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IMAGE RECONSTRUCTION IN DIFFUSE OPTICAL TOMOGRAPHY BY MACHINE LEARNING: A CASE STUDY

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ABSTRACT. Machine learning has shown great potential in solving radiative transfer related problems in recent years. Traditional numerical methods of radiative transfer are computationally expensive, and machine learning methods are shown to reduce cost while maintaining accuracy. For some inverse problems, machine learning methods can be used to improve the accuracy of the results and provide solutions where traditional methods fail. In this study, a simulated diffuse optical tomography (DOT) system is used to investigate the feasibility of neural network models to solve the inverse problem and reconstruct images. The inverse problem of DOT image reconstruction is nonlinear, ill-posed, and underdetermined. The results show the proposed neural network model is more accurate and less time-consuming compared to traditional image reconstruction methods. With our customized PSNR-ICC loss function, the image correlation coefficient between the original and the reconstructed images improves to 0.99, compared to the 0.5-0.8 range with traditional methods. Also, noisy data leads to only minor degradation of the image.

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