1. Motivation

- The inherent limitations in RF spectrum availability and susceptibility to interference make it difficult to meet the reliability required for vehicular safety applications.
- Optical Wireless for V2V:
  - highly directional communication
  - limited range (10s of meters) – limited power, high background noise
  - mechanically steering transmitter and/or receiver is very costly
  - single photodiode receiver may not work in such a mobile setting
- LEDs for rear and head-lights and Cameras (e.g. parking assistance, rear-view cameras) are getting common in cars.

Why not use them for communication?

2. Light Emitting Array – Camera Communication

**Visual MIMO [1]**

- Optical Array transmitter + Camera receiver = VISUAL MIMO

**How does it work?**

- Computer vision based image analysis techniques can be used to spatially separate signals and remove interferences from distracters such as traffic lights.

3. Visual MIMO prototype for V2V

- An LED array transmits the brake pedal intensity information (0-255) in the form of ON-OFF pulses (ON = bit 1, OFF = bit 0) when triggered by an user.
  - Retrieved data is displayed on a receiver computer screen as colors (not-pressed = green, half-pressed = yellow, fully pressed = red)
  - Template matching tracking algorithm implemented in OpenCV based on a binary template of the LED array.


5. References