UNIVERSITY OF BIRMINGHAM

CO-existence Simulation Modeling of Radars for Self-driving

(104526-COSMOS)

MATLAB Files Data Structure

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1. Introduction

This report describes the structure of MATLAB .txt files for the identified use cases by Horiba MIRA. Moreover, it presents the signal processing chain used to generate the .txt files.

Due to the large size of .mat files and the limited storage capacity, the data files are converted to .txt files and compressed. Supporting MATLAB .m file is provided to read and plot the data from text file.

1.1 Data Overview

Brief description of each use-case for which MATLAB .txt files have been provided to project partners is given in Table 1.

Table 1: Description of use-cases

ID	Scenario	Description
1	Case 2d	Adaptive cruise control scenario (No Facades) Static victim and dynamic interferer with both vehicles facing each other. Interferer vehicle is driving towards the victim vehicles in adjacent lane.
2	Case 2f	Adaptive cruise control scenario (Facades) Dynamic victim and interferer vehicles driving toward each other in adjacent lanes
3	Case 3b	Cross traffic alert scenario (No Facades) Static victim, dynamic interference: Victim vehicle is at a distance of 5 m from the start of junction in the crossing lane.
4	Case 3d	Cross traffic alert scenario (Facades) Static Victim, dynamic interference: Victim vehicle at a distance of 5 m from the start of junction in the crossing lane.

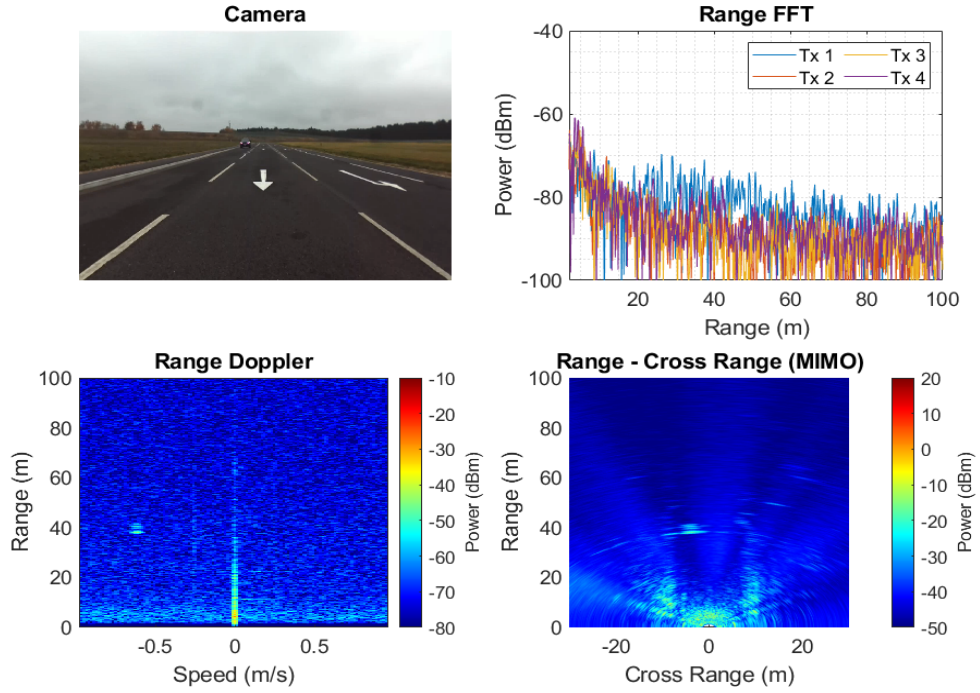
1.2 Signal Processing Chain

The basic signal processing steps involved in generating the .mat files are as under:

1) The radar data is recorded for 20s in MIMO mode with 4Tx and 16 Rx elements, resulting in 156 frames with 128 chirps integrated for a single Doppler frame.
2) Each frame has dimensions: [2048,16,4,128].
3) Blackmann Harris window (length 2048) is applied in fast time, Hann window (length 128) is applied across the slow time and Hann window (length 61) is applied across virtual antenna elements.
4) The extracted folder ***'VariablesToPlot'*** contains the following .txt files. ***'Variable_Range'*** (used to plot the 'RangeData' variable), ***'Variable_Velocity'*** (used to plot 'RangeDoppler' variable), ***'Variable_SlantRange'*** and ***'Variable_CrossRange'*** (used to plot Range-Cross range map).
5) In each extracted folder corresponding to a specific use-case, (for example: 'Case2d_Reference'), there are 4 main multi-dimensional variables stored as text files.
    a) ***Variable_RangeData*** is used to plot Range FFT,
    b) ***Variable_RangeDoppler*** is used to plot Range Doppler map,
    c) ***Variable_Beamform*** is used to plot beamformed imagery and,
    d) ***Variable_ZED_Image*** is used to plot reference camera image.
6) Variable_RangeData, Variable_RangeDoppler are complex data files, therefore their real and imaginary parts are stored in separate .txt files. For example: 'Variable_RangeData_Real' and 'Variable_RangeData_Imag'.
7) The MATLAB .mfile provided reads, organises, and processes the text files automatically by combining the real and imaginary parts of the data to single variable before plotting.
8) In the MATLAB .m file, ***'RangeData'*** has dimensions [1025,4,128,156], ***'RangeDoppler'*** *has dimensions* [1025,4,128,156], ***'Beamform'*** has dimensions [1025,512,156], and ***'ZED_Image'*** has dimensions [720,1280,3,156].

1.3 Example of Processed Output

- Case 2d: Reference for MIMO frame 10



- Case 2d: Interference for MIMO frame 10