**Abstract**

Deep learning has been shown to substantially boost progress in complex tasks involving high-dimensional data, but little work has explored its application to NP-complete problems, where pattern recognition can be used to generate highly accurate approximate solutions. Sudokus remain a popular puzzle and an interesting area of current work in artificial intelligence. In this work, using sudoku as a testbed, we have developed a specialized architecture utilizing two deep convolutional neural networks, which learn in series to solve the given task in steps. While one network labels each empty square with its best estimate of the resultant number to fill in, another predicts the most likely square to have been estimated correctly, iteratively filling in individual empty squares with the best predictions. Our multi-step approach achieves an 11.4% and 37.1% improvement over an approach using a single deep convolutional neural network in both squares and puzzles solved respectively, demonstrating the utility of this method.