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# OPTIMIZING PERFORMANCE OF BASIC SIMULATED ANNEALING ALGORITHM

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The Simulated Annealing (SA) algorithm, an optimization technique inspired by metallurgy annealing, is highly effective for solving complex problems by exploring various states to avoid local optima. This study aimed to enhance the efficiency of the SA algorithm by investigating the effects of two critical parameters: Markov chain length ($Lk$) and cooling schedule. The SA algorithm was implemented using the Metropolis criterion, starting at a high initial temperature and gradually reducing via an exponential cooling schedule. To improve the exploration of the solution space, a dynamic $Lk$ was introduced, where $Lk$ is adapted based on the current temperature. This dynamic approach was compared with a fixed $Lk$ setting under an exponential cooling schedule. The study evaluated the performance of both exponential and linear cooling schedules when paired with the dynamic $Lk$, examining how different cooling schedules affect algorithm performance. The algorithm was assessed using unimodal and multimodal benchmark functions, measuring expected squared error and computation time over 500 runs for each configuration, providing insights into the convergence behaviour of the algorithm and solution quality. The results demonstrated that dynamically adjusting the $Lk$ significantly improves computational efficiency without compromising solution quality. However, the choice of cooling schedule presents a trade-off between accuracy and computational cost, with the linear cooling schedule yielding more accurate solutions at a higher computational expense. These findings emphasize the importance of carefully selecting parameters to optimize the performance of SA algorithms across diverse optimization problems.

**Keywords:** Cooling schedule, Markov chain length, Simulated annealing