Improving Adaptive Large Neighborhood Search with Multi-Armed Bandits

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Abstract

Large Neighborhood Search is a powerful optimization technique for solving problems in operations research such as vehicle routing or stock cutting, but the process of operator selection in Adaptive Large Neighborhood Search (ALNS) is non-trivial and requires per-domain tuning. We propose framing the problem of operator selection as a multi-armed-bandit problem and using the wide variety of existing bandit algorithms in the literature to improve the performance of ALNS. Our contributions include an extension to an existing open source ALNS implementation that allows using all the algorithms from an existing open source multi-armed-bandit repository. We also present an evaluation of ALNS on the capacitated vehicle routing problem showing that even naive bandits can perform better than the previously available operator selection schemes in the open source ALNS implementation. A variety of open questions remain such as whether or not using advanced contextual bandit algorithms can improve performance even further.