# ECE 286: Bayesian Machine Perception

## Class 12: The Research Project

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# Research Projects

- The research project must be performed in groups of **two-four students**
- Each group has to provide a one-page document describing their plans by Thursday, May 14th 12:20PM ⟶ you will get comments within one week
- Final presentations are due during the last two lectures of the course
- **The source code and a final write-up** of the project of 6-8 pages are due during finals week
- MATLAB functions and videos describing two datasets that can potentially be used for the research project will be posted today
- Find group member by using the Canvas discussion board

# Grading

- A very good research project
  - extents the methodologies learned in class in a nontrivial way
  - involves evolution of the developed method using real-data
  - is reported/document well

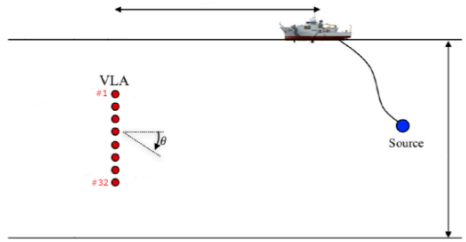
- A typical workflow
  - find partners
  - do literature search
  - decide on a dataset and problem/method
  - implement method, simulate, and document simulations
  - apply method to real data and document results

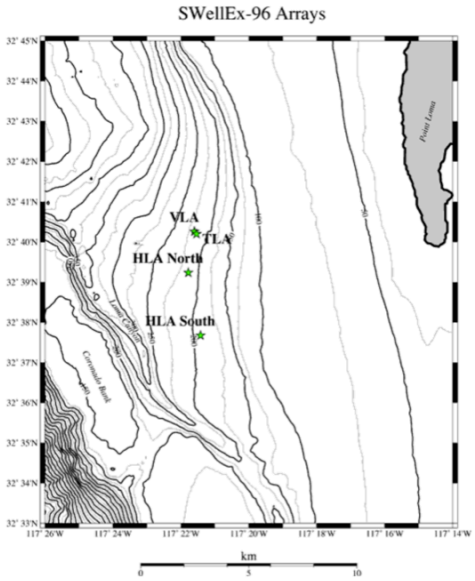
# Hints

- Potential methodological extensions
  - Multisensor fusion; combine data from different type of sensors
  - Multiple dynamic models
  - Deep learning to preprocess camera data (image segmentation)
  - Joint estimation of object extents
  - Scan matching using lidar data
  - Background removal from lidar data
  - …
- Focus on a small subset of the available datasets
- Simulate first before applying algorithm to data!

# Underwater Acoustic Data

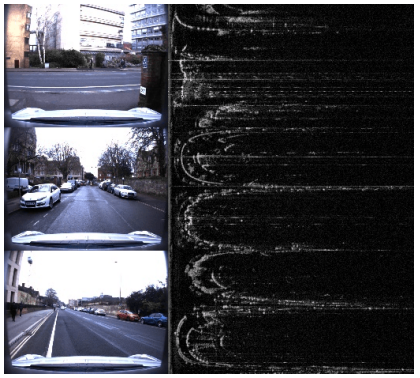
- SWellEx-96 Acoustic Array Data (http://swellex96.ucsd.edu/)
- Acoustic source is towed by ship and transmits multiple tones
- Vertical line array (VLA) deployed underwater performs angle measurements
- GPS ground truth of ship track is available
- Download VLA data from Canvas (64 hydrophones) not from SWellEx-96 website (21 hydrophones)
- Matlab code and video will be posted

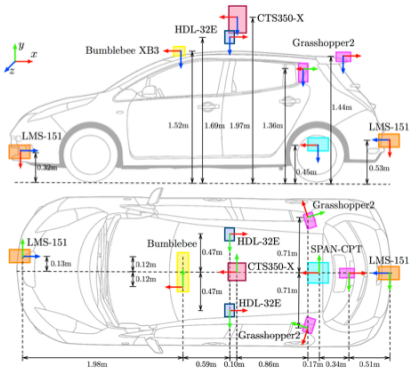


# Autonomous Driving Data

- Oxford Radar RobotCar (https://dbarnes.github.io/radar-robotcar-dataset/)
- Many sensors (360 millimeter-wave radar, 360 lidar, real-time kinematic ground truth, multiple cameras)
- Several publications document the dataset
- No labels
- SDK is available for Matlab and Python (https://github.com/dbarnes/radar-robotcar-dataset-sdk)
- Additional Matlab code and video will be posted





# Further Datasets

- Waymo Open Dataset (https://waymo.com/open/)
  - lidar and camera data
  - 3D lidar labels and 2D camera labels are provided (bounding boxes)
  - detection and tracking competitions

- KITTI Vision Benchmark Suite (http://www.cvlibs.net/datasets/kitti/)
  - mostly camera-based
  - benchmarks and evaluation metrics

- . . .

# Questions???