The Latest of Project Apollo

Bringing autonomous driving to production

Baidu IV
Oct 2017
Apollo is an open ecosystem for autonomous driving

Cloud Service Platform
- HD Map
- Simulation
- Data Platform
- Security
- OTA
- Dueros

Open Software Platform
- Map Engine
- Localization
- Perception
- Planning
- Control
- End-to-End
- HMI

Reference Hardware Platform
- Computing Unit
- GPS/IMU
- Camera
- LiDAR
- Radar
- HMI Device
- Black Box

Reference Vehicle Platform
- Drive-by-wire Vehicle

Apollo 1.0 Release
Apollo 1.5 Release
Apollo 2.0 Release

AI Algorithm
Big Data
High-performance Computing
Apollo empowers all partners and build win-win ecosystem

Diagram:

- Partners
- Private Distribution
- Open to All
- Developer Community
- Clients
- Baidu
Technology Demo (with Bosch)

It通过对摄像头图像
which allows drivers to enjoy
Baidu HD map highlights

**Accuracy**
- Relative Precision: 0.1-0.2m
- Road Features: 200+

**Coverage**
- Total Survey Cars: 280
- HD Map Survey Cars: 40+ and growing
- In 2017 cover Whole China Highway

**Efficiency**
- Automation: 90%+

<table>
<thead>
<tr>
<th>Feature</th>
<th>Detection Rate</th>
<th>Accuracy Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane Marking</td>
<td>95.72%</td>
<td>96.59%</td>
</tr>
<tr>
<td>Barrier</td>
<td>97.48%</td>
<td>99.03%</td>
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<tr>
<td>Curb</td>
<td>98.87%</td>
<td>99.01%</td>
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<tr>
<td>Sign</td>
<td>96.04%</td>
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<tr>
<td>Pole</td>
<td>98.74%</td>
<td>93.47%</td>
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</table>
Self-localization Architecture

- IMU
- Camera
- GPS
- HD MAP

- Historical Trajectory
- Real-time Features
- Prestored Features

- Feature Matching
- Pose Estimation
- Motion Compensation

- Location Results
Technology Demo (with Chery)
Perception Architecture

Feature Detection
- Region Proposal Network
- Conv Layers
- Object Classifier
- Bounding Box Regressor

Feature Detection
- Feature
- Detect
- Recognition

Semantic Segmentation
- Convolutional Encoder-Decoder
- Input: RGB Image
- Pooling Indices
- Output: Segmentation
- Conv + Batch Normalisation + ReLU
- Pooling
- Upsampling
- Softmax

Images:
- Top left: Perception of Traffic Lights
- Top right: Perception of Road
- Bottom left: Perception of Lane Lines
- Bottom right: Perception of Pedestrians
All in one - Apollo Computing Unit (ACU)

ACU
Centralized in-car computing platform for autonomous driving
Ready for mass production
## ACU - Product Overview

### AI Modules
- **Planning & Decision**
  - ACU-MLOC: ✔
  - ACU-MLOP: ✔
  - ACU-MLOP2: ✔
- **Environment Perception**
  - ACU-MLOC: ✔
  - ACU-MLOP: ✔
  - ACU-MLOP2: ✔
- **Self-Localization**
  - ACU-MLOC: ✔
  - ACU-MLOP: ✔
  - ACU-MLOP2: ✔
- **HD Map**
  - ACU-MLOC: ✔
  - ACU-MLOP: ✔
  - ACU-MLOP2: ✔

### Fundamental Capability
- **OTA**
  - ACU-MLOC: ✔
  - ACU-MLOP: ✔
  - ACU-MLOP2: ✔
- **Cyber Security**
  - ACU-MLOC: ✔
  - ACU-MLOP: ✔
  - ACU-MLOP2: ✔
apollo 1.5
is available now

http://apollo.auto
http://github.com/apolloauto