

# Convolutional Neural Network Analysis for Modulation Classification of Wireless Communication Signal

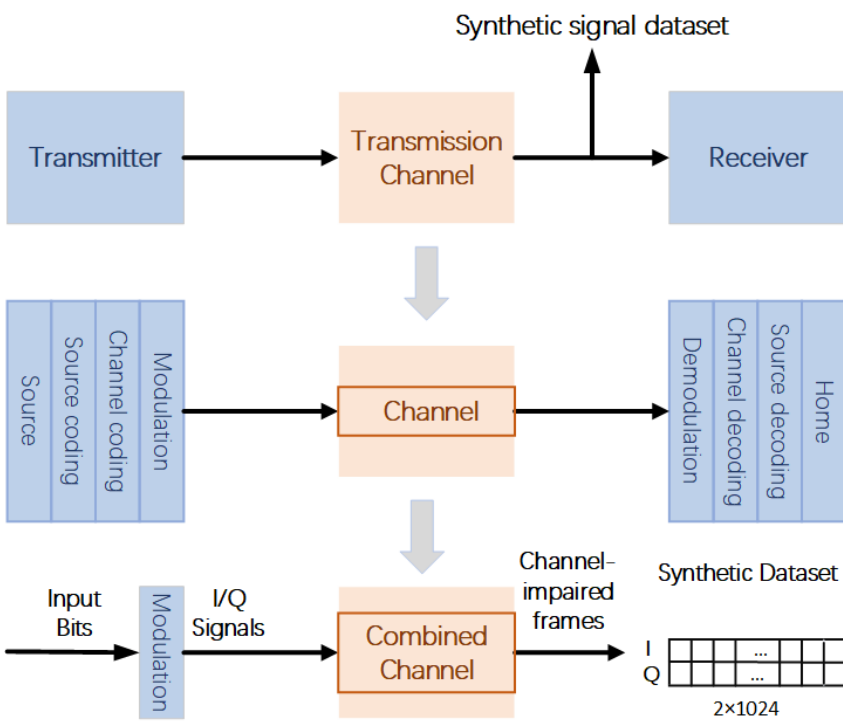
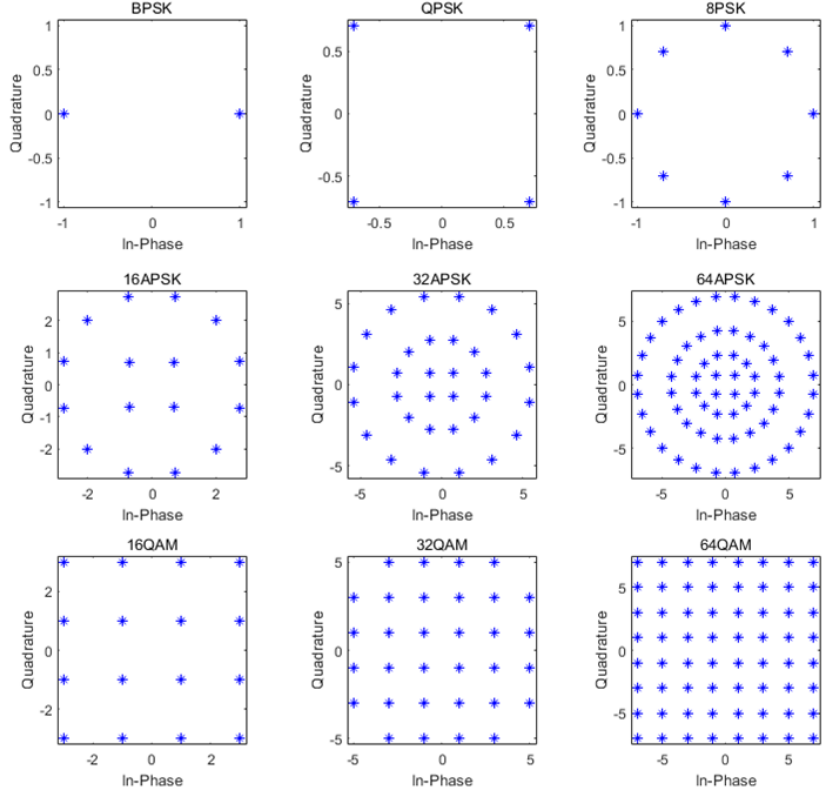
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## Introduction

Modulation recognition of communication signals plays an important role in both military and civil fields. It is widely used in electronic warfare and communication intelligence reconnaissance, communication monitoring and spectrum management, adaptive modulation and software radio. In electronic warfare, if one hopes to recover the message from a piece of intercepted and possibly adversary communication signal, a modulation classifier is needed to determine the modulation type used by the transmitter.

## Dataset

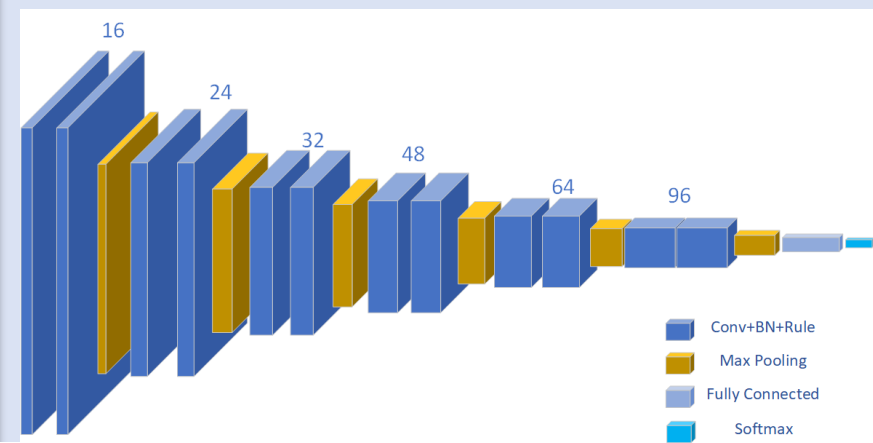
For the modulation classification of M-PSK, M-QAM and M-APSK modulated signals with similar constellation maps, we analyze waveform characteristics of the signal in the time domain.



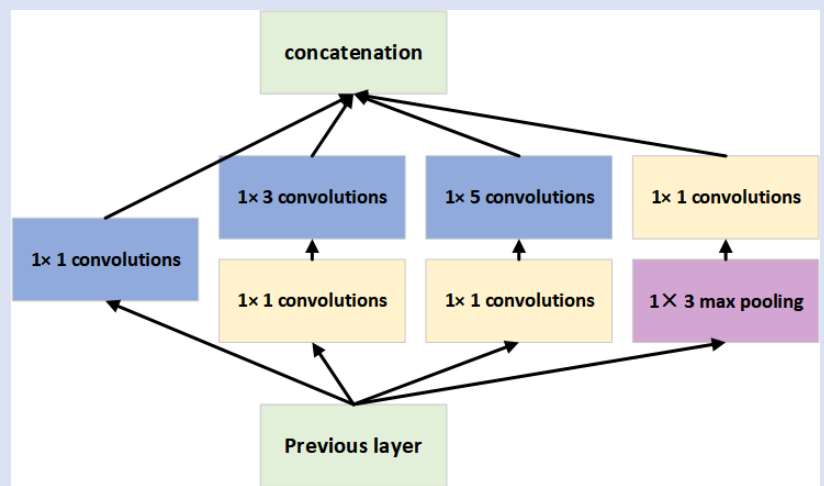
The experimental dataset is generated through the simulation signal transmission process. Then, I/Q data in the form of  $2 \times 1024$  are obtained.

## CNN Models

The first model consists of 12 convolution layers, 6 max pooling layers, 2 fully connected layers and 1 softmax layer

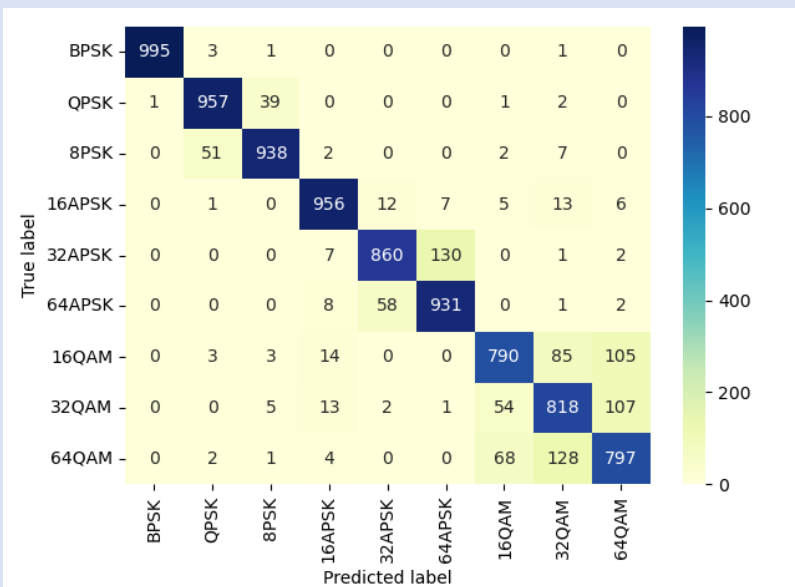
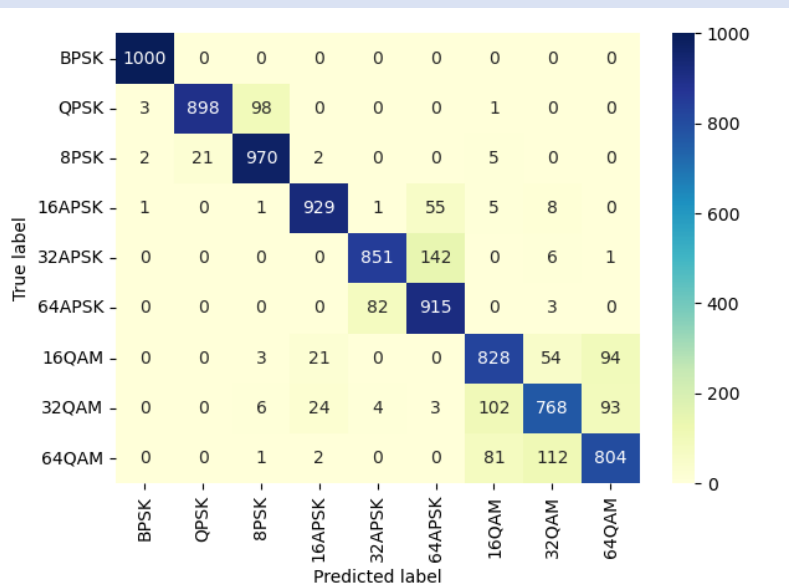


The second CNN model has 3 convolution layers and an inception block.



## Simulation Results

The training accuracy of the first CNN model is 87.66%, and that of the second model is 90.53%. As can be seen from the confusion matrix, the recognition rate of the model in out-of-class modulation mode is higher than that in in-class modulation mode.



In this paper, the modulation classification method of communication signal based on CNN is proposed. The CNN network directly extracts the features of the original data sequence for classification without manual feature selection.