ABSTRACT

This thesis proposes a deep learning-based demapper that utilizes feedforward neural networks to learn the complex mapping functions required for multiuser detection in non-orthogonal multiple access (NOMA) system. By utilizing neural networks, the proposed deep learning-based demapper eliminates the need for the system to check each constellation point individually, hence decreasing the computational complexity of the demapping process, while maintaining a good bit-error rate (BER) performances.

This thesis developed a deep learning-based demapper, trained using a dataset generated with iterative spatial demapping (ISM), to process the received signals from a two-user NOMA scheme. This thesis analyzes two NOMA scenarios: (i) an uncoded scheme that utilizes binary phase-shift keying (BPSK) modulation, and (ii) a coded scheme that employs repetition coding and interleaver to improve transmission reliability. The proposed demapper trained on essential features such as the superposition received signals, channel coefficients, noise variance, and the corresponding user symbols. The performance of the proposed deep learning-based demapper is evaluated through computer simulations and compared against the traditional ISM method, offering key insights into its effectiveness.

This thesis found that a neural network consisting two hidden layers with 8 and 4 neurons, respectively, is the best minimum structure of neural network for the deep learning-based demapper. This thesis also found that the deep learning model consistently obtains a lower BER than ISM at various power levels of the second user in the uncoded scheme, thereby highlighting its ability to manage interference. The results of this study provide a foundation for future research, highlighting the potential of deep learning to reduce complex decoding tasks while effectively handling interference in NOMA systems.

Keywords : Non-Orthogonal Multiple Access, Repetition Code, Interleaver, Iterative Spatial Demapping, Neural Network, Signal-to-Noise Ratio, Bit Error Rate.