Sensor-Independent Autonomous Mobility

Autonomous vehicles navigate by interpreting data continuously recorded by sensors such as cameras and LiDAR – employing a perception algorithm previously trained on similar data. This invention makes the perception algorithm less dependent on the specific sensors providing the data during training and when navigating in the field – thereby contributing to reduced development costs and a simpler, faster and more flexible implementation of new sensor models.

IP RIGHTS
International Application Filed
2022

Train with one set of sensors and use with different ones

In a competitive market, new sensors are continuously integrated into automatic perception systems in order to improve their functionality. Being able to launch new sensors while continuing to rely on the training of the system carried out with data from previous sensors thus provides a competitive advantage, both in terms of costs and time.

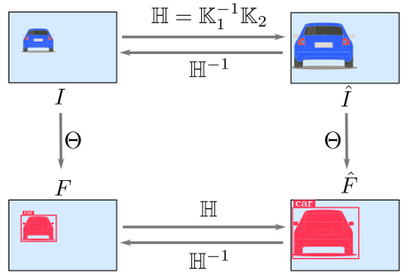
01 Less need for retraining with new data as sensors evolve and are replaced

02 Simpler and faster implementation of new sensor models at reduced development costs

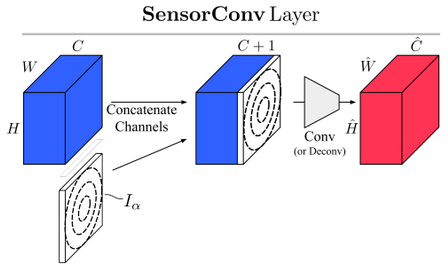
03 Factoring in field of view, mounting angle, resolution, and sensor nonlinearity

04 Successfully tested with both camera and LiDAR images

REFERENCES:
Patent appl. WO2023118163A1
Reichert et al., arXiv:2305.00221



Any particular object should be recognized to have the same properties regardless of the intrinsic geometric characteristics of the sensor used to capture it.



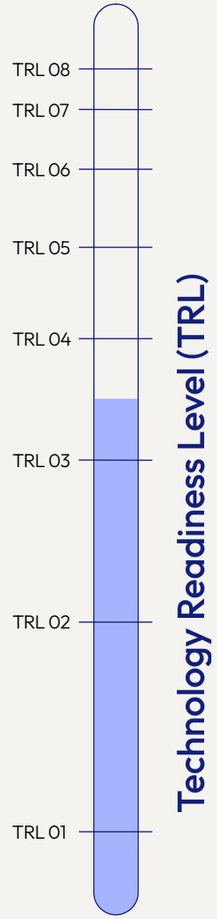
This objective is achieved by concatenating any image data recorded (blue, image size HxW, with C channels) with a sensor-specific additional layer (white) before the data are processed by the perception system.

CHALLENGE

Sensor characteristics like the resolution and field of view affect the resulting pixel-by-pixel representation of a given object like a car or a pedestrian. Thus, a neural network trained to distinguish these features in the images from a specific camera will often not perform as well on images from a different one. When implementing a new sensor, training must therefore start from scratch with images from that sensor, which in turn also implies the costly real-world recording and annotation of these images.

INNOVATION

The invention defines a deflection metric whereby every pixel of an image is assigned an angle with respect to the axis of projection (see image on the left). Geometric properties of the sensor such as its field of view and nonlinear distortion are thereby encoded into the image in the form of an additional channel and taken into account by a neural network trained on images from sensors with differing properties. This in turn improves performance on images from any sensors with geometric properties within the ranges of the training set. Moreover, ambiguity in scale and distortion of objects recorded by any given sensor are also resolved.



01 Basic principles observed · **02** Technology concept formulated · **03** Experimental proof of concept · **04** Technology validated in lab · **05** Technology validated in relevant environment · **06** Technology demonstrated in relevant environment · **07** System prototype demonstrated in operational environment · **08** System complete and qualified

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