Intelligent driving under unexpected circumstances: pavement distress detection and avoidance

AstaZero Researchers Day – Building trust in automated driving
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2016 October 18
Main causes of accidents

- Distraction
- High speed
- Slippage
- Weather conditions
Current perception technologies on vehicles

1. Pedestrian or cyclists detection
2. Vehicles detection
3. Lane marking detection
Advanced perception

1. Pavement distress detection

2. Adverse weather conditions
Why pavement distress analysis?

1. Safety
2. Comfort
3. Duration

Increase reliability, reduce errors and avoid any misinterpretation or false detection.
State of the art

2014 - Patent US20140355839
Google has designed vehicles with pothole detectors that use a combination of GPS and motion sensors to determine when the vehicle drives over a pothole.

2015 - Jaguar Land Rover (JLR) reveal his detection system

https://www.youtube.com/watch?v=NPiynbkNYVE
**Visual on-road traversability analysis**

Detect road irregularities and potholes may help vehicles to:

- Avoid slippage
- Slow down on bumpy roads
- Increase comfort for driver
- Minimize stress for the suspensions
Visual on-road traversability analysis

For trucks:

- Avoid possible damages for the load
- Limit oscillations for the trailer (avoid rollover)
- Auto-adapt suspensions stiffness to the road conditions

1. Detection area → the irregularity is detected
2. Warning area → the truck is getting closer → slow down;
3. Emergency area → high-risk → emergency brake;
How does it work?

Acquisition and interpretation

- Camera image acquisition
- Interpretation via UPD analysis

UPD-based planning

- Traversability grid reconstruction
- Path generation
Evaluation in real environment
Rural environment

- High level of irregularities
- No lane marking
- No features
Night vision

1. Far range detection
2. Reactive control
Any questions?

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All the content has been published on my personal webpage at: https://www.maurobellone.com