OTFS Performance using Neural Networking

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PROBLEM STATEMENT

This research focuses on the design and implementation of Orthogonal Time Frequency Space (OTFS) modulation and demodulation schemes to transmit signals from the transmitter side to the receiver side. In addition, a neural network is proposed to improve the Peak-to-Average Power Ratio (PAPR) and Bit Error Rate (BER) in OTFS modulation, also SDR concepts will be applied. The proposed neural network is based on the deep learning approach, which is used to optimize the parameters of the OTFS modulation. Simulation results will show that the proposed neural network can significantly reduce PAPR and BER compared with the conventional OTFS modulation technique. The results also will demonstrate that the proposed approach can achieve significant performance gains for OTFS modulation. See figure 1 for more details.

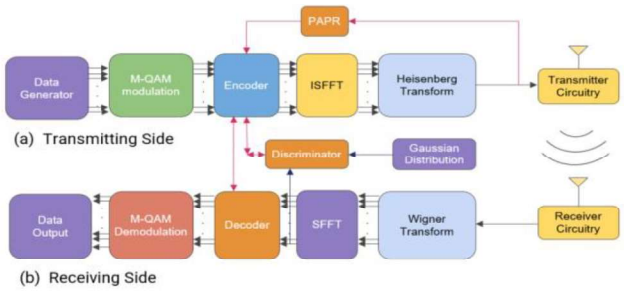

Figure 1- OTFS with NN

1. DEFINITIONS

A. OTFS (Orthogonal Time Frequency Space) modulation is a novel modulation technique that allows for transmitting large amounts of data over a traditional wireless channel. It combines the benefits of several existing modulation techniques, including OFDM, CDMA, and spread spectrum, to provide a robust and efficient modulation scheme. The main benefits of OTFS modulation are that it can provide higher data rates, better immunity to interference, and improved spectral efficiency compared to other modulation techniques. Additionally, OTFS modulation can be used to provide a better link budget and higher spectral efficiency than traditional modulation techniques.

B. Adding a neural network to improve the PAPR (Peak to Average Power Ratio) and BET (Bit Error Rate) of OTFS modulation can be done by using a neural network-based precoder and decoder. The neural network-based precoder and decoder can be used to optimize the OTFS modulation parameters and adapt them to the wireless channel conditions. This can help to reduce the PAPR and BET of the OTFS modulation, resulting in better transmission performance. Additionally, the neural network can be used to identify and mitigate interference in a wireless channel, resulting in improved reception performance. In summary, using a neural network to improve the PAPR and BET of OTFS modulation can provide an efficient and robust modulation scheme for transmitting large amounts of data over a wireless channel.

C. neural network model is the Adversarial Autoencoder. Adversarial Autoencoders (AAEs) are a type of generative model that combines the ideas of generative adversarial networks (GANs) and autoencoders. They are used to learn latent representations of data, with the goal of making the generated data indistinguishable from real data. The model consists of two parts: an encoder network, which maps the input data to a latent representation, and a decoder network, which maps the latent representation back to the original data. The latent representation is then used to generate new data. In addition to the autoencoder networks, AAEs also have a discriminator network, which is trained to distinguish between the generated data and real data. The discriminator is used to provide feedback to the encoder and decoder networks during training. The encoder and decoder networks are optimized to generate data that is realistic and indistinguishable from real data, while the discriminator is optimized to classify the data correctly. AAEs are used for a variety of tasks, including image generation, image super-resolution, text generation, and anomaly detection. They can also be used to learn latent representations of data which can then be used for downstream tasks such as classification and clustering. AAEs can also be used to generate synthetic data for training and testing machine learning models.

2. OBJECTIVES

A. Develop OTFS modulation and demodulation.
B. Implement a neural network to improve the PAPR and BET of the OTFS modulation.

C. Analyze the performance of the system with and without the neural network.

3. RESEARCH METHODOLOGY

A. Literature Review: Research on OTFS modulation and demodulation, neural networks, PAPR and BET.
B. Design: Develop the OTFS modulation and demodulation algorithm, design the neural network.
C. Implementation: Implement OTFS modulation and demodulation algorithm, implement the neural network. Evaluation: Analyze and compare the performance of the system with and without the neural network.

5. RESOURCES

A. Computational: Computer with software for designing and implementing the OTFS algorithm and neural network
B. Human: Researcher to develop, implement, and analyze the system

6. CONTRIBUTION TO THE OPEN-SOURCE

Open-source software has been an integral part of technological development for decades, and it is more important now than ever before. With the help of open-source projects, developers and users alike can benefit from the collective knowledge and effort of the entire community. As a result, I am excited to contribute to the open-source community with the OTFS Performance using SDR project.

The OTFS Performance using SDR project is an exciting opportunity for me to contribute to the open-source community. By participating in this project, I will be helping to build a better, more efficient communication infrastructure for the future. My primary contribution to this project will be in the form of research and development. I will be researching the various aspects of the project and working to develop new ways to improve the performance of the OTFS system. This will involve researching the latest technologies, such as SDR, and how they can be used to improve the system. I will also be exploring ways to reduce the complexity of the system so that it can be deployed quickly and efficiently. In addition to research and development, I will also be contributing to the project by:

A. I will share my project code on Github. This will enable other developers to learn from my code and use it in their own projects.
B. I will create a project page on Github to provide detailed information about my project. This will allow others to understand the structure and purpose of the project and find ways to contribute to it.
C. I will create a Wiki page on Github to provide detailed documentation about the project. This will enable other developers to quickly understand how to use the project and how to contribute to it.
D. I will create issue trackers on Github for users to report bugs and suggest improvements. This will enable the project to be continuously improved and updated.
E. I will use Github's pull requests feature to accept changes from other developers. This will enable collaboration and ensure that the project is continuously improved.
F. I will create a mailing list or chat group on Github to facilitate communication between developers. This will enable developers to help each other and share ideas about the project.
G. I will create a readme file on Github to provide basic information about the project. This will allow others to quickly understand the purpose of the project and find ways to contribute to it.

Finally, I will also be helping to spread the word about the OTFS Performance using SDR project. I will be participating in online forums and communities to discuss the project and to encourage others to join in. By participating in this project, I will be able to contribute my knowledge and skills to the open-source community. This project has the potential to revolutionize the way communication is done, and I am excited to be a part of it.