

Deep learning approach in DOA estimation: a systematic literature review

ABSTRACT

In array signal processing, the direction of arrival (DOA) of the signal source has drawn broad research interests with its wide applications in fields such as sonar, radar, communications, medical detection, and electronic countermeasures. In recent years, the application of deep learning (DL) to DOA estimation has achieved great success. This study provides a systematic review of research on DOA estimation using deep neural network methods. We manually selected twenty-five papers related to this research from five prominent databases (SpringerLink, IEEE Xplore, ScienceDirect, Scopus, and Google Scholar) for exploration. Six questions describing the overall trend of DOA estimation using deep learning are put forward. Then, we answered these questions by reviewing the literature. This review is helpful for researchers in this field because it provides more specific and comprehensive information needed for future research. Specifically, we first analyzed the background of the selected papers, including the type of publication, the number of citations, and the country of origin. Then, the DL technology used in DOA estimation is systematically analyzed, including the purpose of using DL in DOA estimation, various DL models (convolutional neural network, deep neural network, and combination network), and various DOA estimation schemes. Finally, various evaluation criteria (root-mean-squared error, accuracy, and mean absolute error) are used to evaluate the DL technology in DOA estimation, and various factors (signal-to-noise ratio, number of snapshots, number of antennas, and number of signal sources) affecting DOA estimation are analyzed. Based on our findings, we believe that deep learning can perform DOA estimation well, and there is still room for improvement in deep learning technology. In this study, the factors affecting DOA estimation can be used as the direction for researchers to conduct in-depth research.