Project Proposal Review for Project 8

This review evaluates the proposal titled “Classification of Cross-Ambiguity Function (CAF) Surfaces Using Convolutional Neural Networks (CNN) for Coherent and Non-Coherent Signals in Digital Communications” by Clifford Tatum and Hayden Brundage. To solve a problem of learning from coherent and non-coherent signals, this project claims that a convolutional neural network (CNN) approach will effectively be able to separate coherent (useful) signals from non-coherent (meaningless) signals. These signals will be derived from cross-ambiguity function surfaces, which will be generated from frequency shift keying. The large mission of this project is to better allocate computational resources by having them ignore non-coherent signals, which will improve technologies such as radar systems and digital communication architectures. Based on the implementation of the CNN for image-related classification, the targets and aims of this proposal are quite relevant to the Introduction to Deep Learning course (CS5814).

In reflection over the project proposal regarding signal detection, it appears that this product is a comprehensive and unique endeavor undertaken by the authors. It outlines in detail the process by which the data will be generated, including nuances and motivations for design choices that relate to ensure the synthetic dataset matches well with true data (using channel impairment approaches like smearing and time delay). Of note, the paper does an excellent job of communicating the model training and validation process, appropriately outlining the sample percentages for training, validation/tuning, and test sets. The sample size allocated to this classification problem is indicative of a technically sound and more-than-adequate analysis. I do believe this treatment of the problem is a largely complete one. I am curious as to whether there is any way to correlate the synthetic dataset with any existing ones, in order to ensure there is overlap in some level of the characteristics. I am not convinced this is absolutely necessary, but it may provide more context with which to understand the validity of the synthetic data.

Largely, this project proposal carries far more strengths than weaknesses. First, the paper does an excellent job at mapping out model design, including regularization strategies, which are more objective when declared before the analysis takes place, and allocating a sufficiently large dataset in order to conduct the analysis. The project proposal also very nicely explains the technical aspects of signal detection that are relevant for the project, and it chooses very relevant works to discuss in the related works section of the paper. One weakness of the project is that it may benefit from benchmarking the neural network approach with a more traditional machine learning approach. Specifically, it would be interesting to see if the CNN model would be able to perform better than something like a support vector machine.

Ultimately, the manuscript proposal seems to appropriately reference other literature, thoroughly outline its approach, and effectively convey complex concepts to a

general audience, all while maintaining correct spelling and grammar. As this project complets, I am keen to learn about findings and the viability of this model. The presentation seems to have a high ceiling of impact given its focus on more efficient computing for communication and signal detection. I look forward to finding out more from the final presentation.