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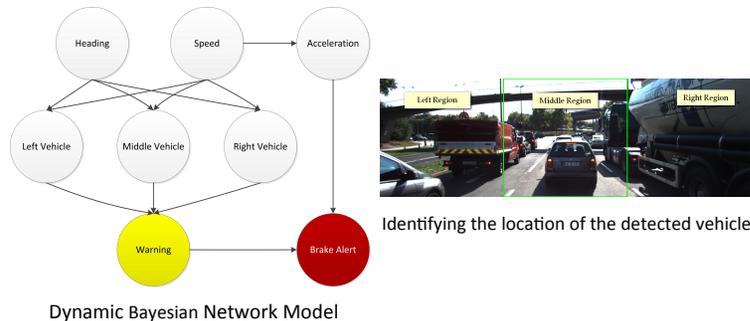
Motivation:

- A driver alert system to prevent and mitigate adjacent vehicle collisions by providing warning information of on-road vehicles and possible collisions.
- These warnings to the driver can reduce the high number of accidents and deaths on road.
- Fusion of modalities may outperform single modality.

Methodology:

A dynamic Bayesian network (DBN) fuses **vision** and **motion** measurements to provide driver awareness.

- The network is parameterized using Expectation Maximization algorithm.



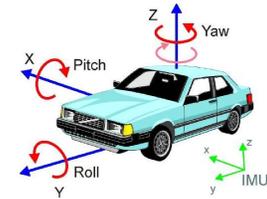
- **Vision** - A histogram of oriented gradient (HOG) feature based classifier is used to detect any adjacent vehicles and their location corresponding to the ego-vehicle.
 - Vehicles both side and rear-end images were used in training.



Examples of HOG Features from rear-end and side vehicle

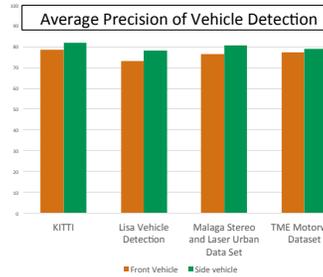
- **Motion** - Ego vehicles heading, speed and acceleration are calculated from an IMU and fed into the DBN.

- Heading- left, straight or, middle
- Speed – low or, high
- Acceleration – increasing or, decreasing.



Results:

The proposed system as tested on public datasets, including KITTI, Toyota Motor Europe (TME) Motorway Dataset, etc.



Performance of Collision Avoidance System

Heading	Cases			Failure Rate	
	Speed	Acceleration	Vehicles Detected	Warning	Brake Alert
Straight	Low	Hidden	Yes	5%	No alert needed
Straight	Low	Increasing	Yes	3%	22%
Straight	High	Increasing	No	6%	No alert needed
Straight	Hidden	Decreasing	Yes	5%	13%
Right	High	Hidden	Yes	8%	26%
Right	Low	Increasing	Yes	4%	17%
Left	Low	Increasing	Yes	3%	17%
Left	High	Increasing	No	4%	No alert needed
Left	High	Decreasing	Yes	9%	19%



Discussion:

- Experimental analysis demonstrated the model issued possible alert and warning in several test conditions.
- The future work will focus on using more sensors in the network, improving vehicle detection performance and collecting more data for network parametrization.