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Leveraging Physics-Informed Graph Neural Networks for Enhanced Combinatorial Optimization

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We introduce an innovative approach to combinatorial optimization problems through Physics-Informed Graph Neural Networks (GNNs). We combine the structural advantages of GNNs with physics-based algorithms, enhancing solution accuracy and computational efficiency. With respect to available literature we were able to design and train a deep graph neural network model able to solve the graph colouring problem in an unsupervised way. Our method shows promising results, demonstrating the potential of merging domain-specific knowledge with machine learning, and opening possibile pathways in computational optimization problems of interest in both theoretical and experimental fundamental physics.

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