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Strong Lens Detection 2.0: Machine Learning and Transformer Models

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The upcoming large-scale astronomical surveys, such as the Rubin Observatory Legacy Survey of Space and Time, are expected to detect approximately 10^5 strong gravitational lenses. However, traditional, non-automated techniques for detecting these lenses are highly time-consuming and impractical for analyzing data on such a large scale. To tackle this issue, we propose a new machine-learning technique known as Transformers. We have compared Transformers and current state-of-the-art Convolutional Neural Networks (CNNs) using data from the Bologna Lens Challenge 1.0 and 2.0 and found that Transformers can be an effective alternative for detecting strong gravitational lenses. The transformer models outperformed all the CNNs that participated in both challenges. Self-attention-based models, such as Transformers, have several advantages over simpler CNNs. They can identify lensing candidates with a high level of confidence and can effectively filter out potential candidates from real data. Additionally, using self-attention layers in Transformers also reduces the problem of overfitting commonly encountered with CNNs.

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