Road Vehicle Automation in the U.S.

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Current U.S. Trends in Driving Automation

- **More realism about what kind of automation will be available when**
- **Focus on narrowly-defined use cases by developers and investors**
- **Industry consolidations and partnerships for critical mass**
- **Diverse industry participants – vehicle and IT industries**
- **Complementary technologies for robustness of higher automation**
- **Recognition of need to earn public trust**
- **Regulatory uncertainty, with distributed decision making**
- **Competition among states for visibility and high-tech jobs**
- **AVS 2020!**

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More Realism About What and When

- **Level 5 automation (ubiquitous) recognized as only a very long-term dream, not a realistic target**
- **Level 4 automation for use cases with bounded complexity:**
  - **Low-speed urban first/last mile transit access**
  - **Low-speed urban package delivery**
  - **Buses in protected busways**
  - **Trucks on low-density rural motorways (and as platoon followers)**
  - **Taxi services in retirement communities or low-density sunbelt suburbs**
- **Very gradual rollouts, with limited numbers of AVs**

Focus on Near-Term Return on Investment

- **Enabling technologies and supporting services that can apply to both low and high levels of automation**

- **Avoiding over-saturated topics (50+ lidar companies)**

- **"Full stack" developers of higher automation only if focused on narrowly defined ODDs**

  - **Protected sites like mines or ports**

  - **Low-speed protected urban environments**

  - **Low-density rural motorway environments**

  - **Commercial markets, not for private personal cars**

Industry Partnerships and Consolidations

- **ADS development is too expensive and risky for big companies to do it alone**
  - **Big companies buying small companies with specialized expertise**
  - **Big companies teaming with other big companies to spread risk (even competitors)**
  - **Automotive – information technology teaming for resources and cultural cross-fertilization**
  - **Desperately seeking new business models**

Diverse Industry Participants

- **Traditional automotive OEMs and Tier One suppliers**
- **Start-ups funded by or teamed with OEMs (Cruise, Argo AI)**
- **Major information technology companies (Google/Waymo, Amazon, Baidu,…)**
- **Ride-hailing companies (Uber, Lyft) teaming with vehicle companies**
- **"Full stack" start-ups, some with huge investments (Zoox, Nuro, Aurora…)**
- **Start-ups focused on niche services and enabling technologies**

Complementary Technologies for Robustness of Higher Automation

- **Multiple sources of perception data:**
    - **Radar AND**
    - **Lidar AND**
    - **Machine vision AND**
    - **Precise localization with detailed mapping, INS, AND**
    - **Wireless communication (V2V and I2V/V2I)**
- **Data fusion, cyber security, environmental disturbances**
- **Machine learning in specific niches where uncertainties limit algorithmic solutions**
- **Unavoidable cost of reaching Level 4 automation**

Recognizing Need to Earn Public Trust

- **Crashes eroded public trust in automation (Uber, Tesla)**
- **Early hype is starting to wear thin**
- **Industry recognizing responsibility for earning public trust**
- **Industry "good actors" trying to get ahead of "bad actors"**
- **Outreach efforts by industry coalitions:**
  - **SAE Automated Vehicle Safety Consortium (AVSC)**
  - **Partners for Automated Vehicle Education (PAVE)**
- **Gaining understanding of general public attitudes**
  - **JD Power surveys**
  - **Missions Publiques/ASU workshops**

Regulatory Uncertainty with Distributed Decision-making

- **Traditional boundaries between federal and state regulations break down with automation**

- **Current federal administration opposes new regulations**

- **Congress has not found consensus on a legal/policy framework**

  - **Industry and traffic safety/consumer advocates pulling in different directions**

- **States determine trade-offs between attracting high-tech industry jobs and protecting public safety from immature systems using regulations**

Competition Among States

- **Economic development emphasis -- seeking high-tech ADS development and testing jobs**
  - **High-tech "image" motivations**
  - **Some earlier regulatory "race to the bottom" trends softening**
- **Providing test tracks and public road test sites for use by industry**
- **Competing for federal government field tests**