Project 8 - Classification of Cross-Ambiguity Function (CAF) Surfaces Using Convolutional Neural Networks (CNN) for Coherent and Non-Coherent Signals in Digital Communications

Summary-

The proposed project aims to leverage Convolutional Neural Networks for classifying Cross-Ambiguity Function (CAF) surfaces derived from Frequency Shift Keying signals in digital communication systems. Its objective is to differentiate coherent signals, which contain meaningful data, from non-coherent/ idle signals, with the aim of conserving computational resources giving importance only to the relevant data. This is an interesting application of CNN's in signal processing. This project proposal aligns well with our course objectives as it focuses on Machine Learning and Deep Learning, and introduces a special use case for Neural Networks in digital communications.

Reflection-

The proposal presents a comprehensive approach with an emphasis on dataset generation and methodology. By simulating CAF surfaces with varying channel impairments, the proposal aims to create a comprehensive and realistic dataset, enhancing the model's robustness in practical applications. In my opinion, CNN's would be a good choice for this as CNN's are great for image classification, although applying them to CAF surfaces is unique and seems technically sound. However, considering the timeline of our project and its deadlines, the proposal may be too ambitious, especially given the detailed requirements for dataset generation and hyperparameter tuning. Additionally, while the project touches on related work in radar and anti-jamming applications, it could benefit from a broader analysis of potential challenges. Including these considerations could provide a more complete and realistic solution for the problem at hand.

Pros/ Cons-

The project proposal is quite innovative and uses CNNs for classifying CAF surfaces, applying Deep Learning to a unique problem in digital communications with the potential to improve

signal processing efficiency. The approach to dataset generation is great, covering various channel impairments to create a robust training environment, while the evaluation metrics demonstrate an understanding of performance and real-time constraints. However, the project relies on synthetic data, which can be a significant limitation, as simulated conditions may not fully reflect the complexity of real-world signals and thus could impact the model's effectiveness in real applications. Also, the ambitious scope may challenge the project's feasibility within our timeline, as hyperparameter tuning and comprehensive testing are essential yet time-intensive for CNN-based models. Addressing these aspects could strengthen the model's overall robustness.

Presentation Quality-

The project proposal is well-structured, with clear sections that follow a logical progression. While it is detailed, minor typing issues like using the word "have" twice in the first line of the 'Related Work' section and occasional inconsistencies in terminology of using non-coherent or idle slightly detract from the overall clarity. A careful proofreading for typos and a consistency check could further improve readability. Additionally, I think that since the topic is slightly unconventional and fairly new, visual aids and depiction of CAF surfaces could make the technical content more accessible and help quickly grasp the unique patterns being classified.

Score- 90/100