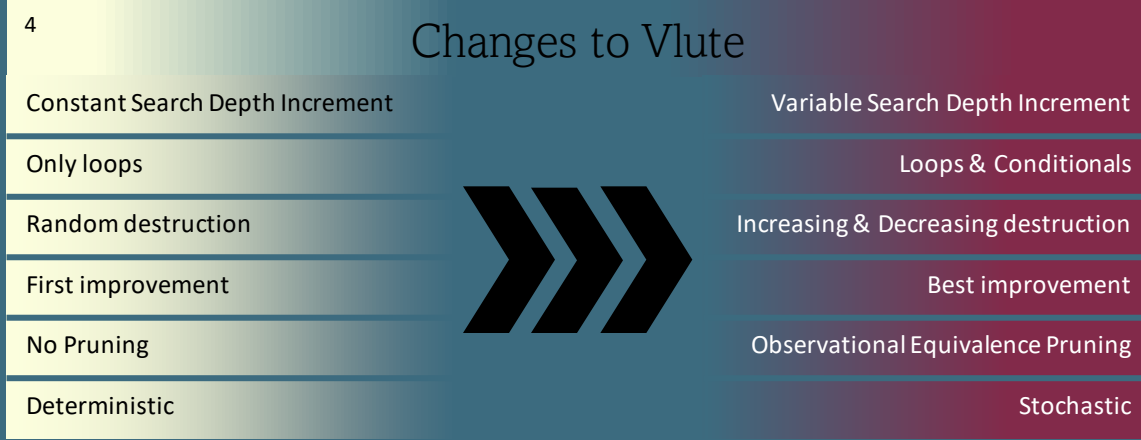# Very Large Neighborhood Search techniques in Program Synthesis

## How can we improve on the Variable-Depth Invent variation of the Very Large Neighborhood Search algorithm?

### 1  BRUTE

A two stage IPS system in which the invent stage combines simple tokens to be used in the search stage.
Tested on three domains: string-transformation, robot-planning, ASCII-art

### 2  VLNS

In Very Large Neighborhood Search (VLNS) "an initial solution is gradually improved by alternately destroying and repairing the solution".
This technique can be used in Inductive Program Synthesis (IPS) for traversing the solution tree.

### 3  VLUTE

An adaptation on BRUTE with a VLNS algorithm and a Variable-Depth Invent stage. This system has shown improvements in some domains.

VDNS

VNS

### 4  Changes to Vlute

| | |
|---|---|
| Constant Search Depth Increment | Variable Search Depth Increment |
| Only loops | Loops & Conditionals |
| Random destruction | Increasing & Decreasing destruction |
| First improvement | Best improvement |
| No Pruning | Observational Equivalence Pruning |
| Deterministic | Stochastic |

### 5

Robot Complexity_vs_execution_time Best improvement

Robot Complexity_vs_execution_time Stochastic

String Complexity_vs_execution_time Best improvement

String Complexity_vs_execution_time w_loop=0

### 6  RESULTS

- No effects of pruning & variable search depth increment

- Best improvement tactic outperforms Vlute in all domains

- Stochastic acceptance outperforms Vlute in robot-planning

  - Performance declines with increasing & decreasing degrees of destruction

  - Absence of loops deteriorates performance in string-transformation but improves ASCII-art and robot-planning

    - Overall best improvements in robot-planning

  - Overall worst deterioration in string-transformation

### 7  FUTURE WORK

- Parameter tuning for stochastic acceptance method

- Best improvement tactic proportional to search depth increment

  - Pruning more suitable to cost function

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