

Convergence of $ACO_{\mathbb{R}}$ on the Hyperplane Model

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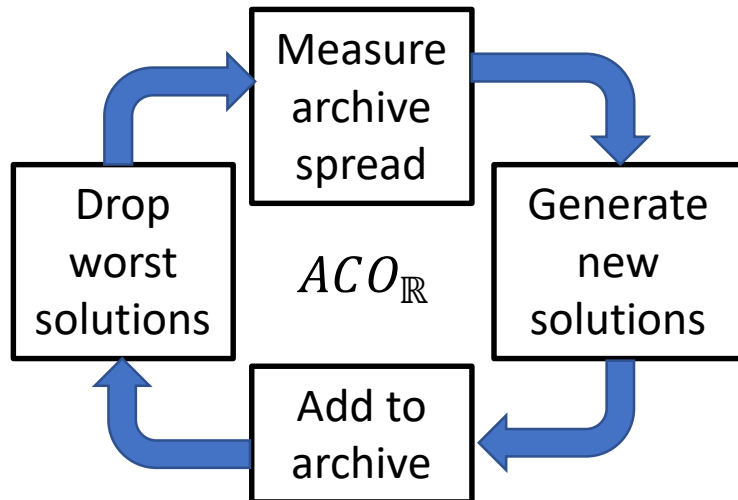
Advised by Dr. Nate Chenette

Background

$ACO_{\mathbb{R}}$ is an **evolutionary strategy** for **continuous optimization**.

Evolutionary Strategy: iteratively tweaking a parent set of solutions to produce better child solutions

Continuous Optimization: minimize or maximize a given $f: \mathbb{R}^n \rightarrow \mathbb{R}$



Results

Theorem: For any $\xi > 0$, there exists k such that $ACO_{\mathbb{R}}$ will find arbitrarily good solutions on the **hyperplane model**.

Hyperplane Model: maximize $f(\vec{x}) = \vec{c} \cdot \vec{x}$ for given constant \vec{c} - better solutions always further in the \vec{c} -direction

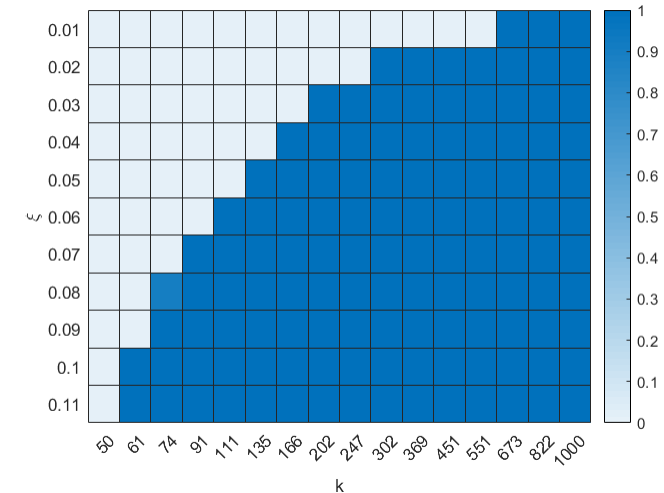
ξ : Multiplier on child solution spread

k : Number of solutions in the archive

Proof Sketch

1. Reduce n -dimensional hyperplane model to 1-dimensional “go right” problem
2. Establish likely structure of solution archive
3. Show average spread of solutions increases over time with large k

Experimental Verification



Proportion of trials where $ACO_{\mathbb{R}}$ found arbitrarily good solutions

Conclusions

Analyzing $ACO_{\mathbb{R}}$ is tractable

Large k good, small ξ bad - provably

Reasonable values well within range (e.g. $k=50$, $\xi=0.85$)