Introduction to Software Package

In this repository, there are three software packages. The introduction of the **Experiment 1** is on page 1, **Experiment 2** is on pages 2-5, and **Experiment 3** is on page 4. They correspond to the three experiments in this paper, respectively. The experimental environment includes VS2019 and MATLAB2018a.

Open **Experiment 1** folder, there are four **.m** files, which are explained as below (this experiment corresponds to Fig. 2 in the manuscript, not the response file).

- The entry file is **demo.m**.
- The **numeric.m** file implements numerical algorithm.
- The **convolution.m** file implements interpolation approximation.
- The **polynomial.m** file implements polynomial approximation. (It is not considered in this experiment)
- These **.mat** files will be loaded into **convolution.m** as initial data.

For example, if you want to verify the interpolation approximation, you can select a value in $q \in (0.8, 2^{-1/7}]$, such as $q = 0.825$, and then change the parameter q in the 3 line of **demo.m**. (If you want to verify the Gaussian approximation, select a value in $q \in (2^{-1/7}, 1)$, such as $q = 0.95$.)

Open **Experiment 2**, there are two subfolders. These subfolders are explained as below.

First subfolder **(dac)**: this subfolder includes 4 sub-subfolders.

- Sub-subfolder **(impact of t)** can be used to get the results of **Fig. 1** in the response file.
- Sub-subfolder **(impact of s)** can be used to get the results of **Fig. 2** in the response file.
- Sub-subfolder **(impact of M)** can be used to get the results of **Fig. 3** in the response file.
- Sub-subfolder **(dac_codec)** can be used to get the results of **Fig. 4 (DAC, DAC+Numerical, DAC+Interpolation/Gaussian)** in the response file.

It should be noted that the codes of the above four projects are basically the same, but there are differences in parameter settings due to different experimental purposes. For convenience, we create 4 versions. There are 4 **.cpp** files and a **.h** file in each project. Among them, the introduction of the 4 **.cpp** files is as follows

- The entry file is **main.cpp**.
- The **entry.cpp** file implements some basic configurations of DAC codes.
- The **dac_enc.cpp** file implements the encoder of DAC codes.
- The **dac_bfd.cpp** file implements the decoder of DAC codes.

Follow this file path **impact of t/SourceFiles/text**, and open **text.sln** file to enter the project.

For example, if you want to obtian the experiment results of Fig. 1(a) in the response file, you need to change the following parameters.

1) In line 64 of **main.cpp**, change the input parameter n to 256.
2) In line 65 of **main.cpp**, change the input parameter pc to 0.016 (0.017, 0.018, 0.019, and 0.02).
3) In line 64 of **main.cpp**, change the input parameter t from 0 to 25.
4) In line 66 of **main.cpp**, change the input parameter R to $-\log_2 0.85 \approx 0.2345$.

Another example, if you want to obtian the experiment results of Fig. 1(b) in the response file, you need to change the following parameters.

1) In line 64 of **main.cpp**, change the input parameter n to 256.
2) In line 65 of **main.cpp**, change the input parameter pc to 0.001 (0.0015, 0.002, 0.0025, and 0.003).
3) In line 64 of **main.cpp**, change the input parameter t from 0 to 18.
4) In line 66 of **main.cpp**, change the input parameter R to $-\log_2 0.95 \approx 0.074$.

Follow this file path **impact of s/SourceFiles/text**, and open **text.sln** file to enter the project.

For example, if you want to obtian the experiment results of Fig. 2(a) in the response file, you need to change the following parameters.

1) In line 60 of **main.cpp**, change the read file to ccs_0.5_0.23447_256_13.txt.
2) In line 65 of **main.cpp**, change the input parameter n to 256.
3) In line 65 of **main.cpp**, fix the input parameter t to 13.
4) In line 66 of **main.cpp**, change the input parameter pc to 0.016 (0.017, 0.018, 0.019, and 0.02).
5) In line 65 of **main.cpp**, change the input parameter s from 0 to 28.
6) In line 67 of **main.cpp**, change the input parameter r to $-\log_2 0.85 \approx 0.2345$.

Another example, if you want to obtian the experiment results of Fig. 2(b) in the response file, you need to change the following parameters.

1) In line 60 of **main.cpp**, change the read file to ccs_0.5_0.074001_256_13.txt.
2) In line 65 of **main.cpp**, change the input parameter n to 256.
3) In line 65 of **main.cpp**, fix the input parameter t to 13.
4) In line 66 of **main.cpp**, change the input parameter pc to 0.001 (0.0015, 0.002, 0.0025, and 0.003).
5) In line 65 of **main.cpp**, change the input parameter s from 0 to 65.
6) In line 67 of **main.cpp**, change the input parameter r to $-\log_2 0.95 \approx 0.074$.

Follow this file path **impact of M/SourceFiles/text**, and open **text.sln** file to enter the project.

For example, if you want to obtian the experiment results of Fig. 3 (DAC+CCS) in the response file, you need to change the following parameters.

1) In line 58 of **main.cpp**, change the read file to ccs_0.5_0.23447_256_13.txt.
2) In line 63 of **main.cpp**, change the input parameter n to 256.
3) In line 63 of **main.cpp**, change the input parameter t to 13.
4) In line 63 of **main.cpp**, change the input parameter s to 8.
5) In line 64 of **main.cpp**, change the input parameter pc to 0.016 (0.017, 0.018, 0.019, and 0.02).
6) In line 65 of **main.cpp**, change the input parameter r to $-\log_2 0.85 \approx 0.2345$.
7) Run line 80 in **main.cpp**

If you want to obtian the experiment results of Fig. 3 (DAC) in the response file, you need to change the following parameters.

1) Other parameters are the same as the above example.
2) Run line 81 in **main.cpp**, *i.e.*, ccs is NULL.

Follow this file path **dac_codec/SourceFiles/text**, and open **text.sln** file to enter the project (this experiment corresponds to **Fig. 4 (DAC, DAC+Numerical, DAC+Interpolation/Gaussian) in the response file**).

For example, if you want to obtian the experiment results of Fig. 4(a) (DAC+Numerical), you need to change the following parameters.

1) In line 60 of **main.cpp**, change the read file to ccs_0.5_0.23447_256_13.txt. (For Fig. 4(d) (DAC+Numerical), change the read file to ccs_0.5_0.074001_1024_13)
2) In line 65 of **main.cpp**, change the input parameter n to 256. (change the input parameter n to 1024)
3) In line 66 of **main.cpp**, change the input parameter pc to 0.016 (0.017, 0.018, 0.019, and 0.02). (change the input parameter pc to 0.001 (0.0015, 0.002, 0.0025, and 0.003))
4) In line 65 of **main.cpp**, change the input parameter t to 13. (change the input parameter t to 13)
5) In line 65 of **main.cpp**, change the input parameter s to 8. (change the input parameter s to 32)
6) In line 67 of **main.cpp**, change the input parameter r to $-\log_2 0.85 \approx 0.2345$. (change the input parameter r to $-\log_2 0.95 \approx 0.074$)
7) Run line 82 in **main.cpp**

Another example, if you want to obtian the experiment results of Fig. 4(a) (DAC+Interpolation), you need to change the following parameters.

1) In line 60 of **main.cpp**, only change the read file to 0.85_256_13.txt. (For Fig. 4(d) (DAC+Gaussian), change the read file to 0.95_1024_13)
2) Other parameters are the same as the above example.

If you want to obtian the experiment results of Fig. 4(a) (DAC), you need to change the following parameters.

1) Other parameters are the same as the first example.
2) Run line 83 in **main.cpp**, *i.e.*, ccs is NULL.

Note that: for other experimental results, the corresponding parameters can be changed according to the title of each subgraph in Fig. 4.

Second subfolder (**ldpc**): this subfolder includes 2 sub-subfolders (**codec** and **peg**).

Follow this file path **ldpc/codec**, and open **ldpc.sln** file to enter the project (this experiment corresponds to **Fig. 4 (LDPC) in the response file**).

- The entry file is **main.cpp**.

For example, if you want to obtian the experiment results of Fig. 4(a) (LDPC), you need to change the following parameters.

1) In line 198 of **main.cpp**, change the read file to reg3.256.70.txt (For Fig. 4(d) (LDPC), change the read file to reg3.1024.88.txt).
2) In line 211 of **main.cpp**, change the input parameter pc to 0.016, 0.017, 0.018, 0.019, and 0.02 (if $q = 0.95$, change the parameter to 0.001, 0.0015, 0.002, 0.0025, and 0.003).

Follow this file path **ldpc/peg**, and open **main.C** file to enter the project (This project is used to construct LDPC codes. For convenience, we have generated files in advance: reg3.256.70.txt, reg3.256.31.txt, reg3.1024.250.txt, and reg3.1024.88.txt.)

Open **Experiment 3** folder, and click **text.sln** to enter the project. Other files are explained as below.

- The entry file is **main.cpp**.
- The **dac_enc.cpp** file implements the encoder of DAC codes.
- The **dac_bfd.cpp** file implements the decoder of DAC codes.

First example, if you want to obtian the experiment results of **Tab. II (DAC+Num)** when $\epsilon = 0.013$ in the manuscript, you need to change the following parameters.

1) In line 51 of **main.cpp**, change the read file to 0.013n.txt (if $\epsilon = 0.009$, change the read file to 0.009n.txt).
2) In line 73 of **main.cpp**, change the input parameter pc to 0.013 (if $\epsilon = 0.009$, change the parameter to 0.009).
3) In line 88 of **main.cpp**, change the input parameter R to 0.1001 (if $\epsilon = 0.009$, change the parameter to 0.0741).
4) Run line 93 in **main.cpp**, *i.e.*, use ccs during decoding.

Second example, if you want to obtian the experiment results of **Tab. II (DAC+Approx)** when $\epsilon = 0.013$ in the manuscript, you need to change the following parameters.

1) In **main.cpp**, only change the read file to 0.013mix.txt. (if $\epsilon = 0.009$, change the read file to 0.009mix.txt).
2) The changes of the parameters pc and R are consistent with the first example.

Third example, if you want to obtian the experiment results of **Tab. II (DAC)** when $\epsilon = 0.013$ in the manuscript, you need to change the following parameters.

1) The changes of the parameters pc and R are consistent with the first example.
2) run line 94 in **main.cpp**, *i.e.*, ccs is NULL.

Note that: This package only contains two read files (limited by file size). If you want to obtain other data, please contact **nyang@chd.edu.cn**.