# Automotive Radar Data Processing System

ELECTRICAL & COMPUTER ENGINEERING

PACCAR Inc

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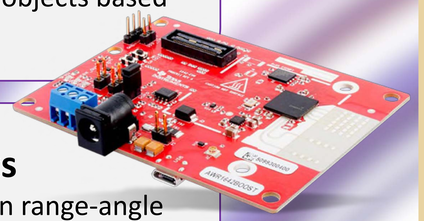
Sponsor: Paccar

## Problem Statement

- Evaluate radar for automotive application
  - Platform: TI-AWR1642BOOST
- Develop radar signal processing algorithms for object detection
- Create classifier to distinguish objects based on radar footprint

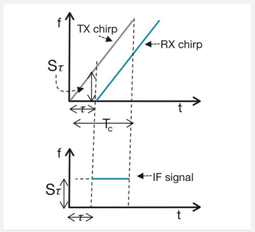


## Requirements

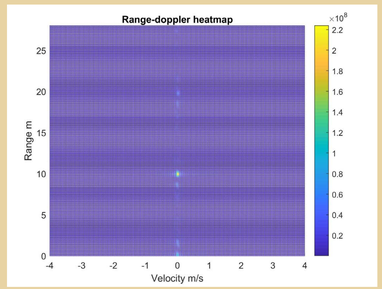
- ☑ Detect the position of object in range-angle heatmap
- ☑ Track the trajectory of object in simple scenario, e.g. one moving target.
- ☑ Detect the velocity of object and show the change of velocity with time.
- ☑ Easy-operating GUI to do signal processing
- ☑ Simple classifier for person and car.

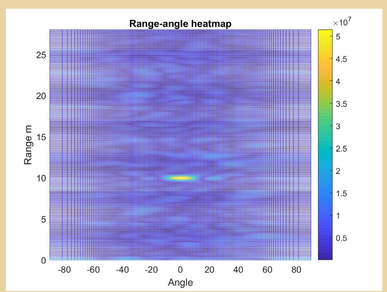
## Implementation

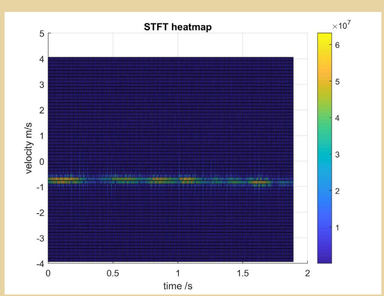
- Using raw data from radar
  - Mixed Rx and Tx signal
- Applied to generate detections:
  - Fourier Transform
  - Short-Time Fourier Transform
  - Constant False Alarm Rate (CFAR)
- Using detection information, created automated processing script to create spreadsheet with data
- Classifier was trained from data gathered



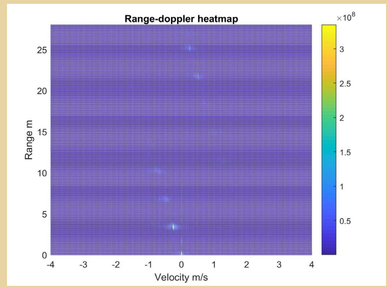

## Vehicle

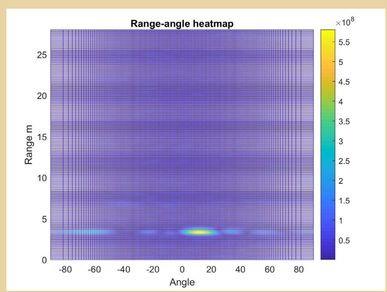


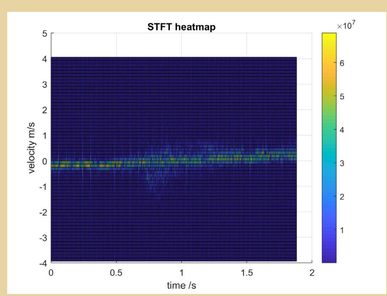



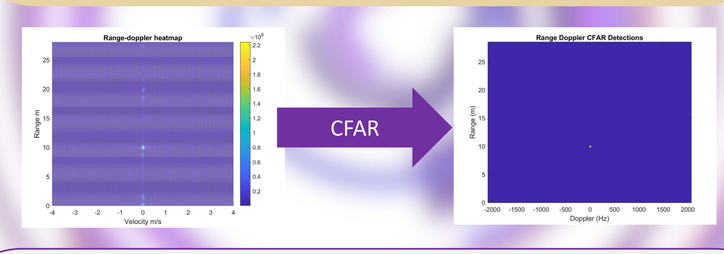



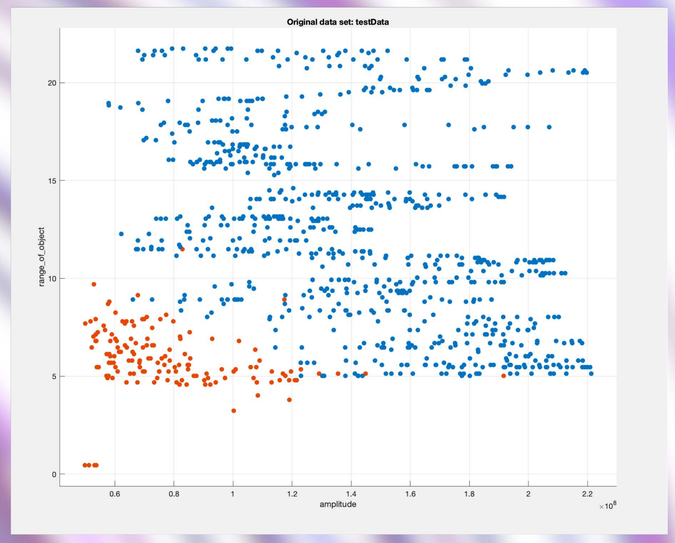

## Pedestrian




## Medium Gaussian Support Vector Machine (SVM) Classifier

- Developed using MATLAB Classification Learner APP
- Trained on 1800 samples of pedestrians and vehicle
- Based on six different features of each detection
- Accuracy: 99.4%

## Conclusion

- Developed algorithms to process raw radar data and give useful information about object.
  - Learned what is needed to form a useful detection
  - Learned applications of Fourier transform?
- Developed classifier that predicts with high accuracy whether object is a pedestrian or a vehicle.
  - Learned how to use MATLAB classification tool

## Future Work

- Diversifying scenarios for algorithm testing and improving robustness
- Improvement of object classifier
  - Train using wider range of data from large set of scenarios to diversify data set
  - Improve pre-processing algorithms to improve on feature detection

## Acknowledgements

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## References

ıovescu, C. and Rao, S. (2019). *The fundamentals of millimeter wave sensing*. [online] Available at: http://www.ti.com/lit/wp/spyy005/spyy005.pdf [Accessed 27 May 2019].