

SELF DRIVING VEHICLE TECHNOLOGY

PERCEPTION

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A BRIEF OUTLINE

The State of Perception

What Perception Can Help Achieve

Market Segments

Monocular Cameras

Stereo Vision

Lidars

Radars

GPS INS

V2V

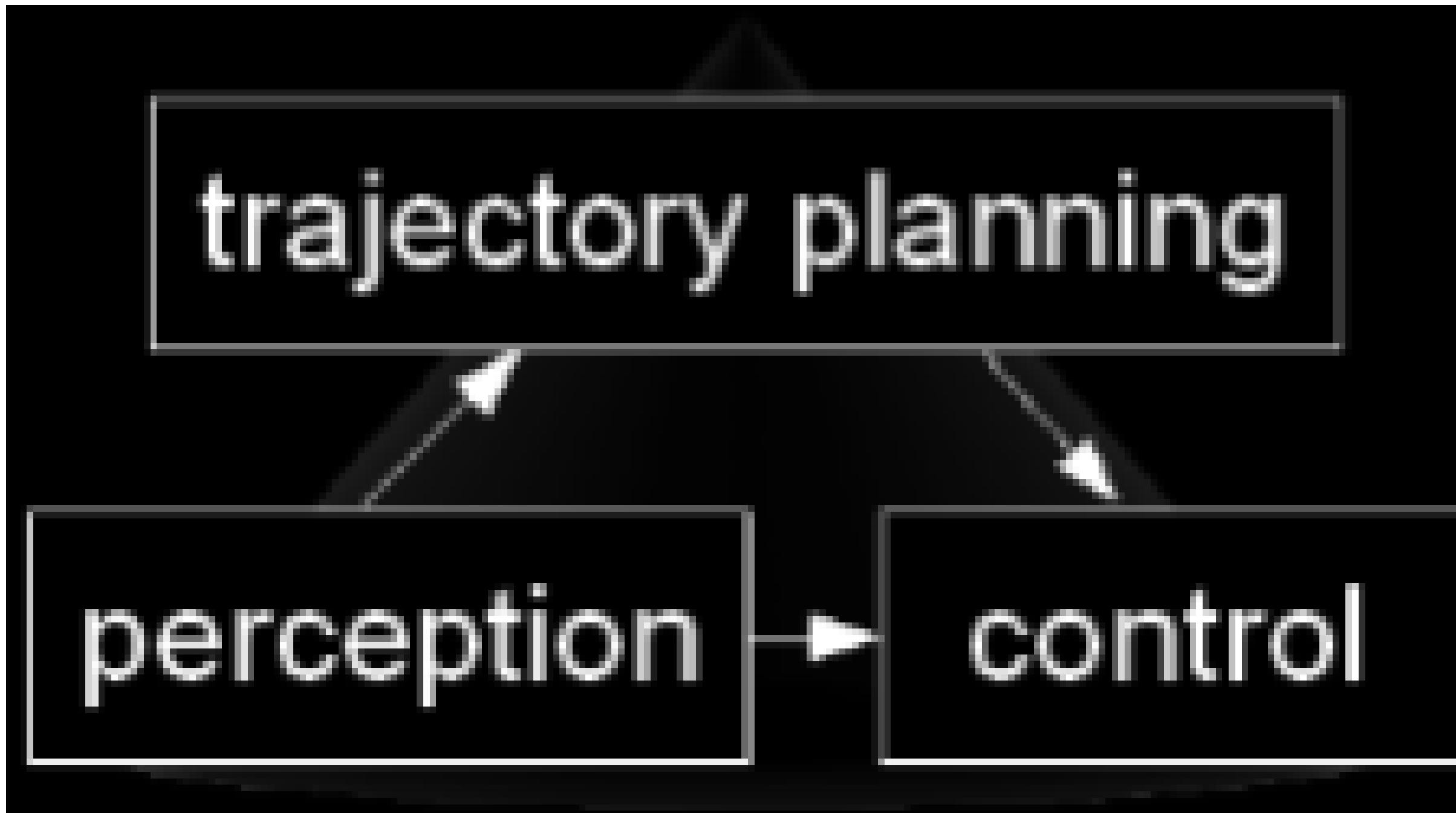
To the Future

THE STATE OF PERCEPTION

WHAT IS PERCEPTION AND WHY IS IT IMPORTANT

Making use of 2D and 3D sensors to perceive the environment around the vehicle.

Environment Perception helps to decide the optimal path and plan the trajectory, thereby, generating efficient control commands for safely manoeuvring the vehicle .



What Perception Can Help Achieve

ENVIRONMENT MAPPING

Using 2D and 3D lidars to map the environment where the vehicle operates and around the vehicle for detecting nearby obstacles for safe driving

LOCALIZATION

Using Lidars and GPS for localizing the vehicle in the map constructed. Helps to track the vehicle in the environment

OBSTACLE DETECTION

Detect pedestrians, vehicles, trees and other obstacles in the near vicinity of the vehicle to generate braking commands and instigate obstacle avoidance algorithms

BETTER DECISION MAKING

After localization and obstacle detection, path planning and navigation algorithms can take effect and the map created will help to control the vehicle and traverse the navigable path

MARKET SEGMENTS

MONOCULAR CAMERA

Using a single camera for detection of obstacles using machine learning, deep learning and computer vision

STEREO CAMERA

Using 2 monocular cameras to estimate depth for 3D point cloud creation

LIDARS

3D/ 2D point cloud data with depth of the obstacle from the vehicle used for environment mapping and vehicle localization

RADARS

Detects distance of the vehicle in front along with velocity and orientation knowledge for adaptive cruise control

GPS AND INS

Gives vehicle position in world coordinates along with vehicle velocity, angular acceleration and orientation.

V2V COMMUNICATION

Vehicle to vehicle communication to achieve intersection collision warning, forward collision warning etc

Monocular Cameras - Deep Learning for Obstacle Detection



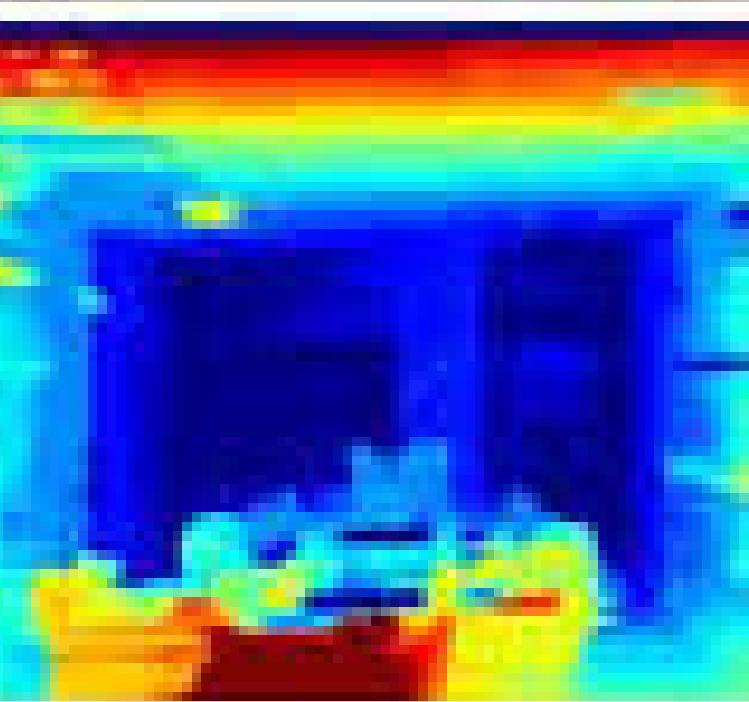
STEREO VISION

USING 2 MONOCULAR CAMERAS FOR DEPTH ESTIMATION AND POINT CLOUD CREATION

Stereo vision offers an inexpensive method of creating a 3D point cloud using just 2 monocular cameras.

The image on the right shows the depth image(4th from the top) where depth is showed by using different color intensities

The final image(bottom) shows the constructed point cloud

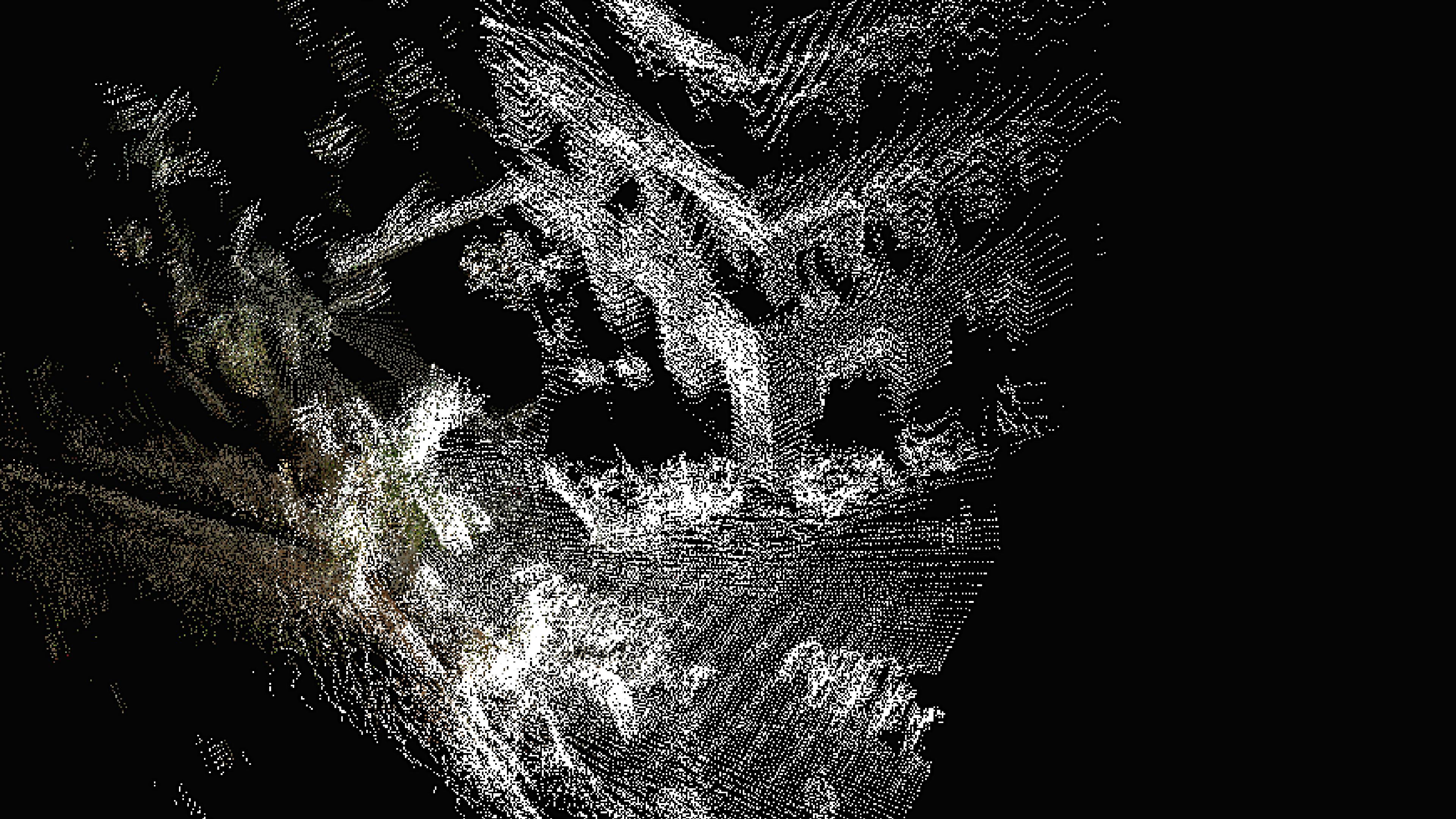


LIDARS

LIDARS ARE CRUCIAL FOR BRINGING ABOUT THE FOLLOWING TASKS

- Obstacle Detection, Segmentation and clustering
- Environment mapping for vehicle localization
- CAD model construction of point cloud
- Map of a building constructed using a 2d lidar(converted into 3d) can be seen in the slide below





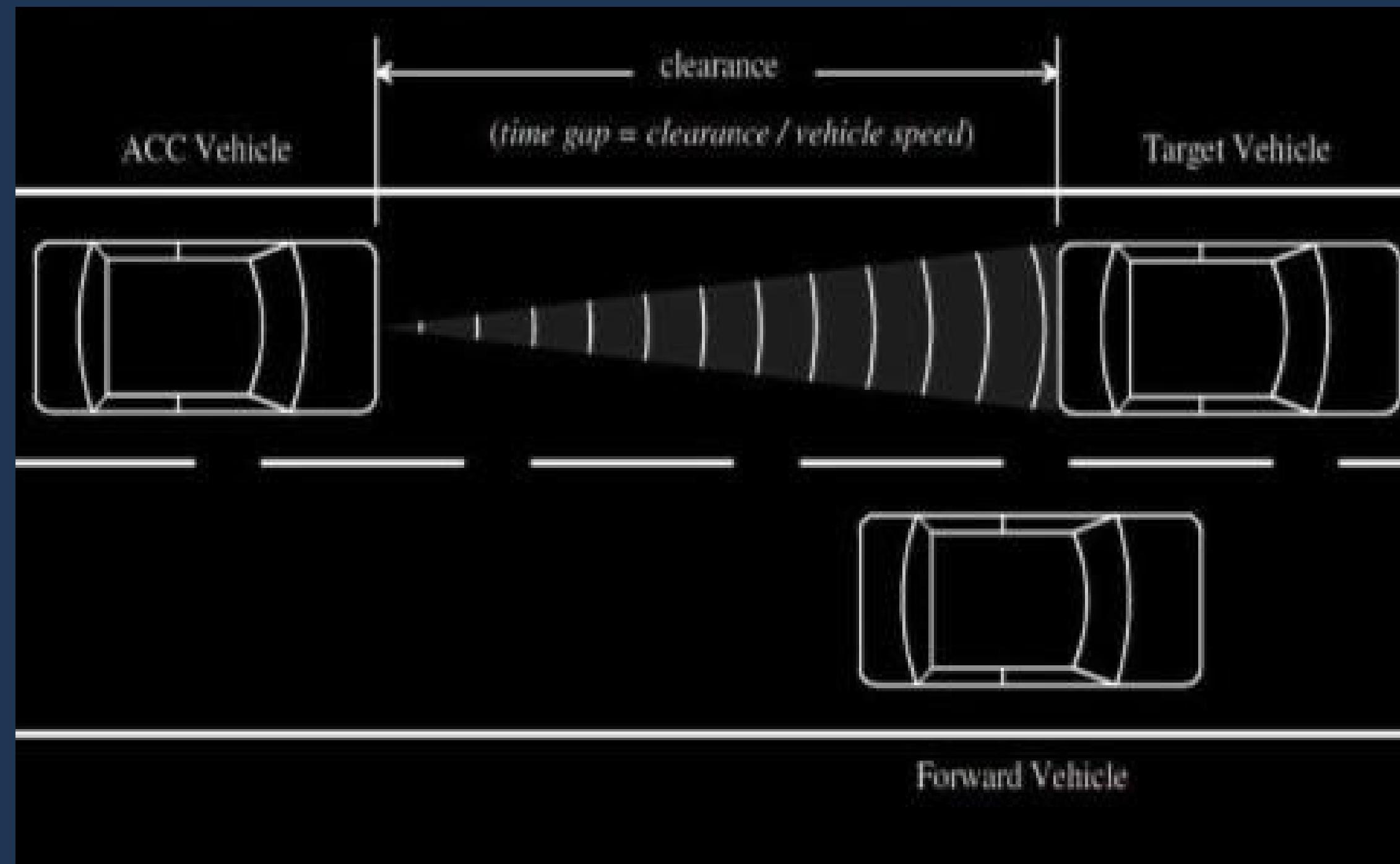
RADARS

ADAPTIVE CRUISE CONTROL

Automatically adjust speed of vehicle in order to maintain a proper distance between vehicles in the same lane.

Radars(medium and short range) are used to implement Adaptive Cruise Control

The India automotive radar market size is projected to reach USD 301.3 million by 2025 and Global RADAR market size is estimated to reach \$10.4 billion



GPS INS

VEHICLE LOCATION

GPS tells the vehicle location in form of latitude, longitude and altitude



VEHICLE ORIENTATION

More information the better. Vehicle orientation information is received from GPS INS.



VEHICLE MOVEMENT

Information about angular and linear motion of the vehicle

V2V ON BOARD UNIT

TALKING CARS

V2V technology - inter-communication between vehicles about their location, speed, direction for better road and vehicle safety.

This new technology is being pursued by many automobile companies. Makes use of Dedicated Short Range Communication and works within a range of 1km.



TO THE FUTURE

People are so bad at driving cars that computers don't have to be that good to be much better.
