Intro. of HD maps

Deriving HD Maps for Highly Automated Driving from Vehicular Probe Data (ITSC), 2016

Presentors:
Kuan-Chieh Hsu 862188621
Huayue Gu 862185891

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Outline

- What is HD maps in general?
- The HD map format in this work
- The process of generating architecture
- Applications
What is HD map?
What is HD map?

- High definition maps are detailed maps for self-driving tasks.
- It’s all about high precision. (scale & comprehensiveness)

HD maps: case 1

HERE map

Link: https://wego.here.com/?x=ep&map=33.9764,-117.3341,10,satellite
HD maps: case 2

- OpenDrive
  - open source format

[Diagram showing the relationship between Driving Dynamics, Traffic Simulation, Real-Time Road Evaluation Library, and OpenDRIVE™ Road Description File]

Link: http://www.opendrive.org/
HD maps: case 3

- TomTom map
  - highway network in Germany

Link: https://www.tomtom.com/products/hd-map/
HD maps and why this paper

- HD map format standardization
- HD map generating architecture
- Adaptive to sensing data

“Find methods to exploit that probe data to generate and maintain HD maps.”
The HD map format in this work
The HD map format

1. Road geometry
   a. Road, lane positions
2. Road furniture
   a. Features: sign, traffic lights
3. Dynamic data
   a. Events, construction

Figure 1: HD map feature classification and related requirements to probe data.
The process of generating architecture
Hypothesis

HD maps could be generated and updated by analyzing a great amount of recorded sensor data of series vehicles.
The whole idea

1. The solution to address the problem
2. A scalable infrastructure
3. The proof to support our hypothesis
4. A metric to evaluate the accuracy of the HD Maps
The whole idea--- Solution

1. An explorative phase
2. A scalability phase
3. A location-based visualization
4. Refind and assess the approach
The whole idea---Solution

1. Particular sub-challenge
   - Develop or adapt experimental map inferring and update approach
2. Select sub-set probe data and reference map
3. Context-aware assessment of experimental approach
   - Passed?
     - Large-scale assessment of approach
     - Passed?
       - Assessed map inferring and update approach
The whole idea--- System Architecture
The whole idea--- A Proof of concept

Approach 1: inferring road geometry with GPS data

Figure 7: Results of Approach 1 (view in ITEF)
The whole idea--- A Proof of concept

Approach 2: Lane inferring with extended probe data

Figure 10: Results of Approach 2 (ITEF)
The whole idea--- Metric

Experimental Setting (The Autobahn section in Germany)

<table>
<thead>
<tr>
<th>Input data</th>
<th>quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traces</td>
<td>100</td>
</tr>
<tr>
<td>Probe Data</td>
<td>15,000,000,000</td>
</tr>
</tbody>
</table>
The whole idea--- Metric

Figure 11: Quality of the inferred map using Algorithm 1 and 2 based on the number of considered probe data.
Applications
Application aspects - For Platform
Application aspects - For Users

- Semantic Segmentation
- Cuboids
- Polygons
- 2D Boxes
- Lines and Splines
- 3D Lidar Point Cloud
Conclusion

- Developing system to infer HD map from probe data
- Inferring HD maps with an accuracy of less than 1 meter is possible
- Working on improving the accuracy of resulting maps using additional sensors
- Working on detecting changes of the road layout as quickly as possible
References


Thanks for your listening!