Mathematical modelling and computer simulations in theory and practice

Documentation of laboratory task no 6

Title: SIMPLE LOCAL SEARCH

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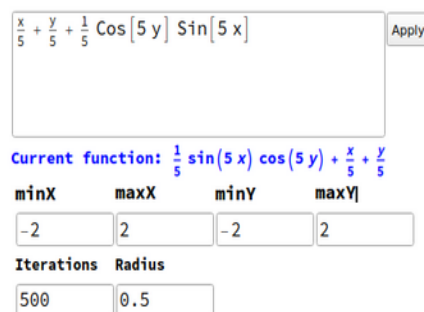Field of studies: Informatics (sem.V)

Project Objective:
Project objective is to visualise simple local search heurystic

Description:
Simple local search involves finding the minimum of a function by continuously and randomly choosing new points within a specified region near the previously generated point. If the value at the new point is lower, it is considered better than the previous value. The algorithm then continues the search..

Inputs:
1. Function to be evaluated (function of 2 variables - x and y)
2. Range of the x and y.
3. Number of the iterations the search will run.
4. Radius in which new points are generated next to the previous best.

Figure 1: Program input

Outputs:
As an otuput (after clicking 'Calculate' button) program is displaying visualisation of the simple local search, where:
- Red points are the 'best' points that were choosen during the operation.
- Blue point is the las one found.
- Black line is displayed to visualise track between them (it's not part of algorithm, as it generates discreete solutions – it's only for visualisation purposes)
- Function being optimized is displayed in 3D .

$$\frac{x}{5} + \frac{y}{5} + \frac{1}{5} \cos[5\,y]\,\sin[5\,x]$$

Apply

Current function: $\frac{1}{5}\sin(5\,x)\,\cos(5\,y) + \frac{x}{5} + \frac{y}{5}$

minX	maxX	minY	maxY
-2	2	-2	2

Iterations Radius

Best solution (x,y,f(x,y))

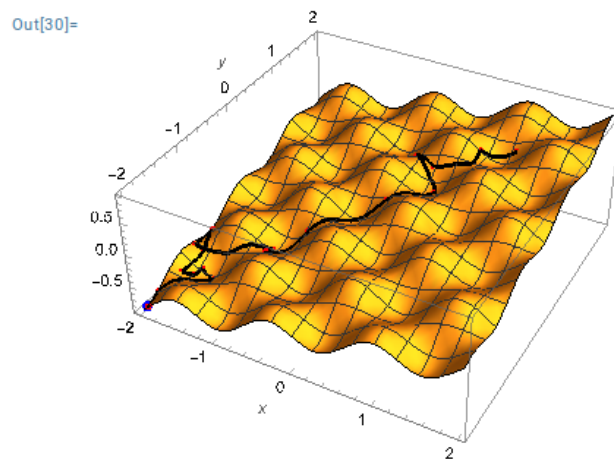| Iterations	Radius	
500	0.5	{-1.99636, -1.94163, -0.889112}

Calculate

Out[30]=

Figure 2: Examplary output.

Algorithm generaly gives better solution for higher numbers of iterations. It's importent to note tho that local minimum may confuse it, even so when the radius is not large enough to escape 'dimples' in the function as shown in 3.

$\frac{x}{5} + \frac{y}{5} + \frac{1}{5} \operatorname{Cos}[5\,y]\operatorname{Sin}[5\,x]$ Apply

Current function: $\frac{1}{5}\sin(5\,x)\cos(5\,y) + \frac{x}{5} + \frac{y}{5}$

minX	maxX	minY	maxY
−2	2	−2	2

Iterations Radius   **Best solution (x,y,f(x,y))**

500	0.5	{0.30063, −1.91782, −0.520293}

Calculate

Out[30]=

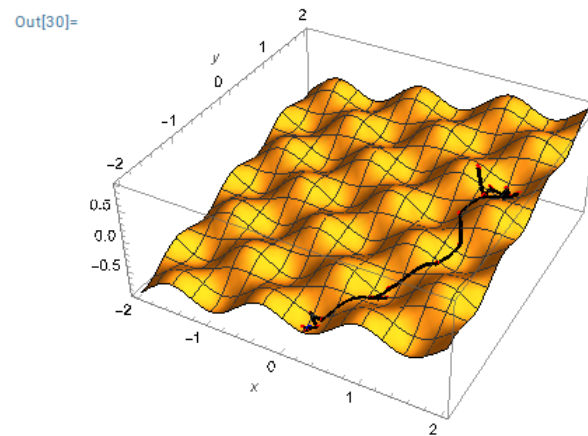*Figure 3: Example of false final solution – local minimum was found.*

Enclosures:

❑ File with the program (Jędrzejczyk_Radosław_proj_6)