Ph.D. DISSERTATION DEFENSE

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Degree:	**Doctor of Philosophy**
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Date:	**Wednesday, 11/29/2023**
Time/Location:	**11:00 AM /** https://stevens.zoom.us/my/ydyao
Title:	**Using Deep Learning in Wireless Signal Identification/Classification**
Chairperson:	**Dr. Yu-Dong Yao, Department of Electric and Computer Engineering Charles V. Schaefer, Jr. School of Engineering and Science**
Committee Members:	**Dr. Jie Shen, Department of Computer Science, Charles V. Schaefer, Jr. School of Engineering and Science**
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ABSTRACT

We exploit deep learning convolutional neural networks (CNN) on a constellation diagram to identify QAM modulation of different orders in static, slow, and frequency selective fading channels. Although constellation diagrams have been studied and classified in literature, most of the work focused on noise. Little has been done to study the effect of multipath fading channels. We develop a highly accurate modulation classification method by exploiting deep learning with the constellation diagram. Based on the experimental results, our CNN model achieves a classification accuracy of 100% at -10 dB signal-to-noise ratio (SNR) under a multipath Rayleigh fading channel.

And then, we use CNN on joint image representation and propose an automatic modulation classification algorithm to classify the communication signals. The combined representations include a constellation diagram, an ambiguity function (AF), and an eye diagram. Experimentation results show that combining constellation and eye diagrams achieves superior classification performance compared to having these representations separately. Combining AF and an eye diagram results in improvement at low SNR.

Finally, we extract features from each of the three datasets (Constellation, Eye diagram, AF) using transfer learning with pre-trained model, and then train the new classifier on top of these features. We compare the results of the feature extraction to the results of the joint image representation.