头、水泥路、涉水路
交通标志识别测试区
曲线驾驶测试区
超车换道交互测试路段
测试区域扩展


Reality
Real Behaviors,
Real Views
Updating
Feedback
Scenario
Settings
Simulated Behaviors,
Simulated Views
Virtual Reality
(b)

iVPC


Scenarios
Tasks
Function Atoms
Functionalities
Scenario 1, Urban Travling
Scenario 2, Grand Traveling
.....
Traffic Lights Recognition
Traffic Signs Recognition
Lane Changing
.....
Traffic Lights Detection
Traffic Light States Identification
Ac/Deceleartion
Steering
.....
Sensing/Recognition
Decision
Action
Scenario-Based Tests
Functionality-Based Tests

IEEE Transactions on Intelligent Vehicles, 2016

Intelligence Testing for Autonomous Vehicles: A New Approach

Li Li, *Senior Member, IEEE*, Wu-Ling Huang, Yuehu Liu, Nan-Ning Zheng, *Fellow, IEEE*, Fei-Yue Wang, *Fellow, IEEE*

***Abstract*— In this paper, we study how to test the intelligence of an autonomous vehicle. Comprehensive testing is crucial to both vehicle manufactories and customers. Existing testing approaches can be categorized into two kinds: scenario-based testing and functionality-based testing. We first discuss the shortcomings of these two kinds of approaches, and then propose a new testing framework to combine the benefits of them. Based on the new semantic diagram definition for the intelligence of autonomous vehicles, we explain how to design task for autonomous vehicle testing and how to evaluate test results. Experiments show that this new approach provides a quantitative way to test the intelligence of an autonomous vehicle.**

***Index Terms*— Autonomous vehicles, intelligence testing**

To find an answer, the Defense Advanced Research Projects Agency (DARPA) had sponsored a series of competitions for autonomous vehicles [8]-[9]. The first two "Grand Challenges" had been held in 2004 and 2005 to check whether autonomous vehicles could travel long distances in off-road terrain. The third "Grand Challenges" had been held in 2007 to foster innovation in autonomous driving in busy urban environments [10]-[11]. These tests fired researchers with keenness for autonomous driving.

Similar autonomous vehicle competitions had also been held in Europe and China. National Science Foundation of China had spent over 30 million dollars to support seven "Intelligent Vehicle Future Challenges" that had been held in different cities of China, through 2009 to 2015 [12]. Several prototype vehicles had successfully passed these competition tests.

Li, Li, Wu-Ling Huang, Yuehu Liu, Nan-Ning Zheng, and Fei-Yue Wang. "Intelligence Testing for Autonomous Vehicles: A New Approach." *IEEE Transactions on Intelligent Vehicles* volume 1, no. 2 (2016): 158-166.

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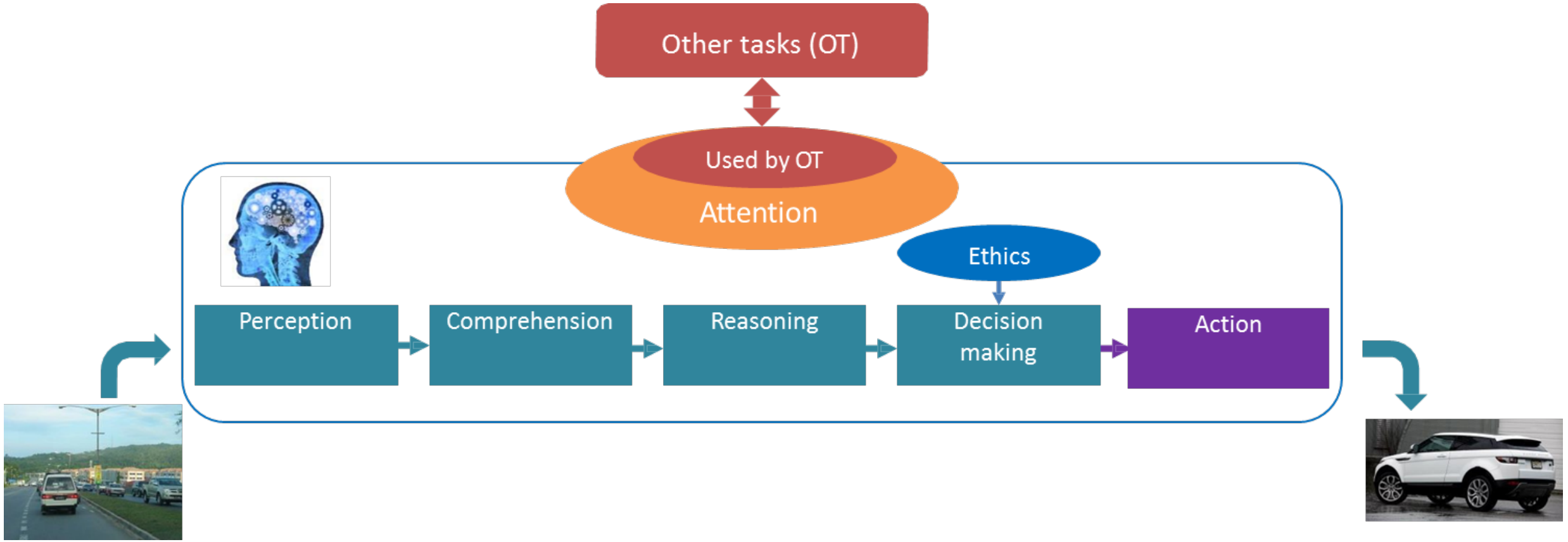
How to achieve a desirable driver-automation collaboration for L1~L3 automation?

Collaborative augmented cognition and decision making (CACDM) for driver-automation collaboration

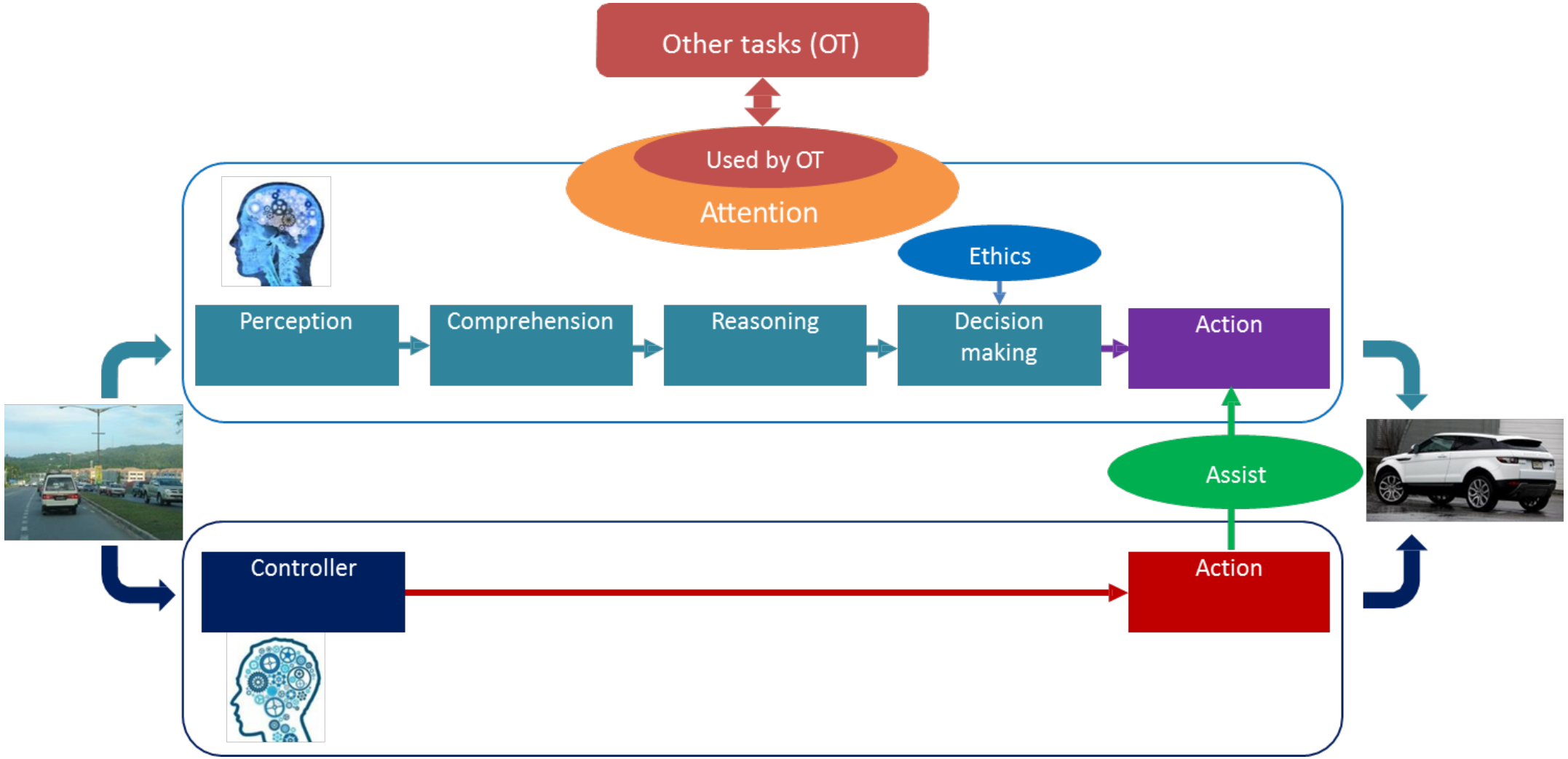
Cognition ??

Using "information processing" approach to simplify

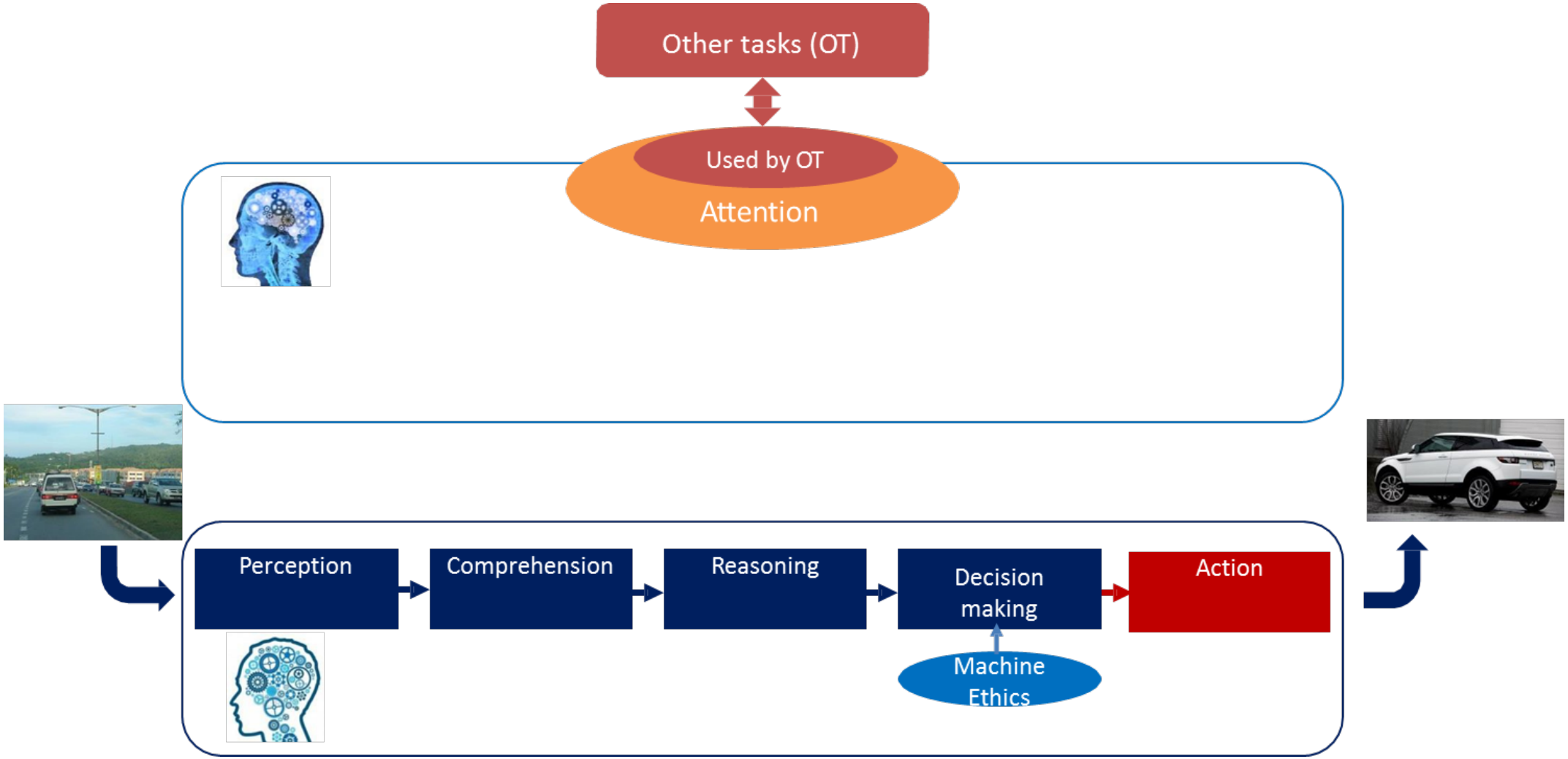
CACDM_L0_no conventional chassis control



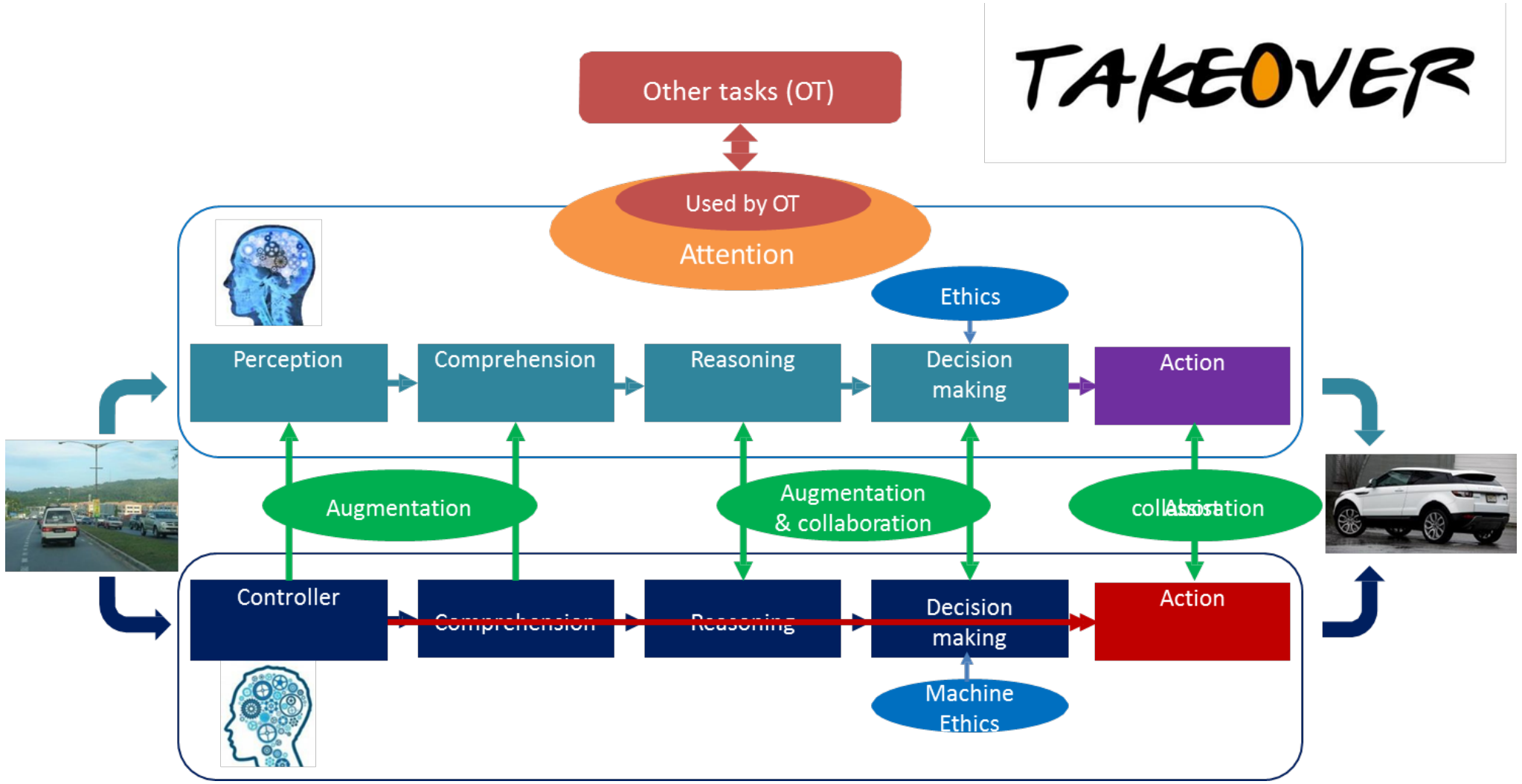
CACDM_L0_with conventional chassis control



CACDM_L5, L4


Other tasks (OT)
Used by OT
Attention
Perception
Comprehension
Reasoning
Decision making
Action
Machine Ethics

CACDM_L3


TAKEOVER
Other tasks (OT)
Used by OT
Attention
Ethics
Perception
Comprehension
Reasoning
Decision making
Action
Augmentation
Augmentation & collaboration
collaboration
Controller
Comprehension
Reasoning
Decision making
Action
Machine Ethics

CACDM_L3: Task switching in cognitive psychology

134 Review *TRENDS in Cognitive Sciences* Vol.7 No.3 March 2003

ELSEVIER

Task switching

Stephen Monsell

Performance measures:
response time (RT) and error rate

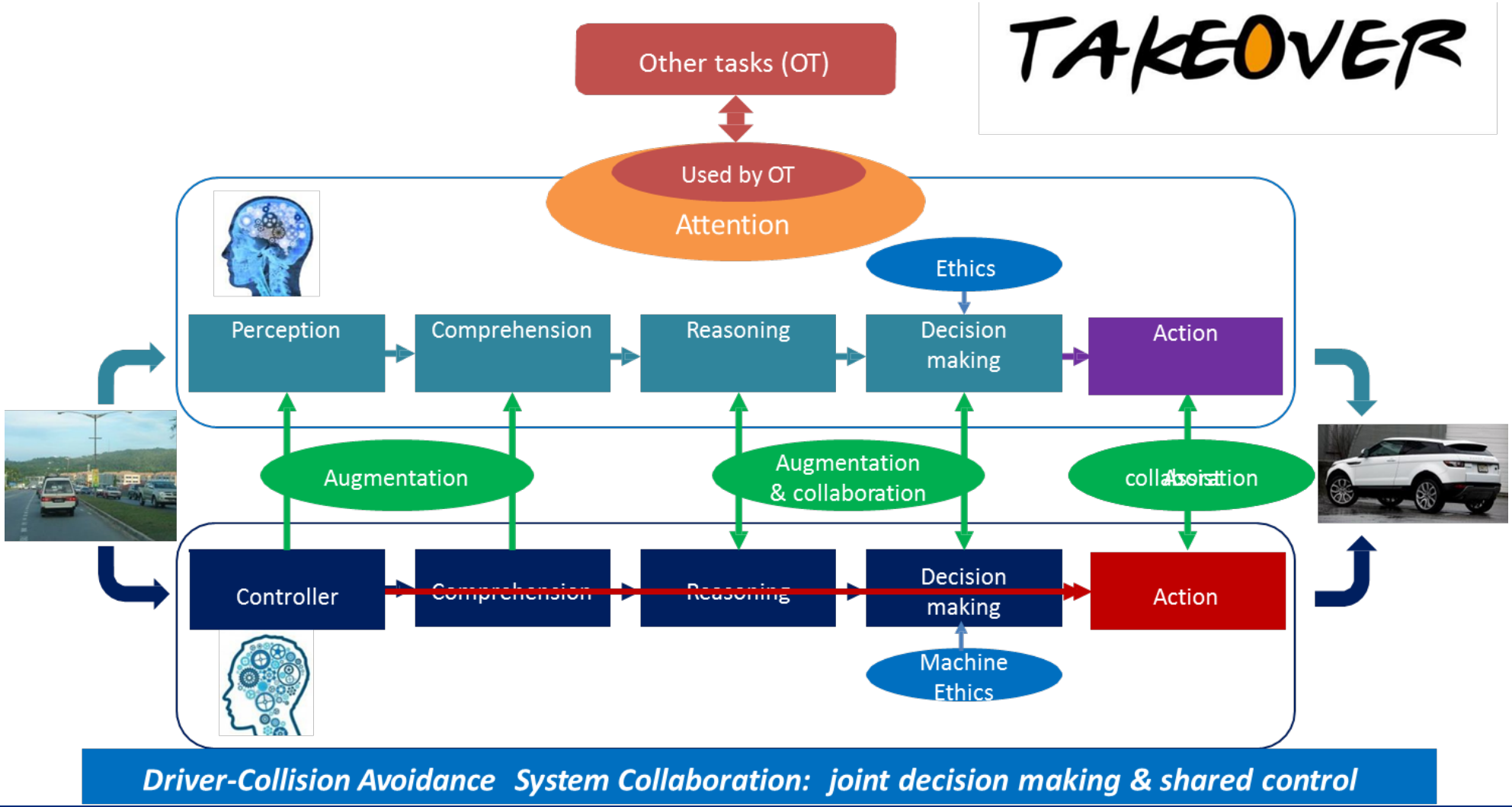
Switch costs

I
- Previous task disengagement (attention disengaging)

II
- Task reconfiguration (task preparation)

III
- Task engagement (attention engaging)

CACDM_L2


TAKEOVER
Other tasks (OT)
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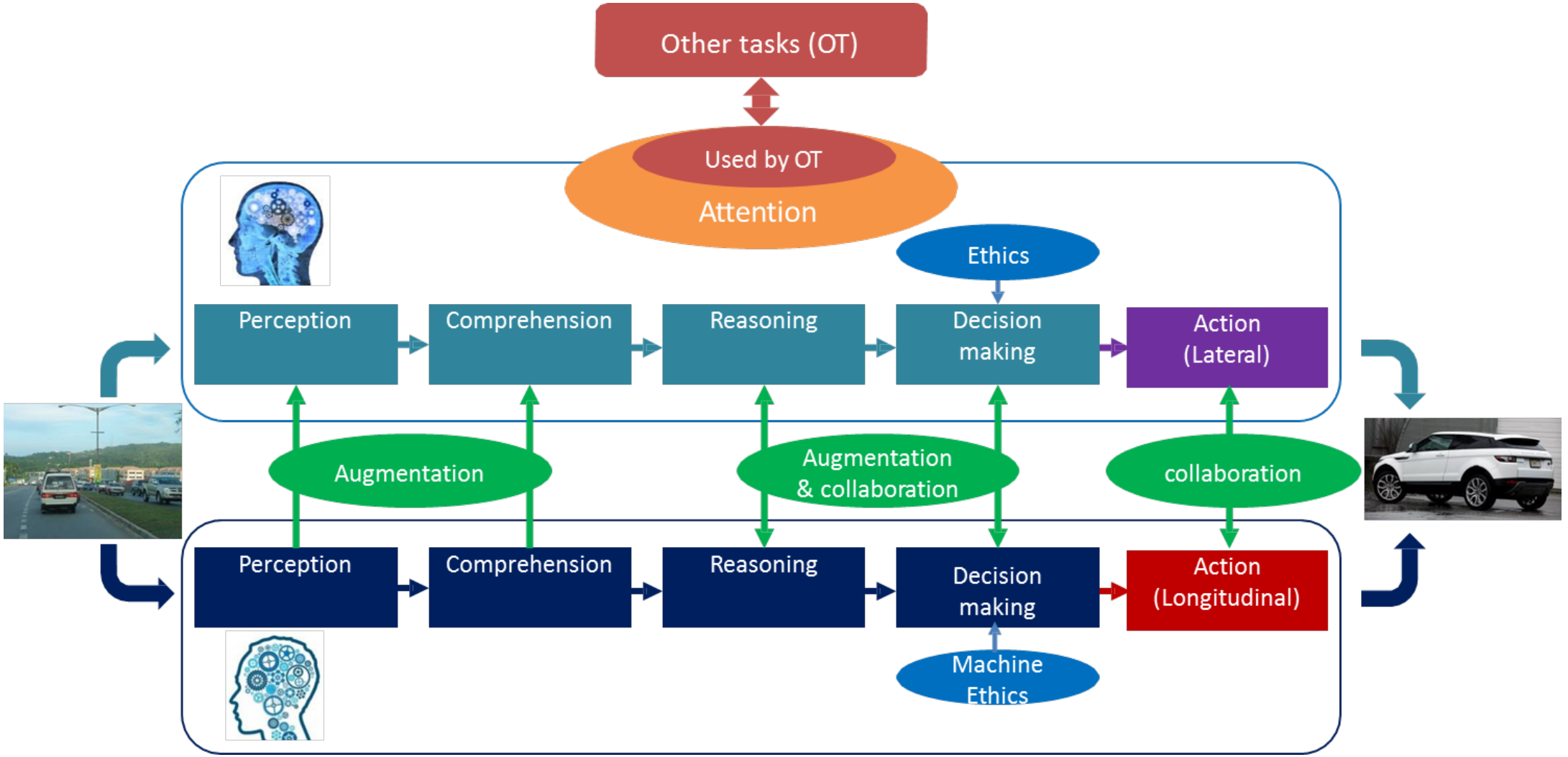
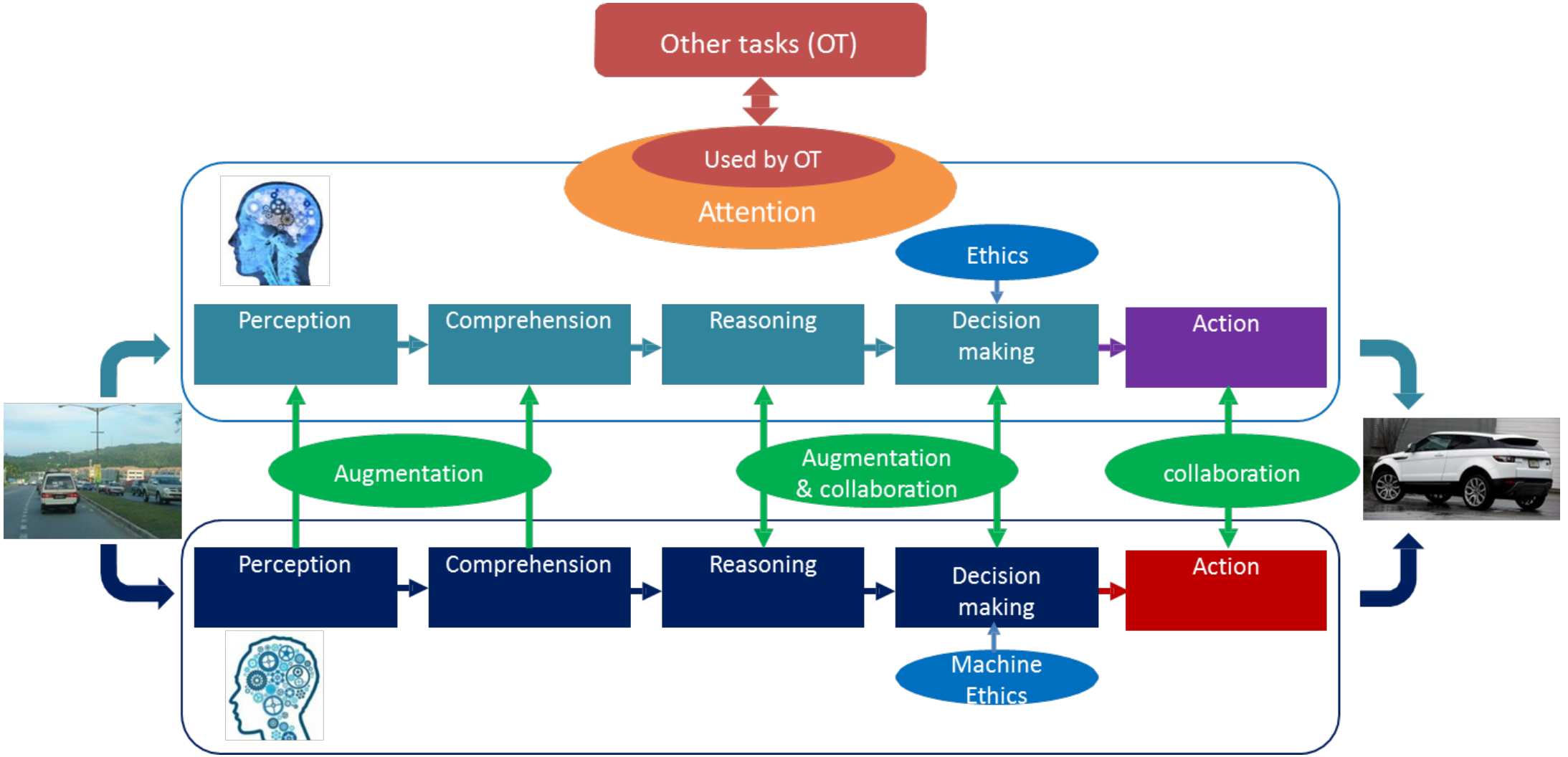
Augmentation & collaboration
collaboration
Controller
Comprehension
Reasoning
Decision making
Action
Machine Ethics
Driver-Collision Avoidance System Collaboration: joint decision making & shared control

CACDM_L1_ACC

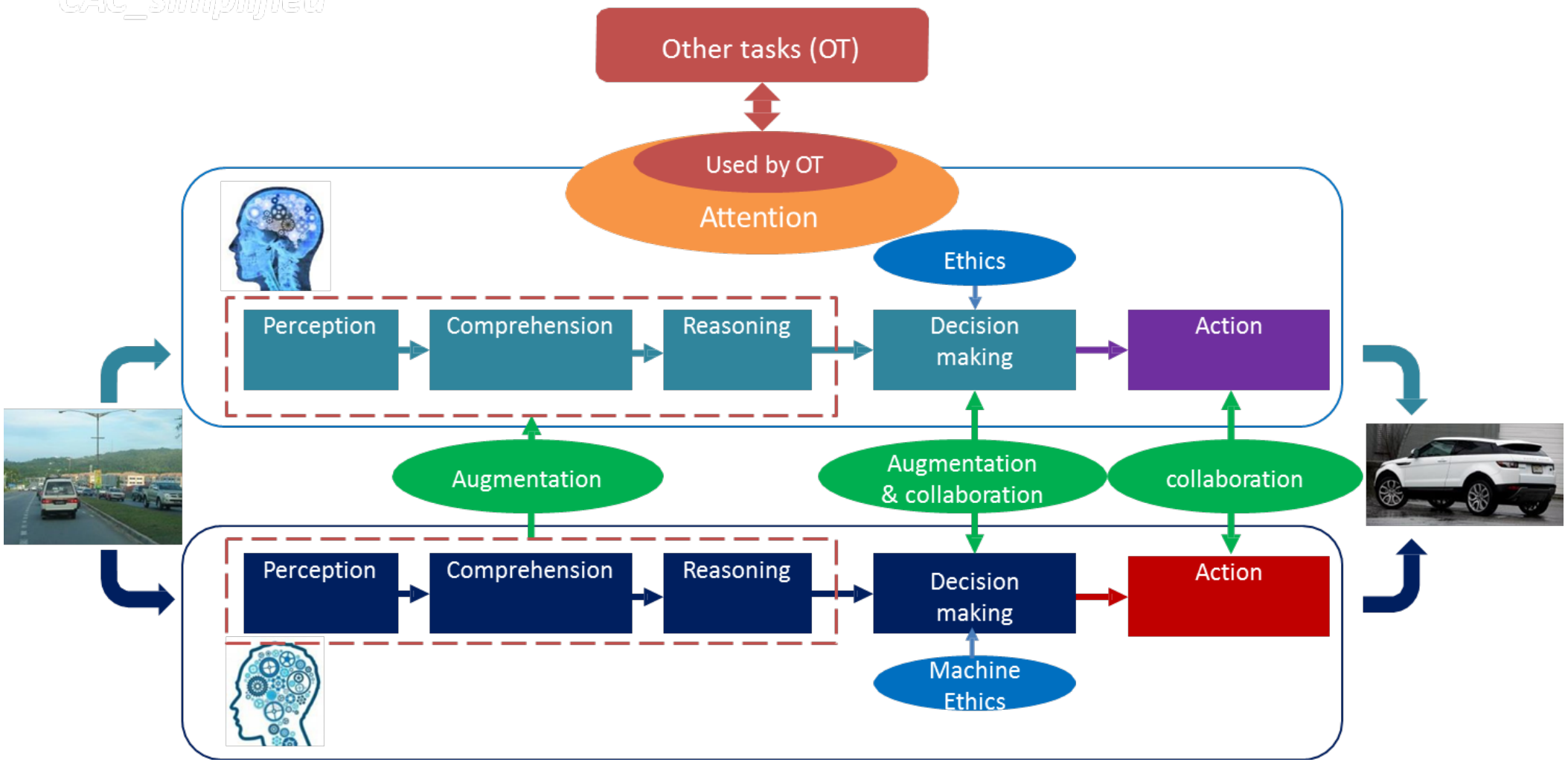

Other tasks (OT)
Used by OT
Attention
Ethics
Perception
Comprehension
Reasoning
Decision making
Action (Lateral)
Augmentation
Augmentation & collaboration
collaboration
Perception
Comprehension
Reasoning
Decision making
Action (Longitudinal)
Machine Ethics

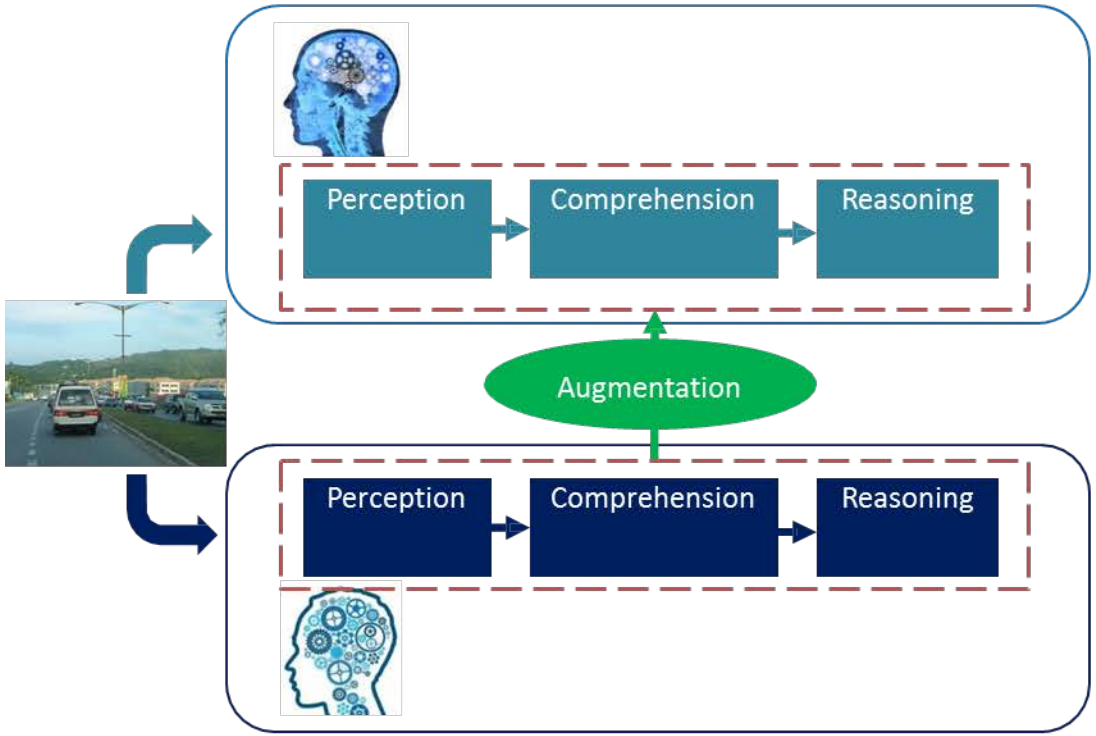
CAC_general


Other tasks (OT)
Used by OT
Attention
Ethics
Perception
Comprehension
Reasoning
Decision making
Action
Augmentation
Augmentation & collaboration
collaboration
Perception
Comprehension
Reasoning
Decision making
Action
Machine Ethics

CAC_simplified

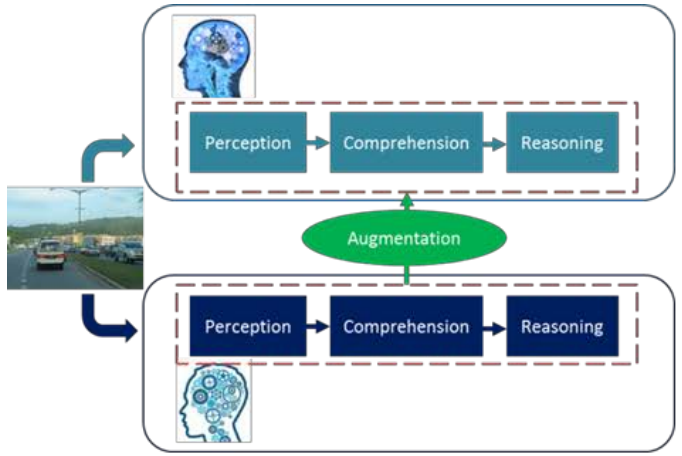
CAC_simplified

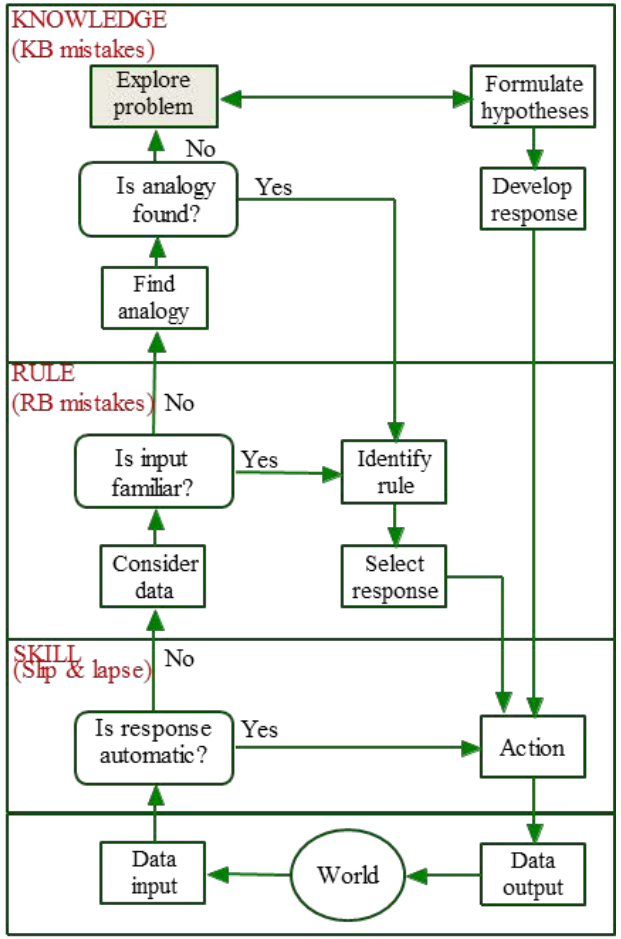




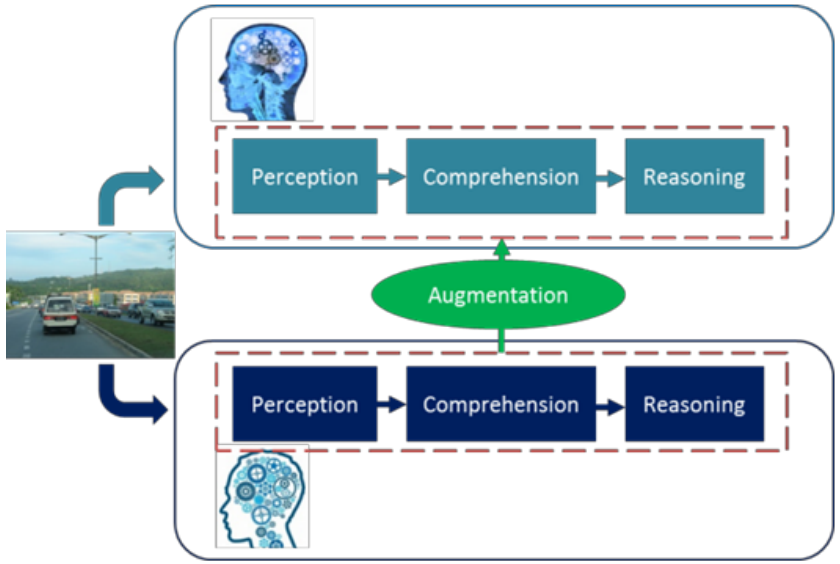
Augmented reality

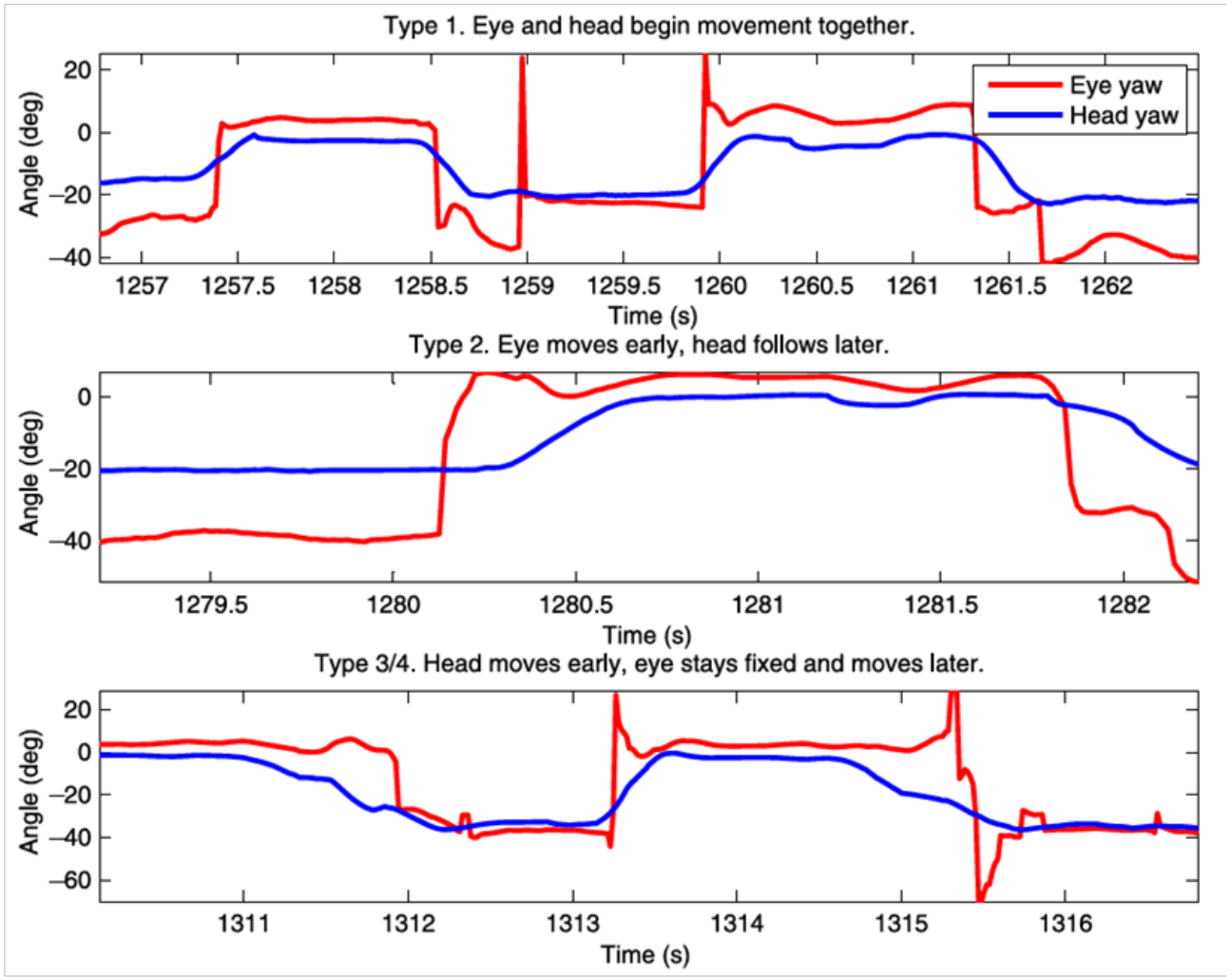
CACDM: Where to see when driving?





CACDM: Eye-head or eye-head-steering coordination and dynamics





CACDM: Eye-head or eye-head-steering coordination and dynamics

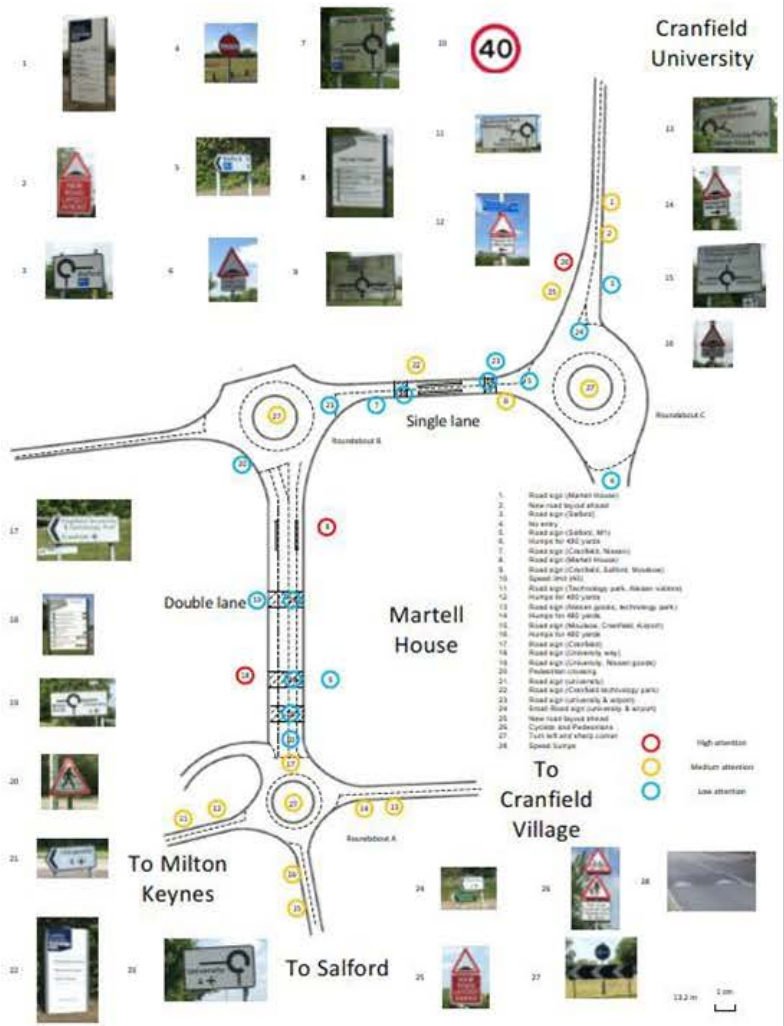


Fig. 4. A snapshot of the software developed for the proposed head tracking system

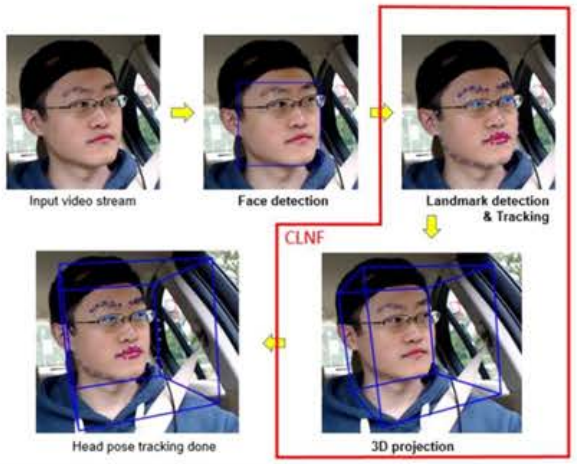
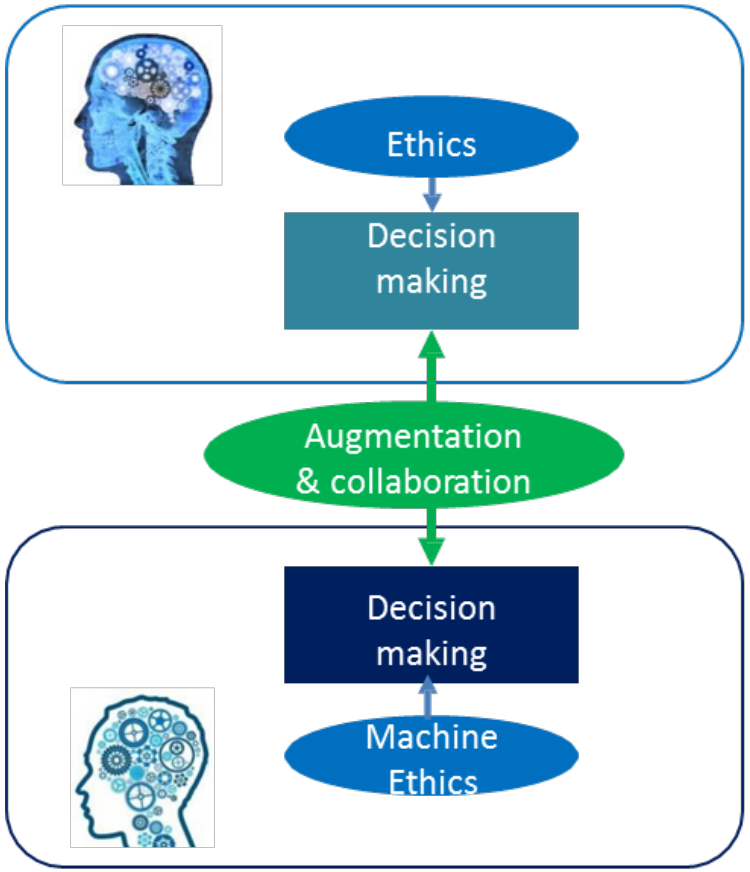
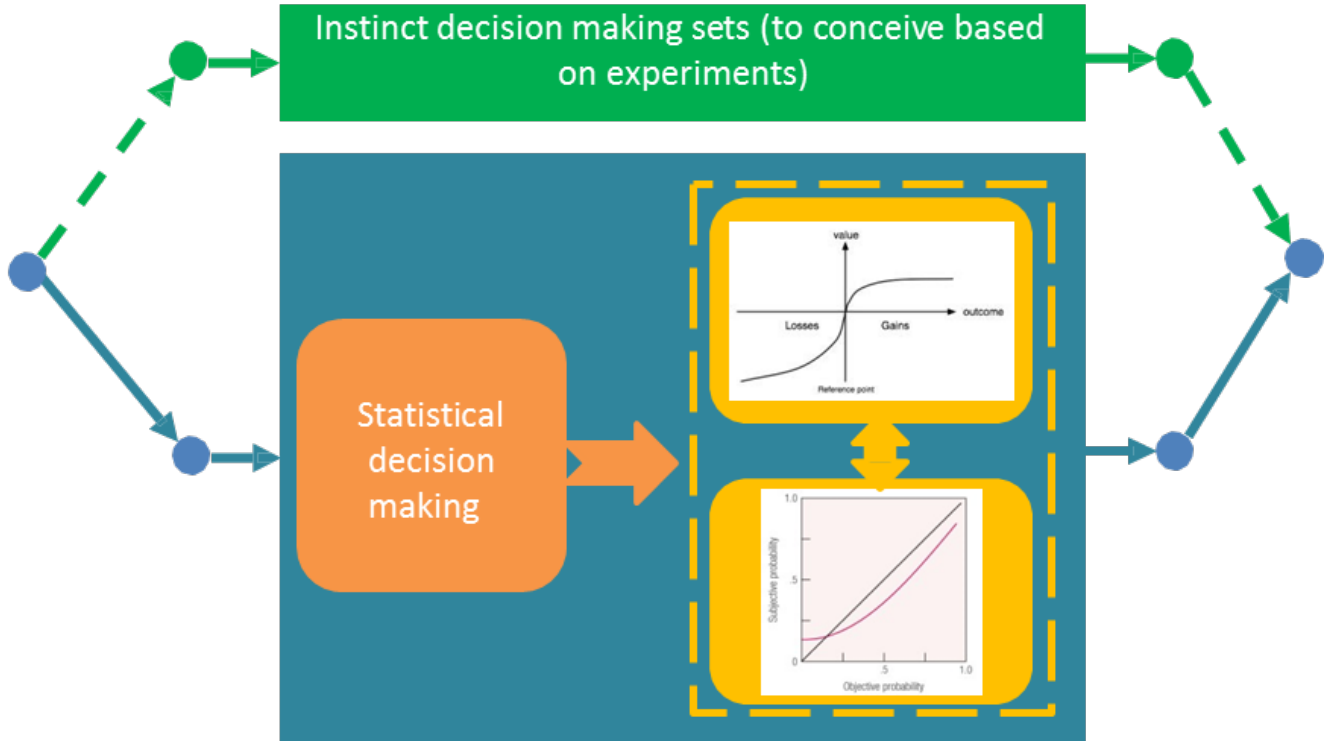


Fig. 9. The LED Indicator used for synchronisation between two tracking systems. Left: Off, Right: On.



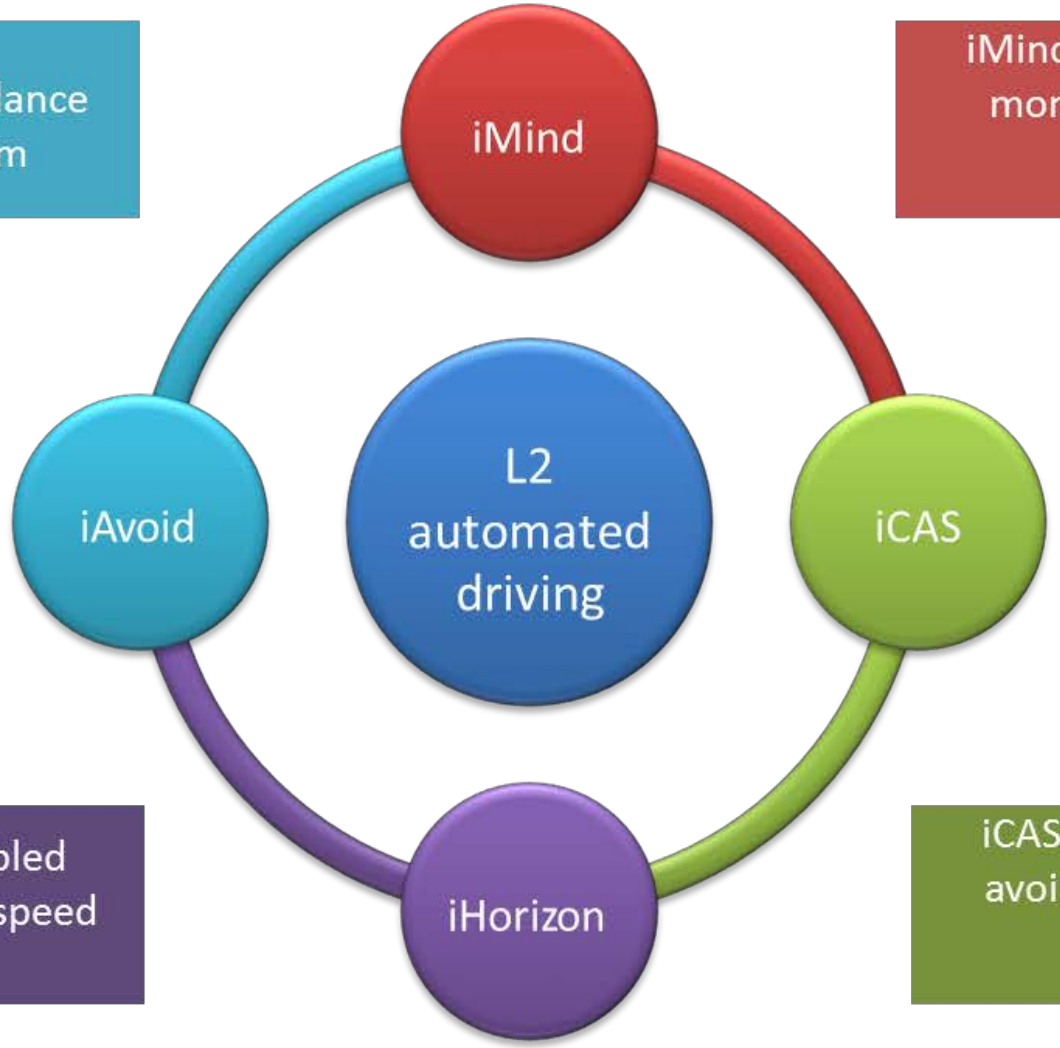
For human driver driving decision making, a dual-process model integrating statistical decision theory and personalized 'subjective utility' and 'subjective probability' can be used.



4i Automated driving system- L2

iAvoid: Vehicle collision avoidance capacity monitoring system

iMind: Driver mind-on-the-road monitoring system for level-2 automated driving



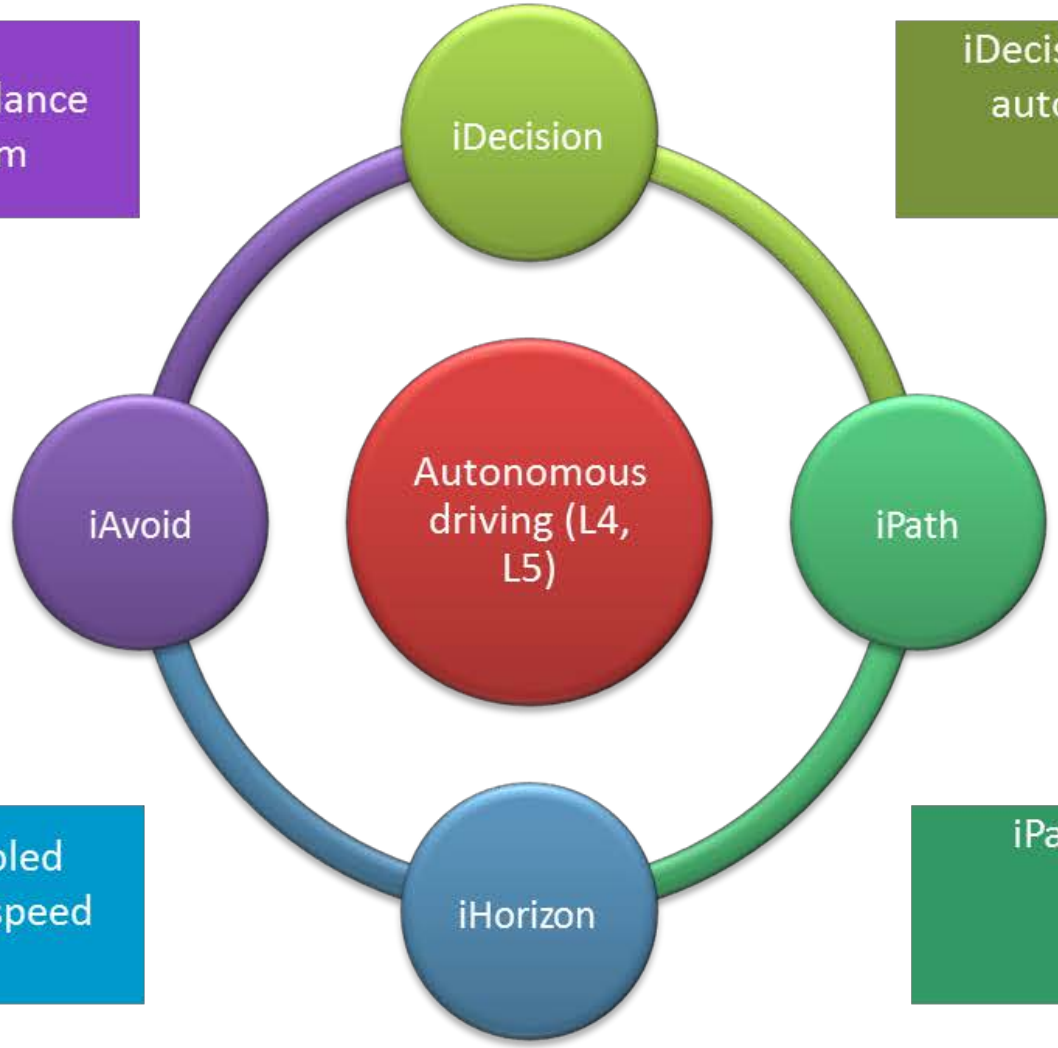
iHorizon: Driving-style enabled short- and long-term future speed prediction system

iCAS: Intelligent driver-collision-avoidance-system collaboration system

4i Automated driving system- L4&L5

iAvoid: Vehicle collision avoidance capacity monitoring system

iDecision: Intelligent human-like autonomous driving decision making system



iHorizon: Driving-style enabled short- and long-term future speed prediction

iPath: Intelligent human-like

Outline

- Intro & roadmaps
- AI and Intelligent Vehicles Future Challenge (IVFC) in China
- Automated driving: From cognitive intelligence to parallel intelligence
  - Framework of cognitive intelligence
  - Framework of parallel driving
- The Future
- Welcome to IEEE IV'2018

From CPS to Cyber-Physical-Social Systems (CPSS)

CYBER-PHYSICAL-SOCIAL SYSTEMS

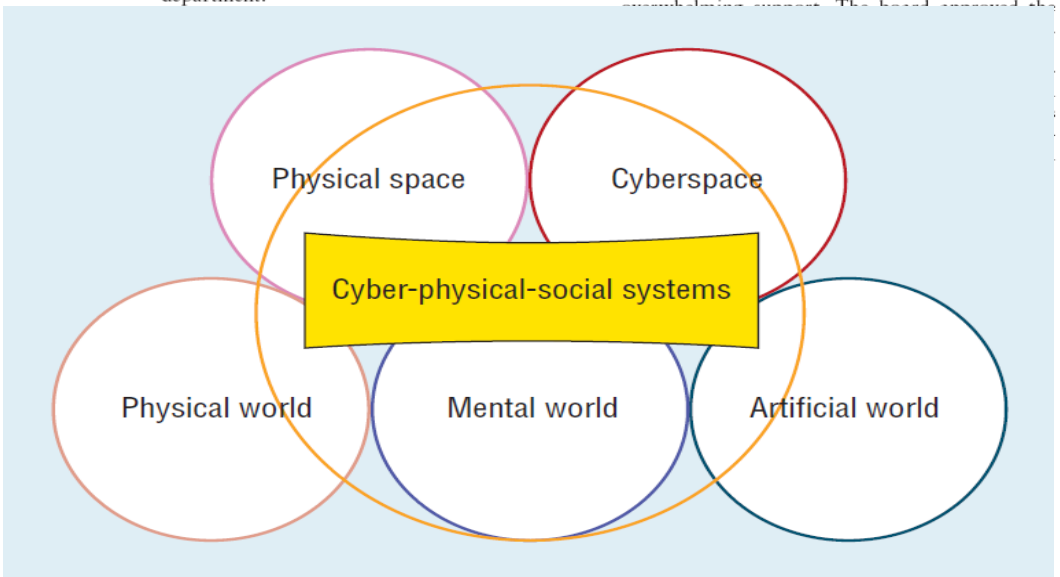
Editor: **Daniel Zeng**, University of Arizona, zeng@email.arizona.edu

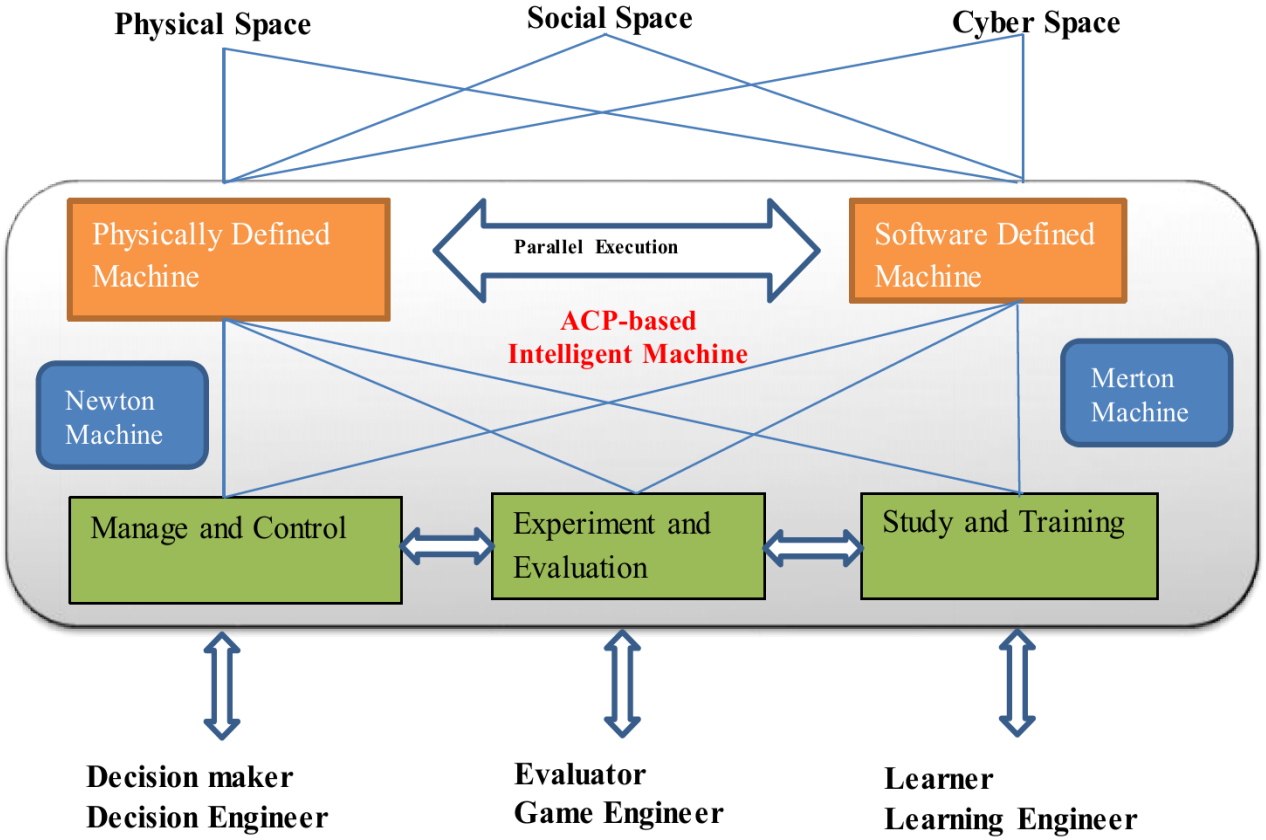
The Emergence of Intelligent Enterprises: From CPS to CPSS

Fei-Yue Wang, *Chinese Academy of Sciences*

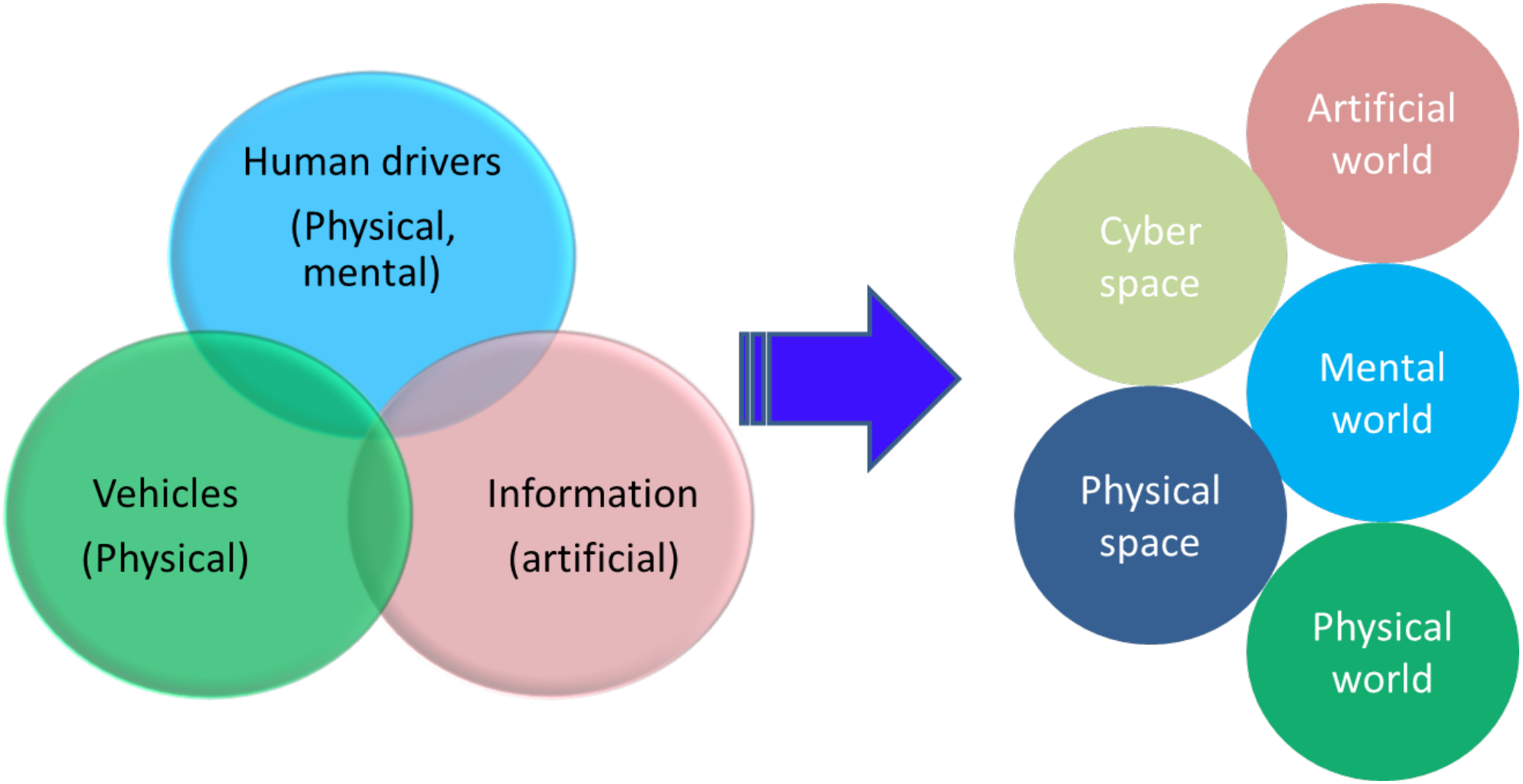
Welcome to the inaugural issue of the Cyber-Physical-Social Systems (CPSS) department!

When *IEEE Intelligent Systems* solicited ideas for a new department at its 2008 Spring Editorial Board meeting, the suggestion of CPS received

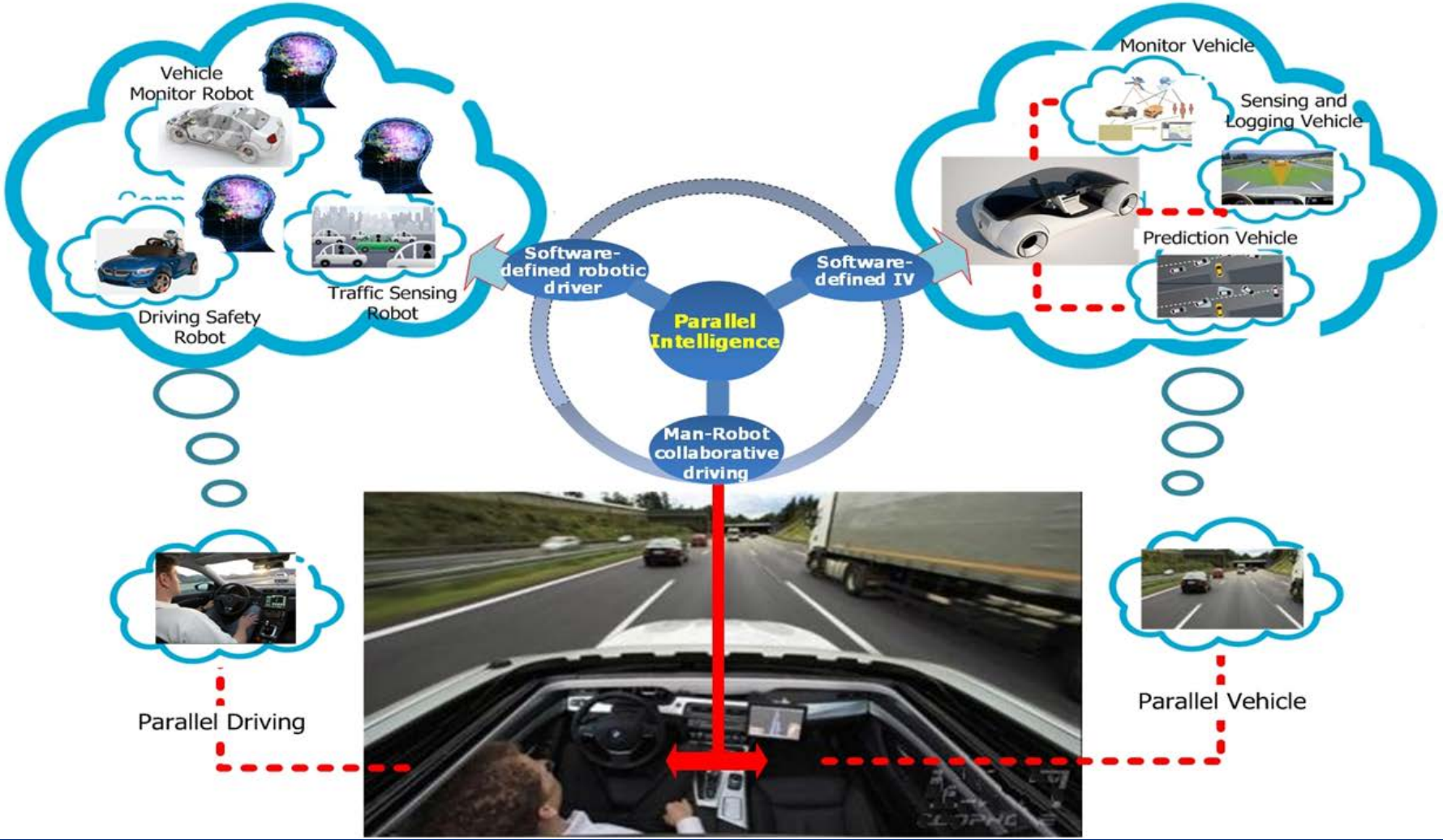




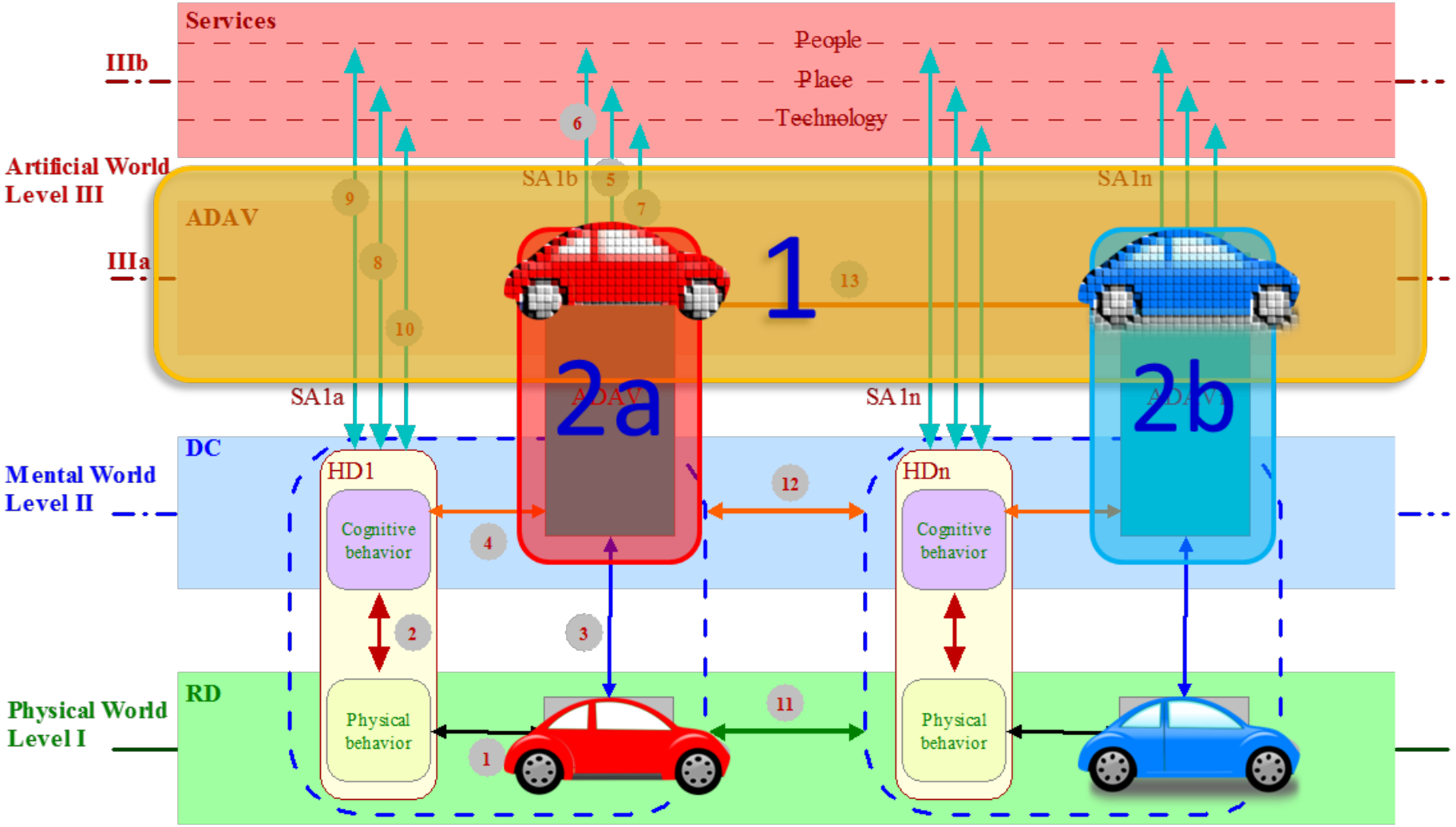
CPSS-based Parallel Driving



Parallel Driving



Parallel Driving: Framework



Parallel Driving

Parallel Driving in CPSS: A Unified Approach for Transport Automation and Vehicle Intelligence

Fei-Yue Wang, *Fellow, IEEE*, Nan-Ning Zheng, *Fellow, IEEE*, Dongpu Cao, *Member, IEEE* and Li Li, *Fellow, IEEE*

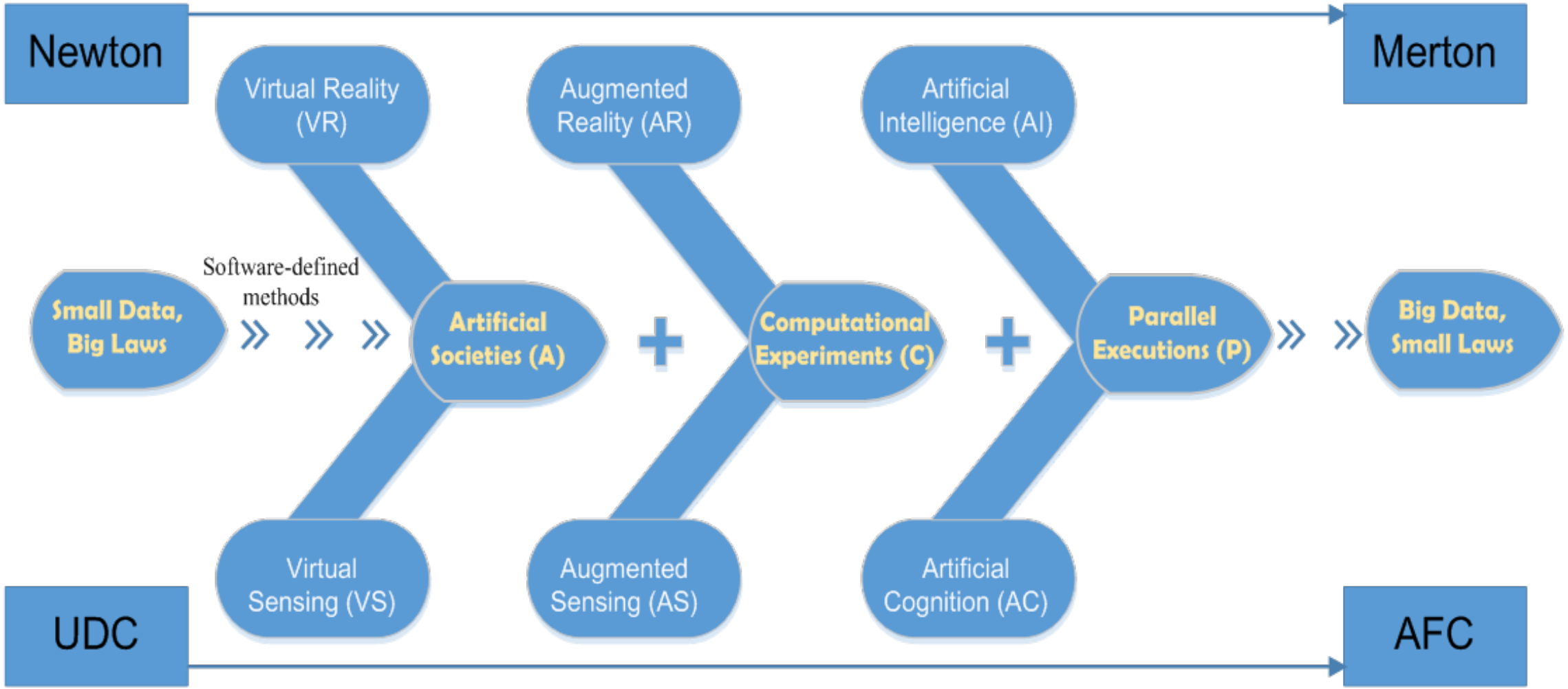
***Abstract*—The emerging development of connected and automated vehicles imposes a significant challenge on current vehicle control and transportation systems. This article proposes a novel unified approach, Parallel Driving, a cloud-based cyber-physical-social systems (CPSS) framework aiming at synergizing connected automated driving. This study first introduces the CPSS and ACP-based intelligent machine systems. Then the parallel driving is proposed in the cyber-physical-social space, considering interactions among vehicles, human drivers, and information. Within the framework, parallel testing and parallel learning are developed and concisely reviewed. The proposed parallel driving is expected to offer an ample solution for achieving a smooth, safe and efficient cooperation among connected automated vehicles with different levels of automation in future road transportation systems.**

***Index Terms*—Parallel driving, Cyber-physical-social systems (CPSS), ACP theory, Connected automated driving, Parallel testing, Parallel learning.**

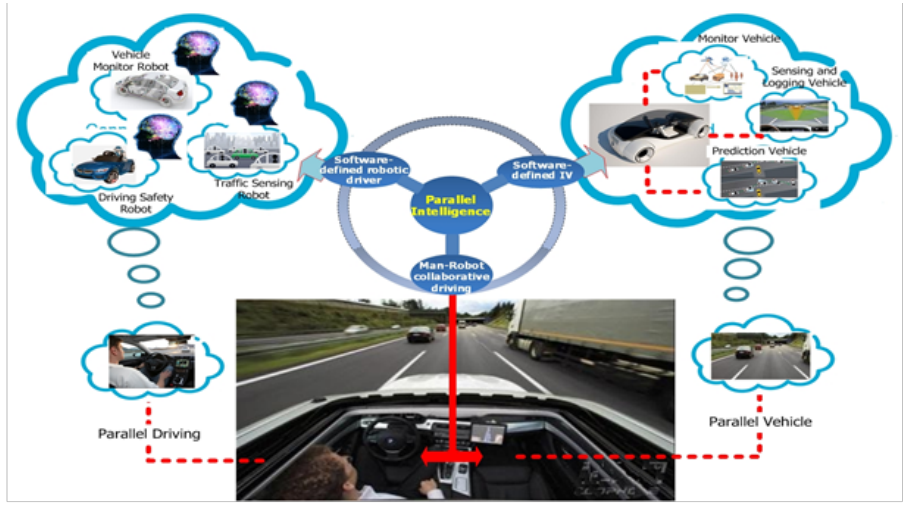
is allowed to be fully disengaged from the driving task. However, if requested, the driver must be ready to take over within a certain period of time. Current automotive technology advances primarily at Level 1 and partially at Level 2, with several commercial product available, such as adaptive cruise control (ACC) for Level 1 automation, and BMW's Traffic Jam Assistant, GM's Super Cruise, Mercedes' Distronic Plus with Steering Assist, Toyota's Automated Highway Driving Assist, Volvo's ACC with Steer Assistance and Tesla Model S for Level 2 Automation [12,18].

Thanks mainly to the DARPA Challenge, there have been substantial technological developments at Levels 4 and 5 (or full automation) [19-22] in the past decade, as also reflected in the Google self-driving cars. One of the on-going challenges for fully autonomous driving is the reliable and robust operation in more complex real-world driving environments, such as those found in urban driving [e.g. 13,23]. In parallel, vehicle platoons or cooperative vehicle automation have also been investigated for a few decades, further enhancing vehicle

Parallel Intelligence: From VS, AS, VC to VR, AR, AI



Parallel Driving Levels (PDL): Technology Roadmap



PDL0

PDL1

PDL2

PDL3

PDL4

PDL5

PDL6

PDL7

2017 2021 2026 2031 2036

Parallel Driving: 8 Levels

Level	Narrative definition	PDS components/subsystems	PDS performance
0 (current)	Knowing basic road and traffic information. No V2X. (unconnected L0 and L1 automated vehicles)	Simple APDL (e.g. digital map with traffic information), simple individual PDS module (e.g. GPS navigation system)	Non-cooperative driving safety, energy efficiency, comfort
1 (2019)	Knowing basic road and traffic information. With V2I and V2V for improving energy efficiency purpose only. (connected L0 ~L2 automated vehicles)	Simple APDL (artificial road infrastructure), simple individual PDS module (energy-efficiency based), V2I, V2V	Non-cooperative driving safety, cooperative energy efficiency, comfort
2 (2021)	Knowing more road and traffic information. With V2I and V2V for improving energy efficiency and safety. (connected L2 and L3 automated vehicles)	Simple APDL (artificial road infrastructure), individual PDS module (combined safety, energy efficiency), V2I, V2V	Cooperative driving safety, energy efficiency, comfort
3 (2024)	Knowing more road and traffic information. With V2I and V2V for improving energy efficiency and safety. APDL (artificial road infrastructure, artificial vehicles), simple CCMS. (connected L3 automated vehicles)	APDL (artificial road infrastructure and artificial vehicles), individual PDS module (combined safety, energy efficiency), V2I, V2V, simple CCMS	Cooperative driving safety, energy efficiency, comfort
4 (2027)	Knowing more road and traffic information. With V2X (V2I, V2V, V2S) for improving energy efficiency and safety. APDL (artificial road infrastructure, artificial vehicles), simple CCMS. (parallel L4 automated vehicles)	APDL (artificial road infrastructure, artificial vehicles), individual PDS module (combined safety, energy efficiency), V2I, V2V, V2S, simple CCMS, APDL to services communication	Cooperative driving safety, energy efficiency, comfort
5 (2030)	Knowing more road and traffic information. With V2X (V2I, V2V, V2S) for improving energy efficiency, safety and traffic efficiency. APDL (artificial road infrastructure, artificial vehicles), medium-level CCMS. (parallel L4 automated vehicles)	APDL (artificial road infrastructure, artificial vehicles), individual PDS module (combined safety, energy efficiency, traffic efficiency), V2I, V2V, V2S, medium-level CCMS, APDL to services communication	Cooperative driving safety, energy efficiency, comfort, traffic efficiency
6 (2033)	Knowing more road and traffic information. With V2X (V2I, V2V, V2S) for improving energy efficiency, safety and traffic efficiency. APDL (artificial road infrastructure, artificial vehicles, artificial drivers), medium-level CCMS. (parallel L4 automated vehicles)	APDL (artificial road infrastructure, artificial vehicles, artificial drivers), individual PDS module (combined safety, energy efficiency, traffic efficiency), V2I, V2V, V2S, medium-level CCMS, APDL to services communication	Cooperative driving safety, energy efficiency, comfort, traffic efficiency
7 (2036)	Full parallel driving services with a full APDL layer and advanced CCMS. (parallel L5 automated vehicles)	All PDS components/subsystems at the advanced level with a full APDL CCMS	All cooperative

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Back to the Future

PAST PRESIDENT'S REPORT

Fei-Yue Wang

Past President's Report to the IEEE ITSS Board of Governors

Editor's note: The following message was presented to the IEEE ITS Society's Board of Governor's (BoG) Meeting on October 4, 2007, at the Bill & Melinda Gates Commons, Paul Allan Center for Computer Science and Engineering, University of Washington, Seattle, Washington, USA. This is the most recent President's Report to the BoG. Prof. Wang was the President-Elect (2006), Presi-

flow like time flies, so fast, so smooth, and so seamless, that it becomes part of the environment, there would be no pollution, and you are always on time, no matter what! There will be no need for intelligent transportation systems by then, traffic intelligence would be inherent in our world, it will be everywhere and at every time. In this future, we have done our job.

Time flies by fast. The last time I was in this city was 12 years ago. My family and I spent a long vocation in Seattle and Vancouver. I rented a car and didn't feel much traffic here at all. At the time, Bellevue had very few houses. However, this time around was an entirely different story. The traffic between the airport and our conference was terrible. At only 2 o'clock in the afternoon, the

The Fall 2007 IEEE ITSS Board of Governors Meeting at the Bill & Melinda Gates Commons, Paul Allan Center for Computer Science and Engineering, University of Washington, Seattle, WA, USA.

Report to the Board of Governors of the IEEE Intelligent Transportation Systems Society

by Fei-Yue Wang

IEEE ITSS BoG Meeting, October 4, 2007
Bill & Melinda Gates Commons
Paul Allan Center for Computer Science and Engineering
University of Washington, Seattle, WA, USA

The Future

"Above all else, we should Keep Our Own Color, Our Own Identification. We are an ITS society within IEEE, not some traditional transportation society. For that we have ITE, the Institute of Transportation Engineers, and TRB, the Transportation Research Board. I was actually happy to be told by Bill a year ago that someone had commented that we were no transportation organization. Indeed, in the sense of traditional transportation, we are not now, and we should be not in the near future. **We should be the force to force others to change. For that, we must have and keep our own identity."**

IEEE ITS Magazine, vol.1, No.1, pp.4-9, 2009

CAS Qingdao Academy of Intelligent Industries

QA:
Question & Answer

AI:
Artificial Intelligence

II:

Intelligent Industries

Parallel rover tracks

Headquater for Innovation, Makers and Commercialization.

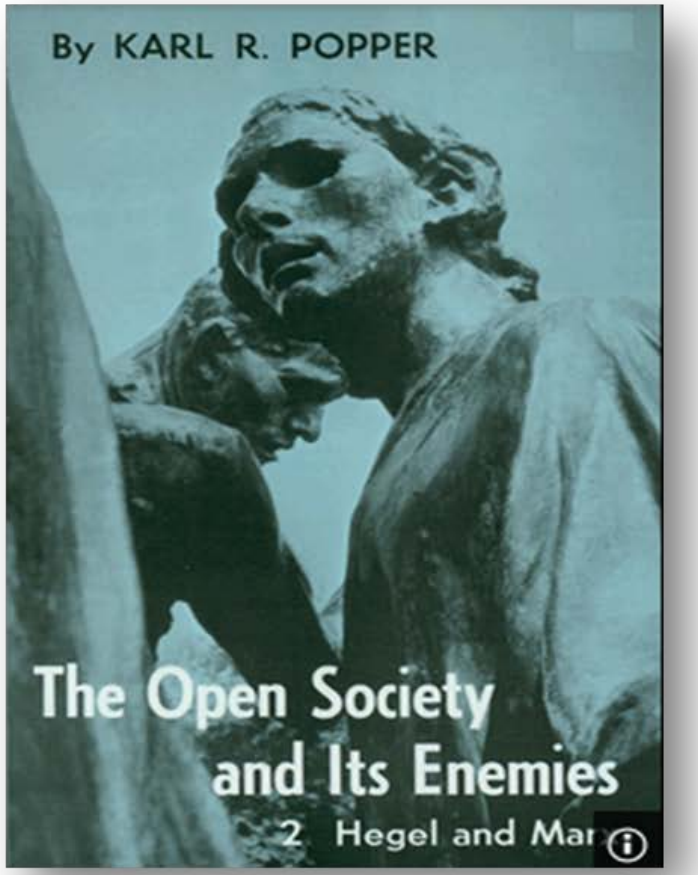
QAII: Industries & Factories



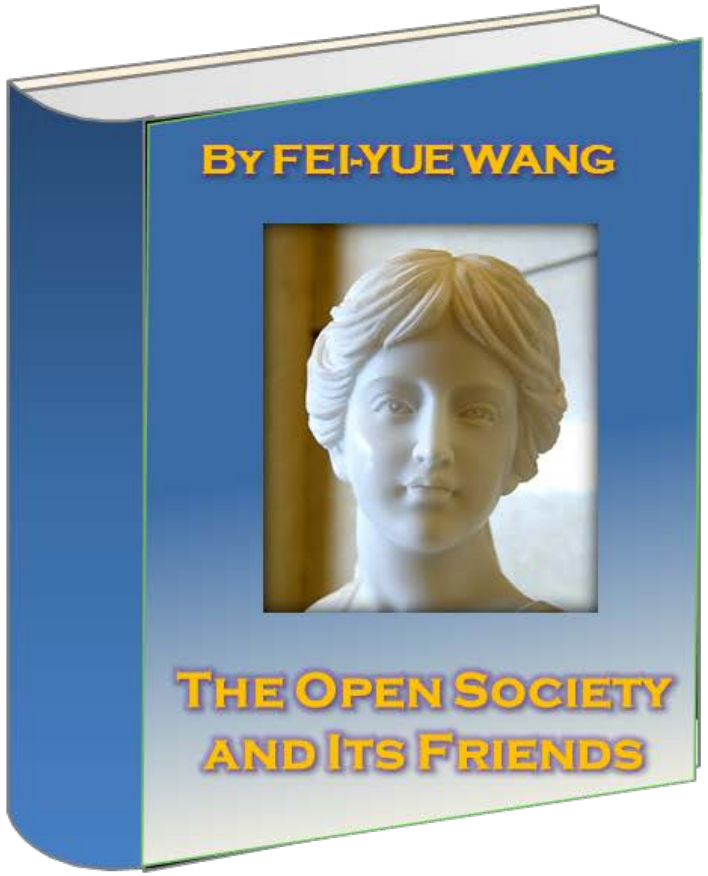



My Book in 2024: AI will provide 90%+ of our jobs in future

POPPER'S BOOK:
THE OPEN SOCIETY AND ITS ENEMIES



WANG'S BOOK:
THE OPEN SOCIETY AND ITS FRIENDS



March 30, 2003, reading Thomas S. Kuhn's "The Road Since Structure".
Thinking the inspiration of philosophy and the ignorance of life.

Shared Life

活的历史载体
生的时代象征
　是过去走向未来的桥渡
　是已知遭遇未知的界口

Our Life

存进无奈的反射
写出万般的曲折
　原谅那是你岁月的忠实记录
　感叹这是我追求的完整轨迹

Nature's Life

因果随机的回应
生灵永远的田野
　不该想谁为过客谁是主人
　不再问从何开始为何终结

Eternal Life

困惶中天问无声
希望里自作多情
　晨曦下日半的尺棰吟唱着万事的不竭
　夕阳上无限的存在呼唤着有限的生命

The 29th IEEE Intelligent Vehicles Symposium
(IEEE IV'18) June 26 – July 1, 2018, Changshu, Suzhou, China

General Chair:

- **Prof. Fei-Yue Wang**, Institute of Automation, Chinese Academy of Sciences

General Co-Chairs:

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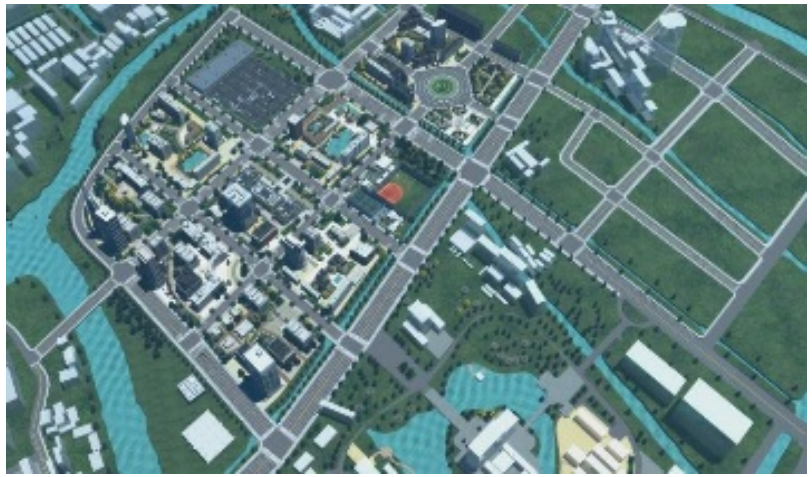
- **Prof. Miguel Sotelo,** University of Alcala, Spain

Program Chair:

- **Prof. Nanning Zheng**, Xi'an Jiao Tong University

Program Co-Chairs:

- **Prof. Li Li**, Tsinghua University, China
- **Prof. Lingxi Li**, IUPUI
- **Prof. Dongpu Cao,** Cranfield University, UK



Thank you ！

Q & A

Fei-Yue Wang，AI and Intelligent Vehicles Future Challenge (IVFC) in China: From Cognitive Intelligence to Parallel Intelligence, Challenges for a data-driven society ITU Kaleidoscope Academic Conference, Nanjing, China, 28 November 2017