

NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR
HAZRATHBAL, JAMMU&KASHMIR-190006



ASSIGNMENT BY

JAIDEEP MANUPATI (2021BITE083) & VIDYA SAGAR KODI (2021BITE091)

BRANCH : INFORMATON TECHNOLOGY

COURSE : DATA COMMUNICATION

ASSIGNED BY : DR. IQRA ALTAF GILLANI

SEMESTER : V

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REPORT

Specification: Digital Encoding and Decoding Tool

1. Introduction:

This Python script provides a versatile tool for digital signal processing, encompassing various encoding and decoding techniques. The tool supports both analog and digital input types and allows users to encode and decode signals using different line encoding and modulation schemes.

2. Language and Libraries:

The script is written in Python and utilizes the following libraries:

NumPy: Used for numerical operations and array manipulations.

Matplotlib: Employed for creating visualizations and plots.

3. Supported Encoding Schemes:

Digital Encoding Schemes:

NRZ-L (Non-Return-to-Zero Level)

NRZ-I (Non-Return-to-Zero Inverted)

Manchester, Differential Manchester

AMI (Alternate Mark Inversion)

B8ZS (Bipolar with 8 Zero Substitution)

HDB3 (High-Density Bipolar 3 Zeros)

Analog Modulation Schemes

PCM (Pulse Code Modulation)

DM (Delta Modulation)

4. Usage:

1. Input:

Users can choose between analog and digital input types.

For digital input, a binary stream (e.g., 101001) is required.

For analog input, a sequence of floating-point values separated by spaces is expected.

2. Digital Signal Encoding:

Choose from a variety of encoding schemes by entering the corresponding option.

For AMI encoding, users can opt for additional scrambling with B8ZS or HDB3.

3. Analog Signal Modulation:

Choose between PCM and DM modulation schemes.

4. Decoding:

Users can choose to decode the encoded signal.

Decoding options are available for each encoding scheme.

5. Features:

Identifies the longest palindrome in the digital data stream.

Visualizes the digital data and its encoded form using Matplotlib.

6. Assumptions:

Input data integrity is assumed; no error checking is implemented for simplicity.

Continuous analog signals are assumed for modulation.

7. How to Run:

Ensure Python is installed on your system & Install required dependencies: numpy, matplotlib.

Run the script in a Python environment.

Bash Command to use: `python3 dc.py`

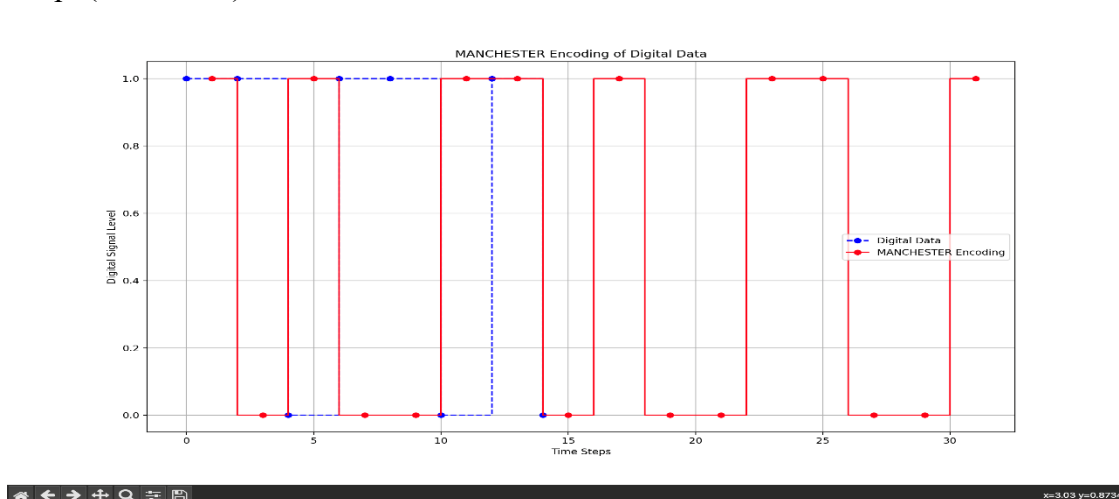
8. EXAMPLE:

For Digital

Output(screenshot):

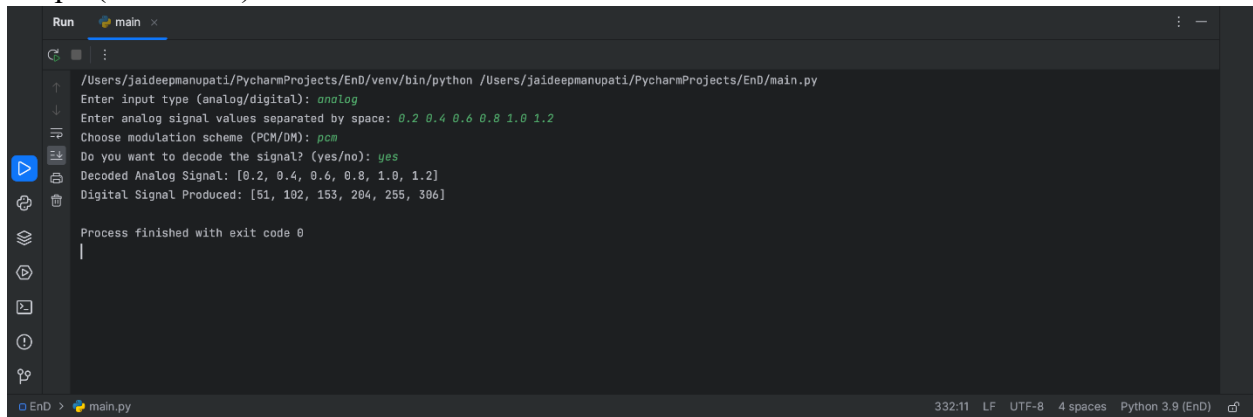
```
Run main x
/Users/jaideepmanupati/PycharmProjects/EnD/venv/bin/python /Users/jaideepmanupati/PycharmProjects/EnD/main.py
Enter input type (analog/digital): digital
Enter digital data stream (e.g., 101001): 11011010
Longest Palindrome: 101101
Choose line encoding scheme (NRZ-L, NRZ-I, Manchester, Differential Manchester, AMI, B8ZS, HDB3): manchester
Do you want to decode the signal? (yes/no): yes
Decoded Digital Stream: 11011010
Digital Signal Produced: [1, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 0, 1]
Process finished with exit code 0
```

Graph(screenshot):



For Analog

Output(screenshot)



```
Run main x
/Users/jaideepmanupati/PycharmProjects/EnD/venv/bin/python /Users/jaideepmanupati/PycharmProjects/EnD/main.py
Enter input type (analog/digital): analog
Enter analog signal values separated by space: 0.2 0.4 0.6 0.8 1.0 1.2
Choose modulation scheme (PCM/DM): pcm
Do you want to decode the signal? (yes/no): yes
Decoded Analog Signal: [0.2, 0.4, 0.6, 0.8, 1.0, 1.2]
Digital Signal Produced: [51, 192, 153, 204, 255, 306]

Process finished with exit code 0
```

9. References:

NumPy Documentation: <https://numpy.org/doc/stable/>

Matplotlib Documentation: <https://matplotlib.org/stable/contents.html>