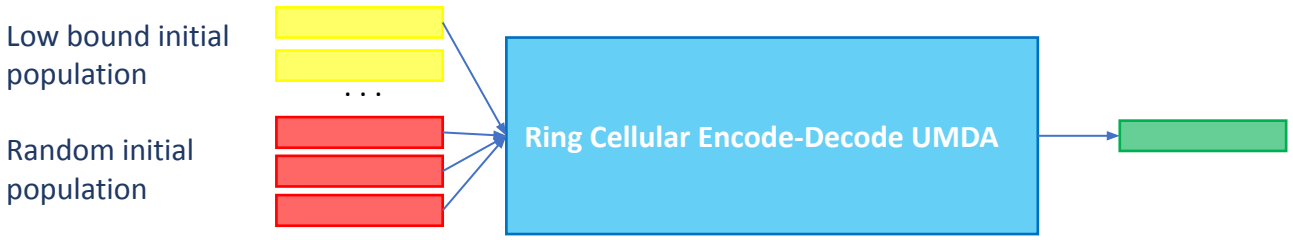
RCEDUMDA: Ring Cellular Encode-Decode UMDA



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

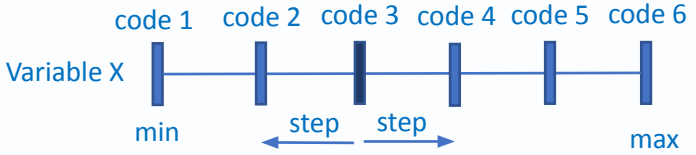
Reduces the search space converting the continuous variables into categorical variables (encoding) and reconverting the categorical variables into continuous variables (decoding).

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

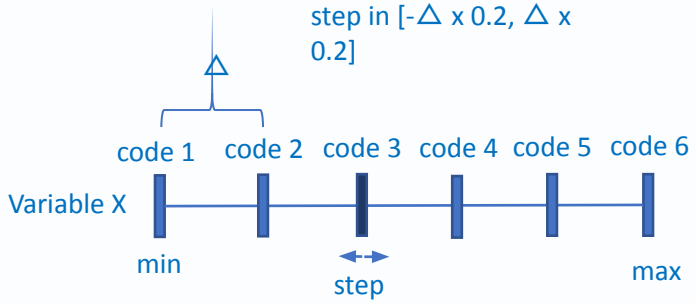
Uses **elitism** to maintain the best individuals in the next generation

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:



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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RCEDUMDA: Ring Cellular Encode-Decode UMDA

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 in extra generations.
- An initial population that includes the 20% of solutions initialized with the variable's lower bounds is a diverse but promising sample of the search space.

Further related bibliography

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