







Human Resource Development in CAV Industry

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- Skills needed for working in CAV industry
- How to develop human resource for CAV industry
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Jobs in CAV Industry



CAV Research and Development

CAV Manufacturing value chain







Jobs in CAV Industry









What's skill you need for working in CAV industry?

- Programming Skills
- Robotics and Electrical Engineering
- Machine Learning/AI
- Traditional Automotive Engineering Skills
- Vehicle Dynamics and Control
- Data Analytic
- Data Communication







Skills for autonomous vehicles jobs

Top 10 skills for autonomous vehicles jobs

Rank	Skill	Rank	Skill
1	Programming: C or C++	6	Programming tools: Git
2	Programming: Python	7	Programming: Matlab
3	Image processing	8	Programming: Java
4	Artificial intelligence	9	Programming: Shell script
5	Machine learning	10	Embedded software
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How to Develop Human Resource for CAV Industry





Online courses



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Open-Source Data Platform for Autonomous Driving



- Berkeley BDD100: The dataset was released in 2018 containing 100k raw videos, 120 million image frames across multiple US cities and for different weather locations. A portion of about 10k images has been annotated on a pixel level.
- **Baidu** ApolloScape: Baidu's ApolloScape dataset from 2018 contains 140k high-resolution images with pixel annotation and 3D semantic points representing various weather scenarios and locations in China.
- Waymo Open Dataset: The dataset is representing 1000 driving scenarios in urban and suburban US environments was captured in 2019 with lidar and high-resolution cameras. The collection includes 12 million 3D labels as well as 1,2 million 2D labels of vehicles, pedestrians, cyclists, and signs.
- Lyft Level 5 Dataset: Lyft's dataset from 2019 includes 55k 3D-annotated images from lidars and cameras driving around in the US. The collection provides a surface map and HD spatial semantic map of the gathered data.
- Aptiv nuScenes: The nuScenes dataset from 2019 contains 1000 driving scenarios in the US and Singapore. The collection yields 1,4 million lidar and camera images and about 1,4 million annotated objects.
- Scale PandaSet: The dataset provides 100 complex driving scenes from 2019 that have been collected in the US. The collection includes 48k camera as well as lidar images.







Top 8 Autonomous Driving Open-Source Projects

- Carla an open-source simulator for autonomous driving research. It has been developed to encourage development, training as well as validation of autonomous urban driving systems
- **SUMMIT** Simulator for Urban Driving in Massive Mixed Traffic is a high-fidelity simulator that promotes the advancement and testing of crowd-driving algorithms.
- **Flow** an open-source computational framework for deep RL and control experiments for traffic microsimulation.
- **PGDrive** an open-ended and highly configurable driving simulator that integrates the key feature of the procedural generation (PG).
- **Deepdrive** an open simulation platform built to accelerate progress and increase transparency in self-driving.
- AirSim developed by Microsoft, AirSim is an open-source, cross-platform simulation platform for autonomous systems.
- LGSVL Simulator an open-source autonomous vehicle simulator developed by LG Electronics America R&D Centre.
- **Gym-Duckietown** a simulator for the Duckietown Universe. It is written in pure Python/OpenGL (Pyglet).







Open-source autonomous driving S/W



Source: https://www.autoware.org/autoware



Baidu builds global autonomous driving ecosystem





Apollo Technical framework





Competitions: Japan Automotive AI Challenge





Qualifying online simulation

event date April 12th-May 13th, 2022 format online

Contents

Challenge course

- Language: Japanese only
- Offer environment :
 - Education program (online, about 4-5 hours)
 - Cloud exercise environment (can be used with GPU on / off)
 - Exercises
 - Online tutorial

- Language: Japanese / English
- Offering environment
 - Cloud exercise environment (can be used with GPU on / off)
 - Exercises



Common issues

Run scenario: Run a scenario with traffic lights, stop lines, obstacles, etc. **Challenge task**

Running Keep speed, acceleration, jerk, etc. within a certain range

- Stability Correctness Put the vehicle in front, back, left and right in a certain stop
- **Cognitive** Recognize the crossing of a person at a pedestrian crossing, etc., stop the vehicle appropriately, and restart.

Exercise (competition)

Utilizing an automatic driving simulator, from data collection to model construction, learning, data enhancement and model improvement, while using deep learning, compete for the time to go around a predetermined course.

The course to run differs between the challenge course and the advanced course.





Advanced course



Platform for AD development/study

OSCAR is an open-source project that aims to provide a fully functional autonomous driving platform and easy-to-use tools to speed up the autonomous driving development process.



Remote Laboratory

Remote experimentation environment for autonomous driving









Platform for AD development/study







CAV HRD at Smart Mobility Research Center Chulalongkorn University

Seminar on Automated Vehicles in Bangkok (Oct 2-4, 2018)





The by-wired vehicle was developed by CU Smart Mobility. High level sensor and program were from Nagoya University.

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Participants attended 2days lecture class and 1day onsite demo class.

System of Demo Vehicle





CAV HRD at Smart Mobility Research Center Chulalongkorn University



3 inhouse developed CAV prototypes



5G-Teleoperated vehicle and cockpit



Autonomous delivery vehicle prototype platform





Just arrived! 3 autonomous shuttles from Turing Taiwan

These 3 new AVs will be used for NBTC research project and Bachelor/Master/Doctoral degree student projects/thesis.





CAV HRD at Smart Mobility Research Center 17th NSTDA Annual Conference Chulalongkorn University



6-DOF Driving Simulator for Human/AV in the loop study

Chulalongkorn Digital Twins Campus for AV simulation

Chulalongkorn Automotive Engineering Knowledge Transfer Unit



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Thank you

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