先端科学技術研究科　修士論文要旨

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要旨

Beam prediction is a critical and challenging issue for millimeter wave (mmWave) communication systems. Although the deep learning (DL)-based beam prediction for the mmWave system is capable of improving the transmission performance, it has drawbacks in the low learning efficiency and the weakness of the noise. In order to solve these problems, this thesis proposes two novel DL models to realize the high beam prediction accuracy with high learning efficiency and robustness for multi-cell massive multiple-input multiple-output (MIMO) and intelligent reflecting surface (IRS)-assisted mmWave systems, respectively. For the multi-cell massive MIMO mmWave systems, we propose an individual memory-driven transformer (IMDT) DL model with individual long short-term memory (LSTM) and spatial attention module to realize highly reliable performance. Specifically, the individual LSTM extracts the frequency features for each base station (BS) based on the channel state information (CSI) dataset. In addition, the spatial attention module provides the multi-cell global features based on the frequency features extracted from each antenna at the BS. For IRS-assisted mmWave systems, we propose a memory-driven simple transformer (MDST) DL model and the channel matrix compression module. MDST-DL model has the memory-shared gated recurrent unit (GRU) and the simple spatial attention module with global average-pooling (GAP). It can realize highly reliable performance with a small overhead. Since the channel matrix compression module converts the spatial-frequency domain CSI into the sparse angular-delay domain, the data size is significantly compressed in the delay domain. In the MDST-DL model, the compressed CSI is input to GRU to extract the frequency features. Besides, the simple spatial attention module obtains the global features with a small overhead based on the frequency features extracted from each element at the IRS. The computer simulation results show that the proposed IMDT-DL and MDST-DL models achieve highly reliable performance.