SIMULATION MATLAB CODE for PMI-Based Codebook Enhancement

PMI-Based Codebook Enhancement for Efficient Reference Signaling

VERSION 1.1

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Required Applications

Main Application

- Application Name: **MATLAB**
- Version: R2023a (Other versions are also highly likely to be compatible.)
- Description: A high-level language and interactive environment for numerical computation, visualization, and programming, widely used for data analysis, algorithm development, and modeling.
- Download Link: https://mathworks.com/products/matlab.html

Required MATLAB Toolbox

- Toolbox Name: **Statistics and Machine Learning Toolbox**
- Description: Provides functions and tools for data analysis, statistical modeling, machine learning, and predictive analytics. (In this simulator, the function "ksdensity" is used for kernel density estimation.)
- Download Link: https://mathworks.com/products/statistics.html

Update History

[2024-07-12] Version 1.0

- Initial version code.

[2024-07-15] Version 1.1

- Update the code for plotting figure 6 & 7

Contents

- **Folders/files**

- **Structures Diagram**

- **Code Explanation [Demo.m, Figure_3.m]**

Folders and files

Folder

File

PMI-based Codebook Enhancement Github Code

generateChannel.m – Generate channels based on Saleh-Valenzuela channel model

enhanceCodebook.m – Generate enhanced codebook using the proposed codebook enhancement method

generateDFT.m – Generate DFT codebooks

generateVQ.m – Generate perfect location information-based codebooks

Sum_rate.m – Evaluate sum-rate performance using codebooks

rank_adaptive_sum_rate.p – Evaluate sum-rate using the rank adaptive scheme

KDE_setup.m – Set up for kernel density estimation (KDE)

Plot1.m
Plot2.m
Plot3.m
} Plot the process of proposed codebook enhancement

location_xs.mat – UE locations generated by SUMO

Demo.m – Demo code for explanation this simulator.

Figure3.m – Draw figure 3 in the paper

function

- The files in function folder are used in simulations
- File list

ARV_UPA.p	sph2xyz.p
Codebook_DFT.p	SV_channel.p
Codebook_VQ.	xyz2sph.p
inverse_rotation.p	
kmeans_plus_clustering.p	
laprnd.p	
PMI2sph.p	
rotation.p	

channel

- This folder is generated and populated by generateChannel.m file.

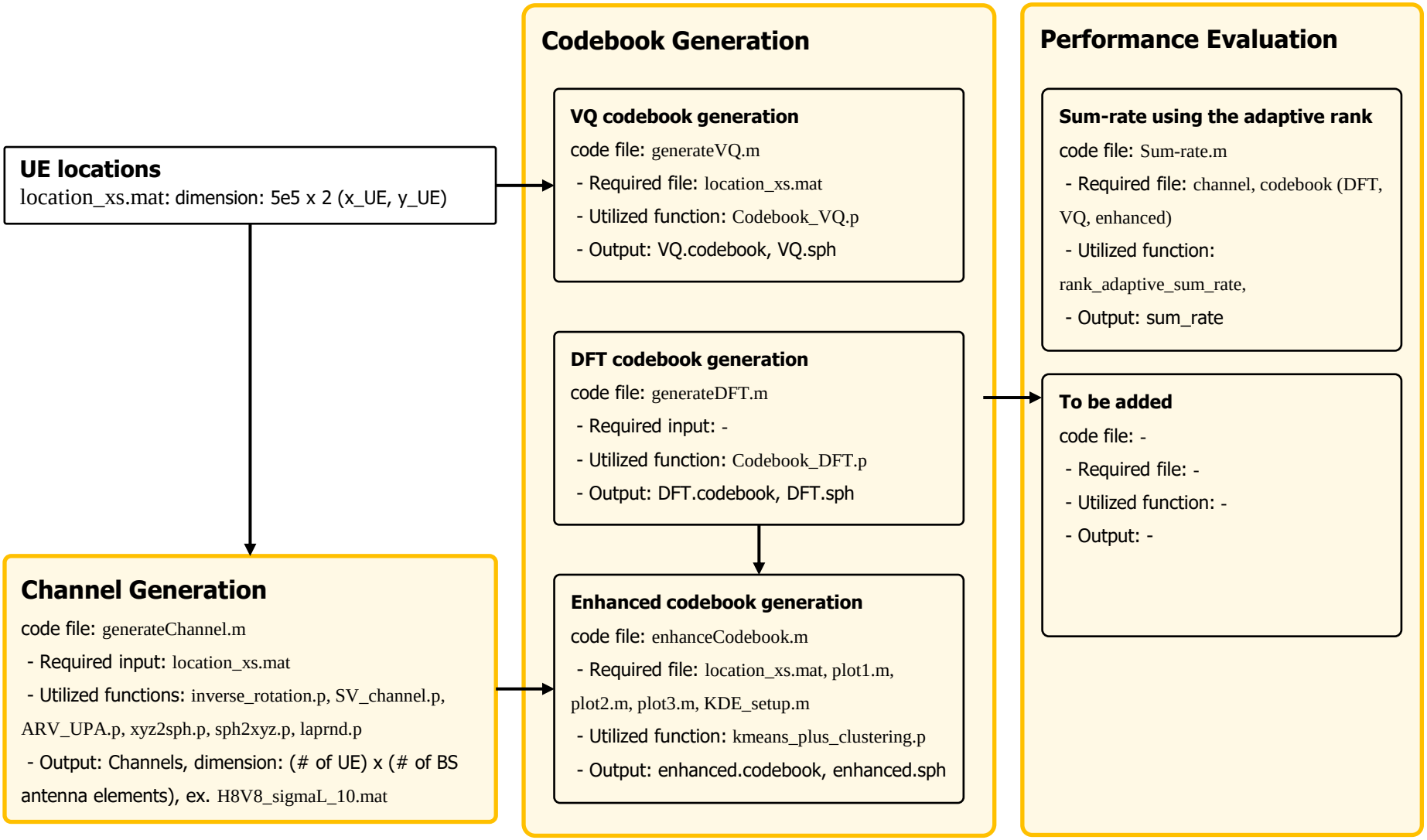
codebook

- This folder is generated and populated by enhanceCodebook.m, generateDFT.m, and generateVQ.m files.

sum_rate

- This folder is generated and populated by Sum_rate.m file.

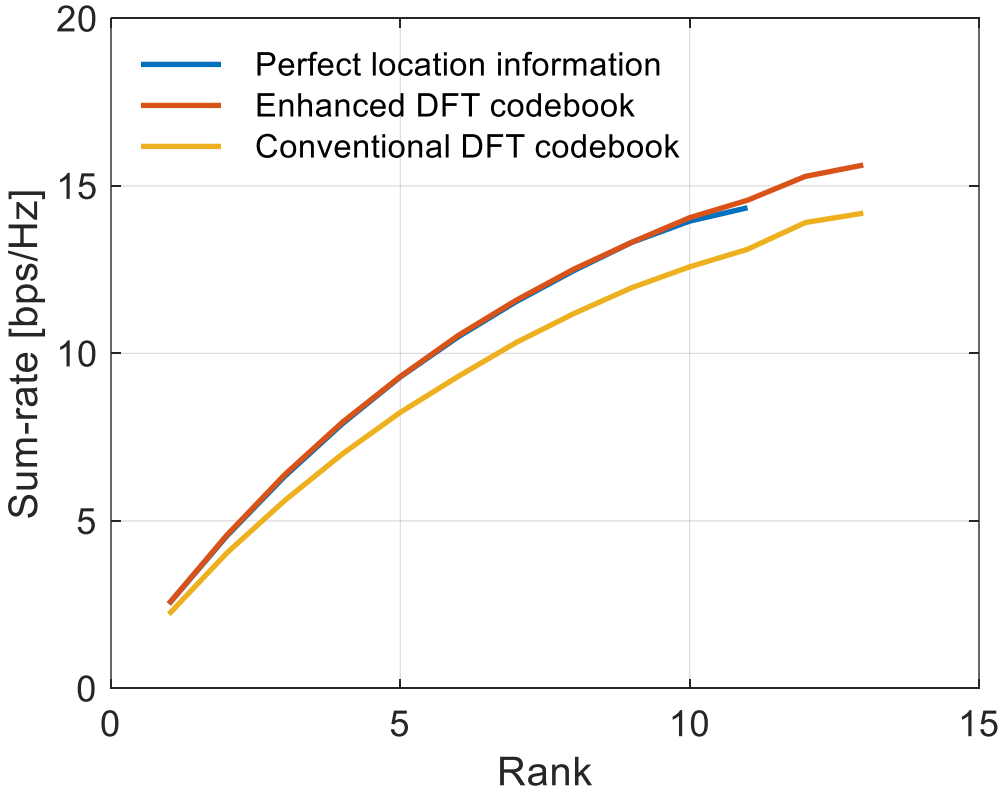
Structure Diagram



Code Explanation [Demo.m]

- Execute all parts of the structure diagram to plot the sum-rate results.

- Output figure:

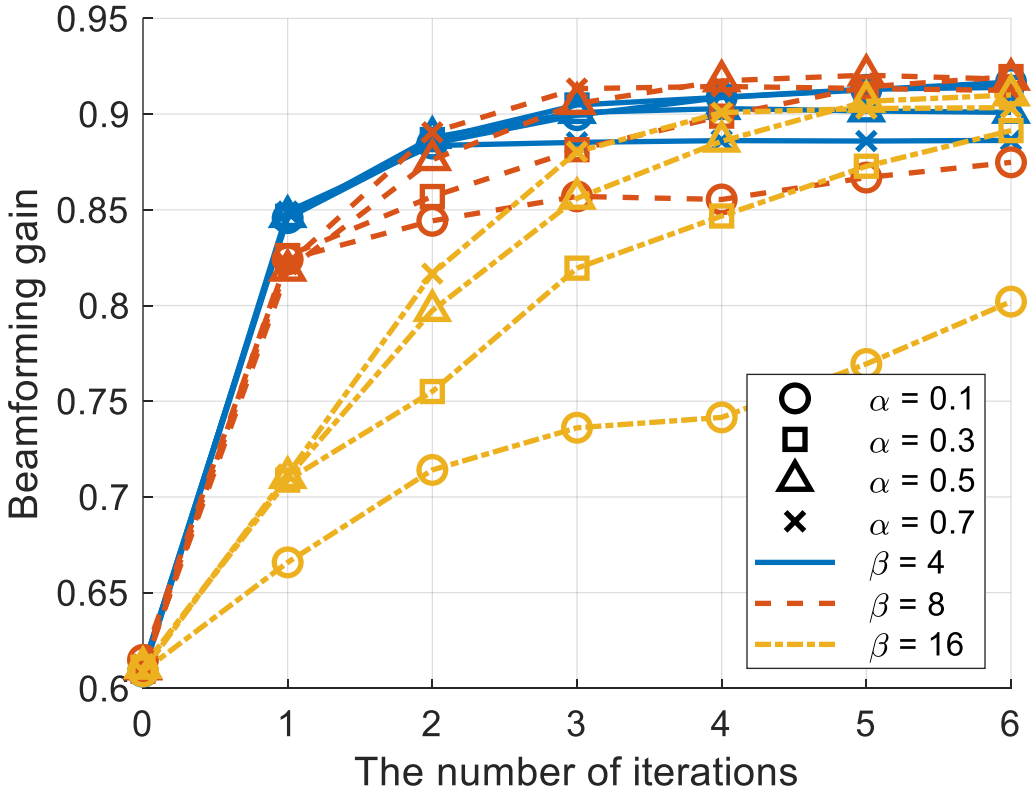


Code Explanation [Figure_3.m]

[CPU: i5-11400F, RAM: 32GB]
Required time: 1870 sec
Required memory: 3GB

- Plot the figure 3 in the paper

- Output figure:



Code Explanation [Figure_6and7.m]

[CPU: i5-11400F, RAM: 32GB]
Required time: 680 sec
Required memory: 3GB

- Plot the figure 6 and figure 7 in the paper

- Output figure: