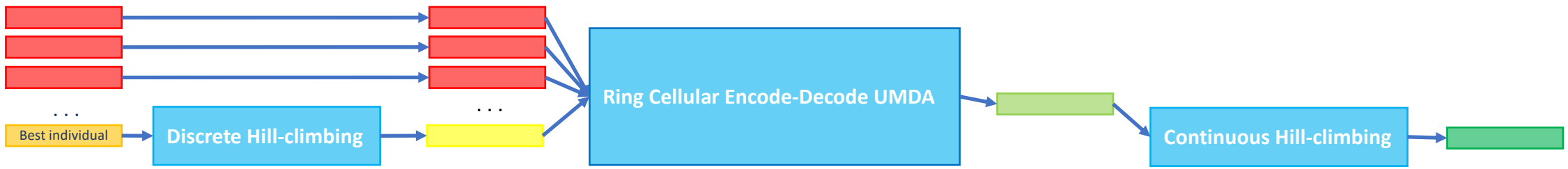
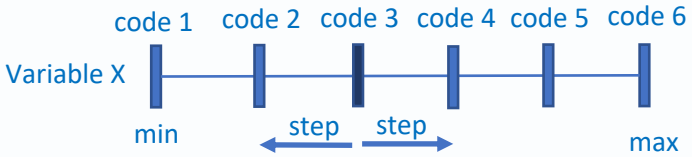
$HC_2RCEDUMDA$: Hybrid Ring Cellular Encode-Decode UMDA



Reduces the search space converting the continuous variables into categorical variables (encoding) and reconverting the categorical variables into continuous variables (decoding).

Use a discrete step into a range of the number of codes parameter. Example with 6 codes and step=1:



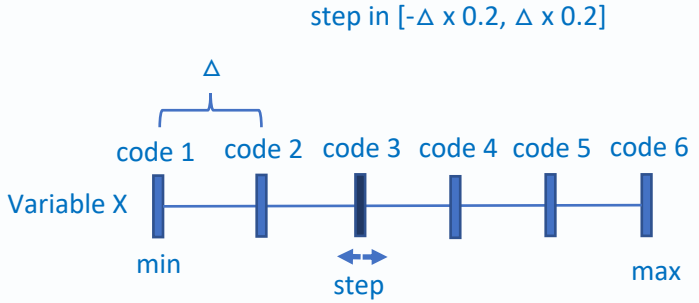
Uses a cellular ring structure for partitioning the population into many small sub-populations or cells.

Reduces the search space converting the continuous variables into categorical variables (encoding) and reconverting the categorical variables into continuous variables (decoding).

Generates new encoded individuals from the univariate marginal distribution (including scales probabilities) of the best encoded individuals of the sub-populations.

Uses elitism to maintain the best individuals in the next generation

The range of the step is a fraction of the range between values associated with the codes. Example with 6 codes and ratio = 0.2:



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Ring Cellular Encode-Decode UMDA (RCEDUMDA)

function RCEDUMDA($Pop, c, m, maxIt, l, s, r, \alpha, k, minB, maxB$)
  ▷ *Input:*
    Pop - *initial population*
    c - *number of cells,* m - *size of the cells,*
    $maxIt$ - *maximum iteration,* l - *number of elitist individuals,*
    s - *number of selected individual,* r - *neighborhood ratio,*
    α - *additional occurrence,* k - *number of codes,*
    $minB$ - *vector of min bounds,* $maxB$ - *vector of max bounds* ◁
  ▷ *Output:*
    $bestSol$ - *best solution* ◁
  $t \leftarrow 1$
  while $t \leq maxIt$ **do**
    Select globally l elitist individuals
    for all $cell \in Pop$ **do**
      $M \leftarrow$ the m best individuals in $neighborhood(cell, r)$
      $eM \leftarrow encode(M, k, minB, maxB)$
      $p \leftarrow$ the estimated distribution $\prod_{i=1}^{l} p(x_i)$ from eM
      $p \leftarrow scale(p, \alpha)$
      $eC \leftarrow c$ new individuals generating according to p
      $C \leftarrow decode(eC, k, minB, maxB)$
      Insert C in the same cell of an auxiliary population $auxPop$
    Replace the Pop with $auxPop$
    Include the elitist individuals, replacing the individuals in their positions
    $t \leftarrow t + 1$
  $bestSol \leftarrow$ the best individual in Pop
  return $bestSol$

General considerations

- Pop is structured as a ring composed of adjacent cells. Each cell contains a set of individuals.
- Elitist individuals are not evaluated in later generations. This fact saves evaluations that are used additionally by the continuous Hill-climbing algorithm.
- The continuous Hill-climbing algorithm performs a local search around the decoded solution provided by RCEDUMDA.

Further related bibliography

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