Mapping the New Generation of Maps – High Definition Maps

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• Cartography = Map making
• Traditionally always done by cartographers (paper and pen / GIS software)
• Standard maps → purpose, audience, layout, visual hierarchy, color, scale, projection, context, visual variables, labels

source: US Census Bureau
• Contain all / most map elements
• User-centered → visualization and design is very important
• Used to: answer a question, make a decision, see data in context, tell a story, inspire
Focused on goal-directed route planning and the execution of movement
Usability is key – consumed by humans
Standard definition map – accurate but not precise, updatable but not up-to-date
• autonomous cars require the surrounding environment information

• the **High definition (HD) map** is a detailed representation of the physical environment features

• 3 challenges / characteristics of map making for autonomous vehicles:

  1. **precision (cm level) = HD**
  2. **fresh (up-to-date) – once/week**
  3. **work seamlessly w. autonomous driving system**
1. Precision → LiDAR + other sensors

Source: Cult of Mac
2. freshness → survey fleet / crowd-sourcing
3. seamless work w. autonomous system →

Layers of HD maps

- 2D orthographic map → foundation layer
- DEM → (geometric map layer)
- Lane / Road model → semantic layer
- Stationary map
HD mapping process

Data collection
- LiDAR point clouds
- Camera imagery
- GPS + IMU

HD map generation
- Sensor fusion & pose estimation
- Data fusion & data processing
- Object location detection
- Semantics extraction

Quality control & validation

Update & maintenance
Conclusions (challenges, concerns)

• high costs of creation & huge amount of data
• lack of standards → there’s no Google Maps / SDI for self-driving cars
• legal issues / regulatory limitations → e.g. GDPR
• information safety inside the cloud → e.g. hacking, infrastructure failure
• rapidly growing market
• HD map is the ”key part of the autonomous driving puzzle”
• cartographers need developing skills if they want to be part of the HD mapping process
Thank you!

Questions?
PS: Don’t throw away the paper maps just yet.