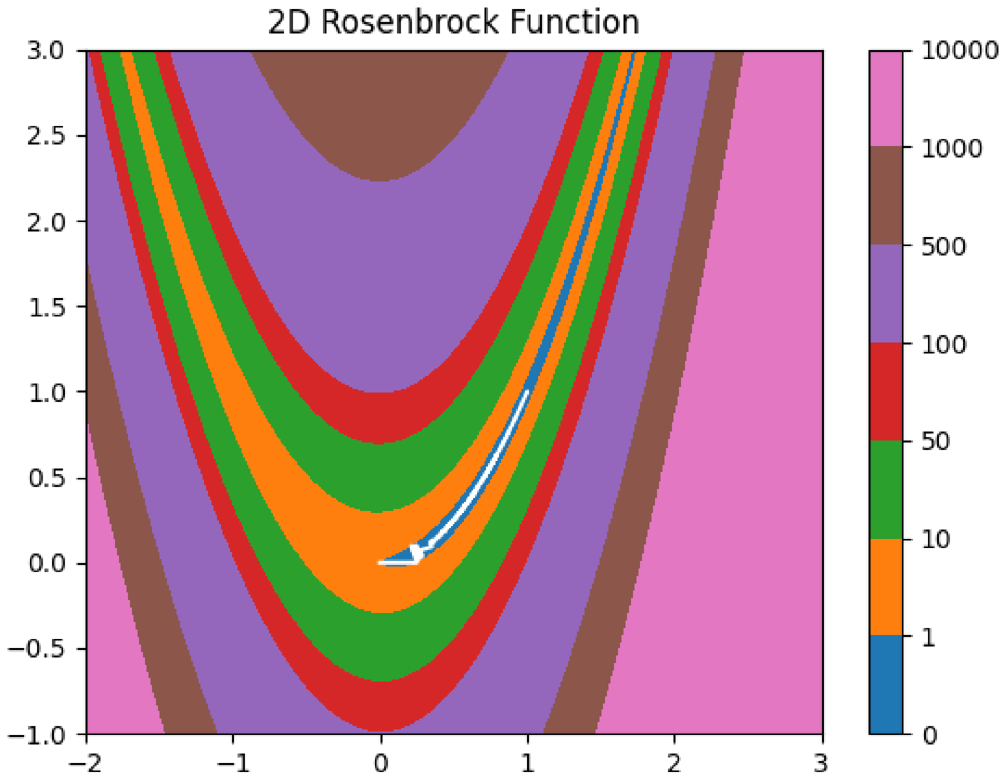
Homework_1: Linear-search Steepest Gradient Descent

1. Workflow

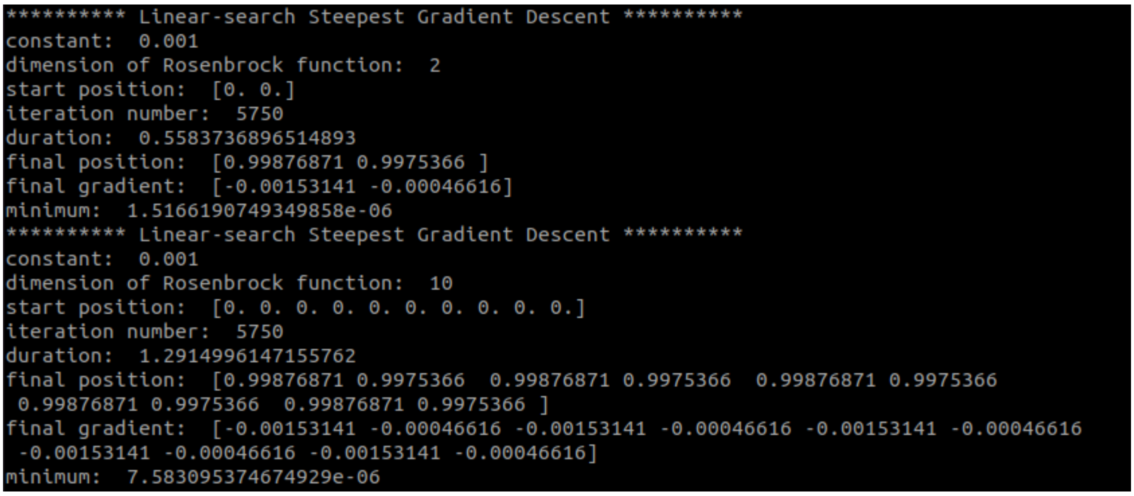
- implement a class named Rosenbrock which can instantiate Rosenbrock function with any dimension and calculate the value and gradient of such function
- implement a function which optimize the given Rosenbrock function with Linear-search Steepest Gradient Descent

2. Result

- Visualization of a 2D Rosenbrock function



- Optimization result of a 2D RB function and 10D RB function



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********** Linear-search Steepest Gradient Descent **********
constant:  0.001
dimension of Rosenbrock function:  2
start position:  [0. 0.]
iteration number:  5750
duration:  0.5583736896514893
final position:  [0.99876871 0.9975366 ]
final gradient:  [-0.00153141 -0.00046616]
minimum:  1.5166190749349858e-06
********** Linear-search Steepest Gradient Descent **********
constant:  0.001
dimension of Rosenbrock function:  10
start position:  [0. 0. 0. 0. 0. 0. 0. 0. 0. 0.]
iteration number:  5750
duration:  1.2914996147155762
final position:  [0.99876871 0.9975366  0.99876871 0.9975366  0.99876871 0.9975366
 0.99876871 0.9975366  0.99876871 0.9975366 ]
final gradient:  [-0.00153141 -0.00046616 -0.00153141 -0.00046616 -0.00153141 -0.00046616
 -0.00153141 -0.00046616 -0.00153141 -0.00046616]
minimum:  7.583095374674929e-06
```

3. Analysis

- Armijo condition can help the optimization algorithm a lot. Without using of Armijo condition, it is hard to converge to the reult[1, 1, ..., 1].