

Introduction

Information is required to make informed decisions, but how do robots and autonomous vehicles collect it?

Sensors!



Unfortunately, the sensors are returning seemingly arbitrary values!

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-0.8665, -2.3345327, 0.8, 20.11475, 20.2, 3.5242093
-5349717, -3.2051682, 0.8, 32.386242, 30.3, 3.365921
7.595019, 2.6333203, 0.8, 29.450361, 23.7, 3.7900963
7.6485434, -2.9783022, 0.8, 44.874416, 21.0, 3.4738464
7.5195863, 3.8058813, 0.8, 46.073785, 22.5, 3.5531614
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26.591814, -2.7856915, 0.8, -0.460789, 18.7, 5.0713396
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24.7875, -16.320148, 0.8, 39.268166, 20.7, -10.282348
10.129545, -6.647786, 0.8, -5.484176, 14.3, 4.7695317
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```

How do we read this?

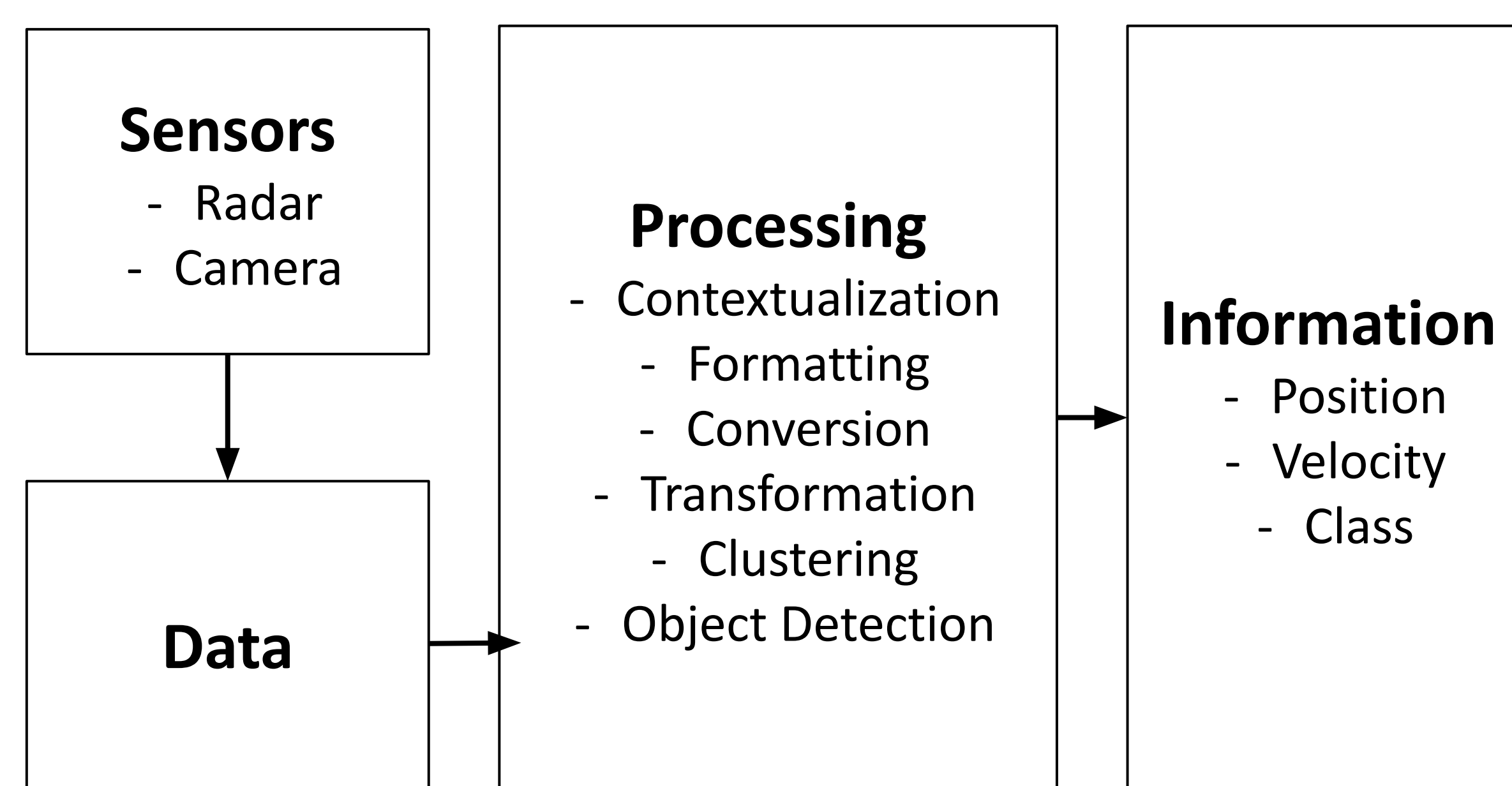
We must **process** the data into a usable context!



Data processing happens here

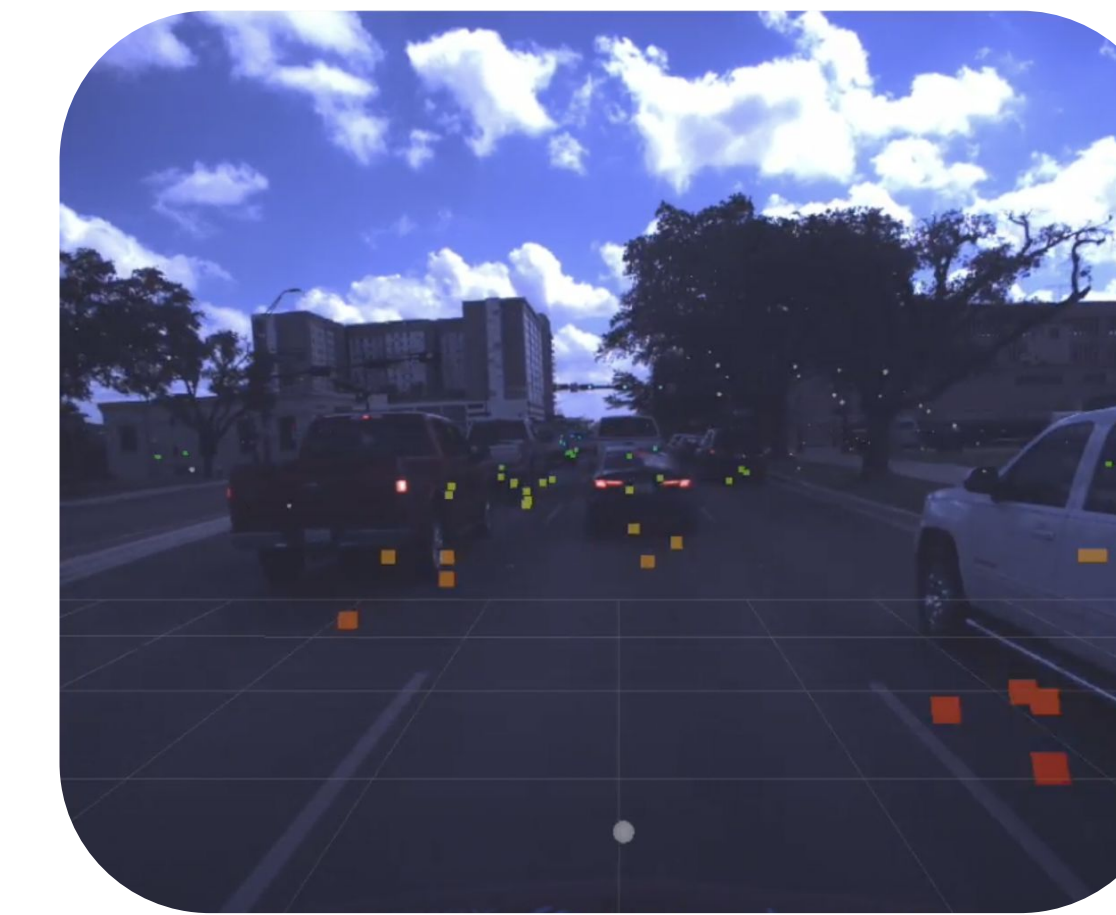
This is where this research project fits – the processing of sensor data into usable information!

In this project...



The How

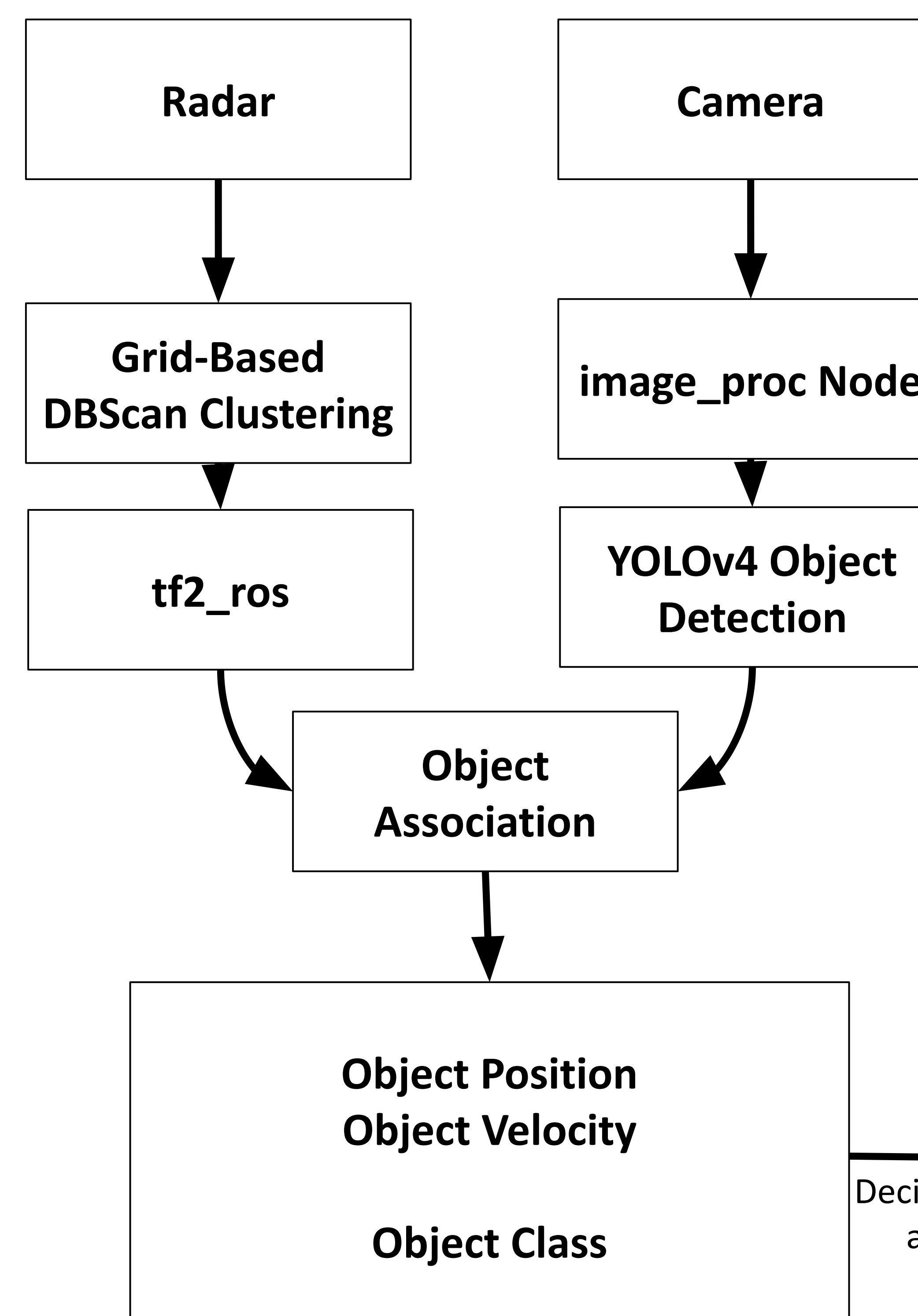
- 1) Utilized Robot Operating System 2 (ROS2) to read in radar and camera data and visualize.
- 2) Process radar data through Grid-Based Density-Based Clustering algorithm to identify position and velocity of objects.
- 3) Process camera data through YOLOv4 Object detection system to classify objects (i.e. Car, Motorcycle, Human, etc.).
- 4) Associate objects with their classification and attributes into a simple package of information.



Inputs

Processing

Output



Dive Deeper

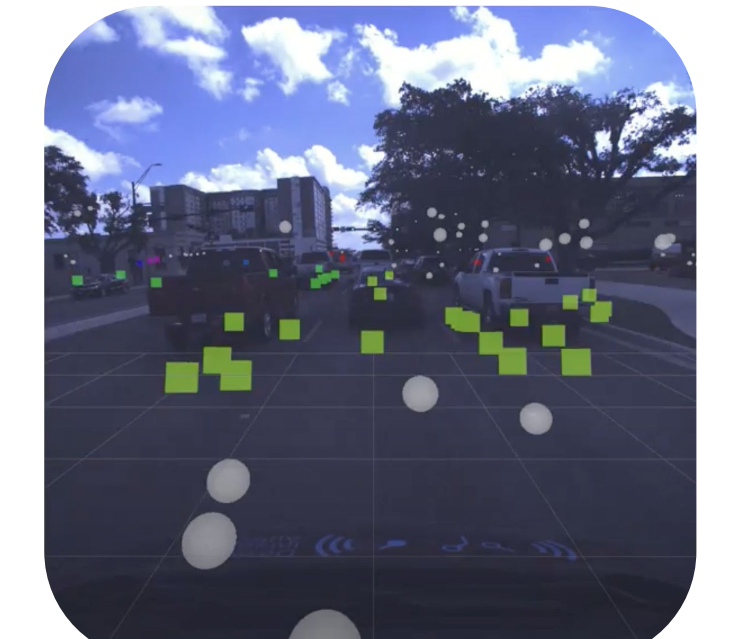
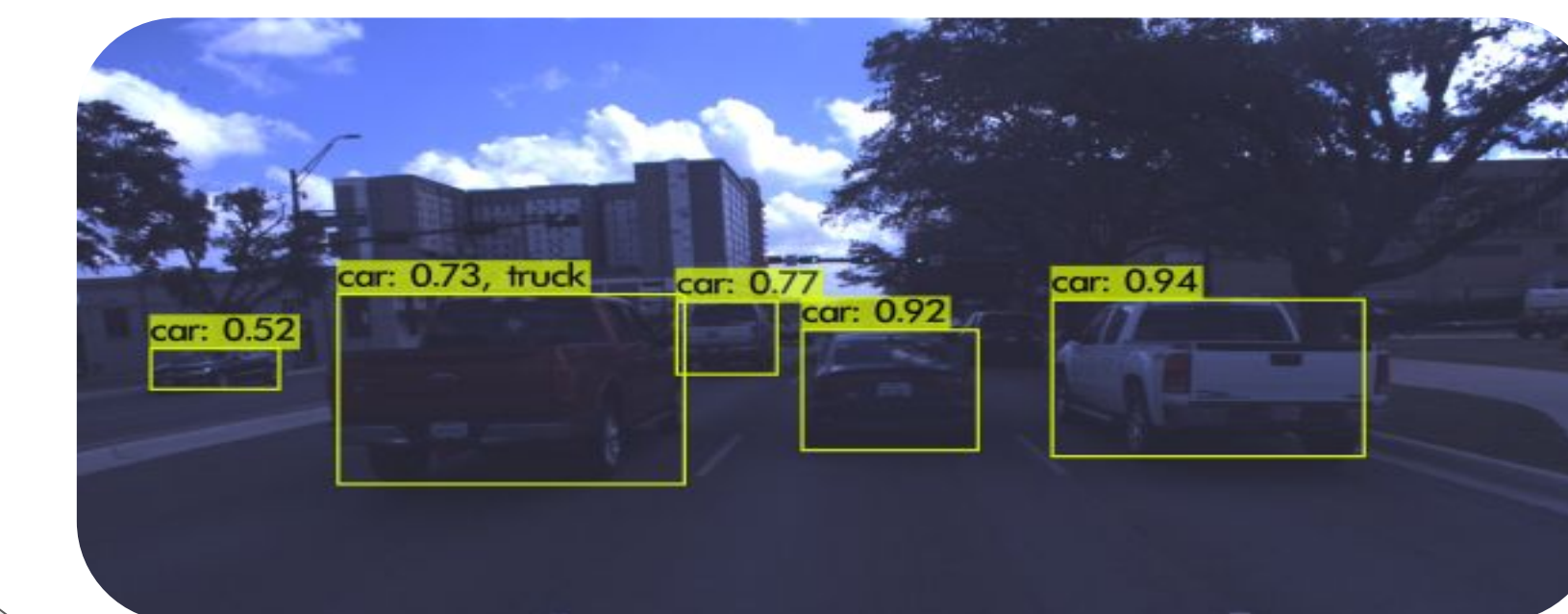
Grid-Based DBScan - A clustering algorithm designed for non-equidistant sampling density.

image_proc Node - An image processing node for raw camera data to eliminate image distortion and convert image data to color.



tf2_ros - Allows for the overlay of radar points and the camera image.

YOLOv4 - A real-time object detection algorithm that uses features learned by a deep convolutional neural network to detect objects.



Results

The object detection functions properly and accurately; The radar tended to over-cluster within complex environments with a small lag between frames.

The association of dynamic objects has not been finished yet.



Video Demonstration

How is this going to be used? It was designed for an autonomous driving context, but can be used in other fields such as robotics.

Future steps? Create the association of dynamic objects; Reduce lag in real-time clustering; Collect more attributes.