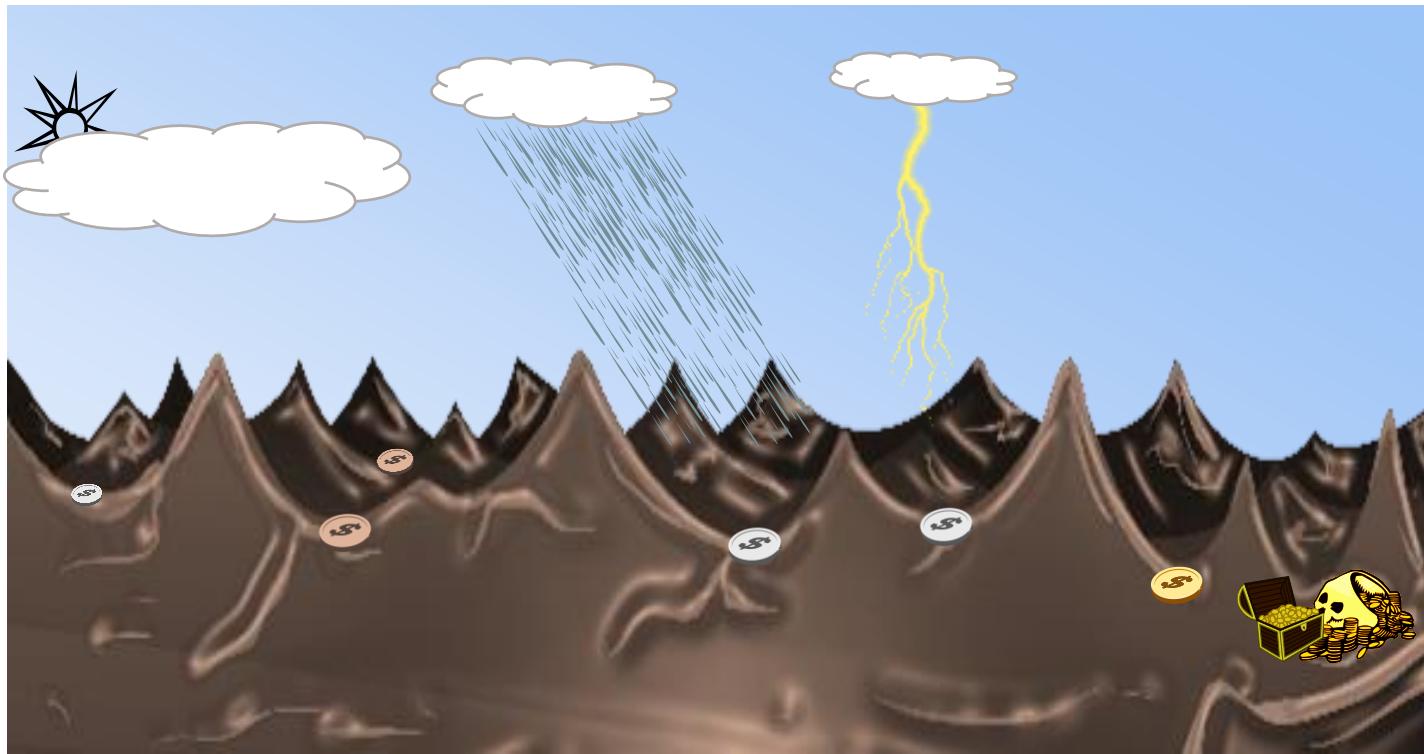
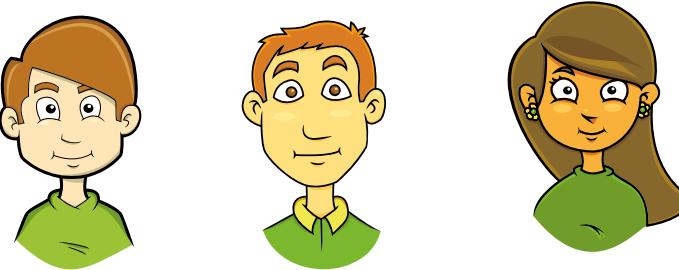


**Single-objective
optimization
algorithms**

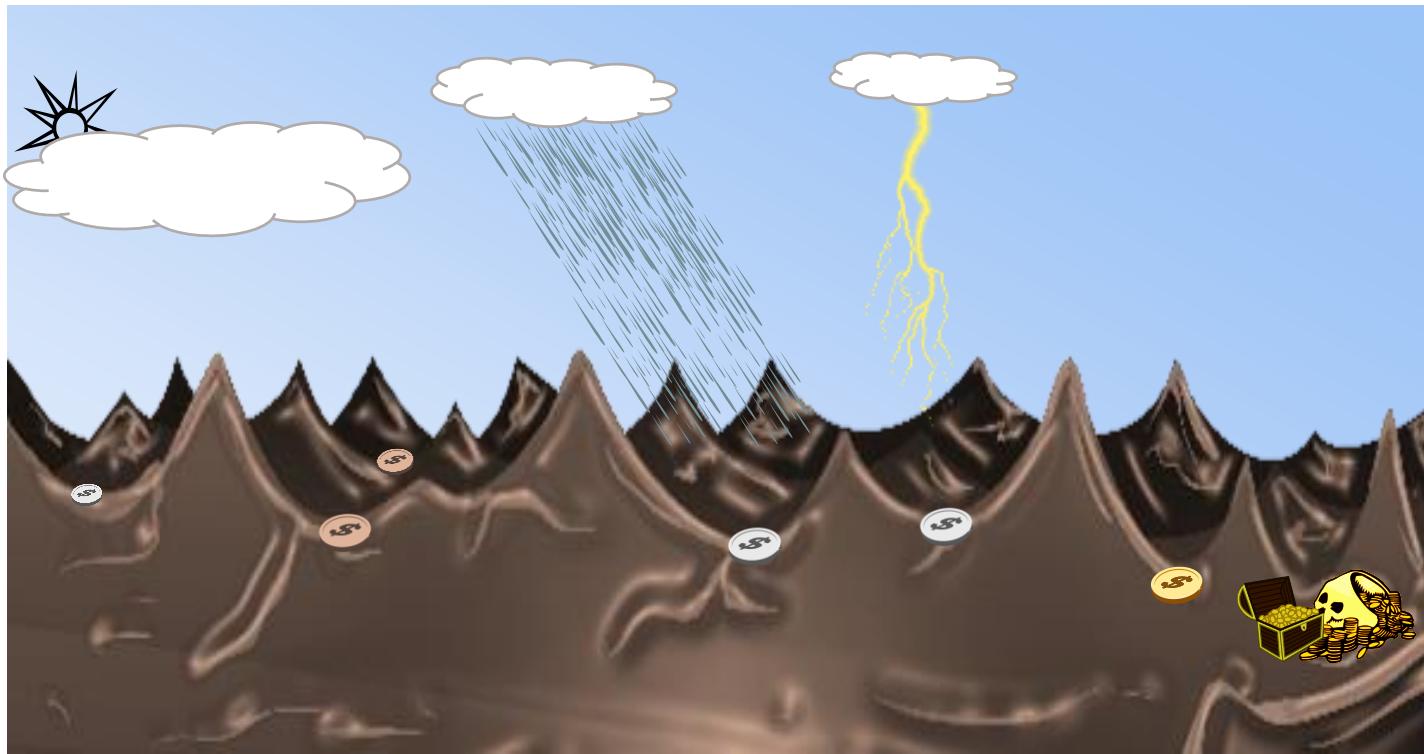
Analogy



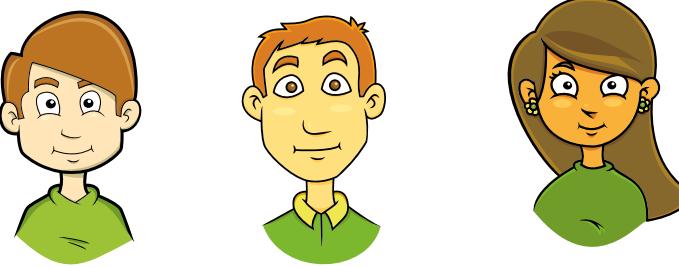
Analogy



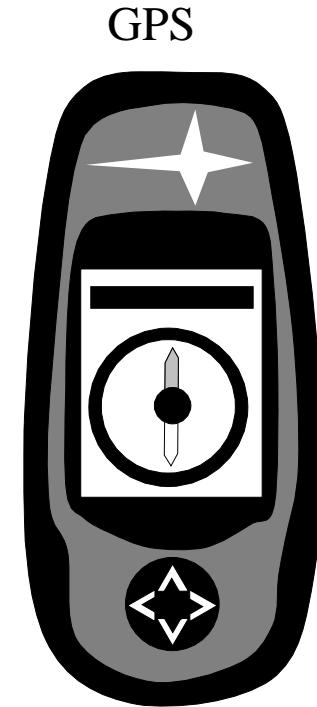
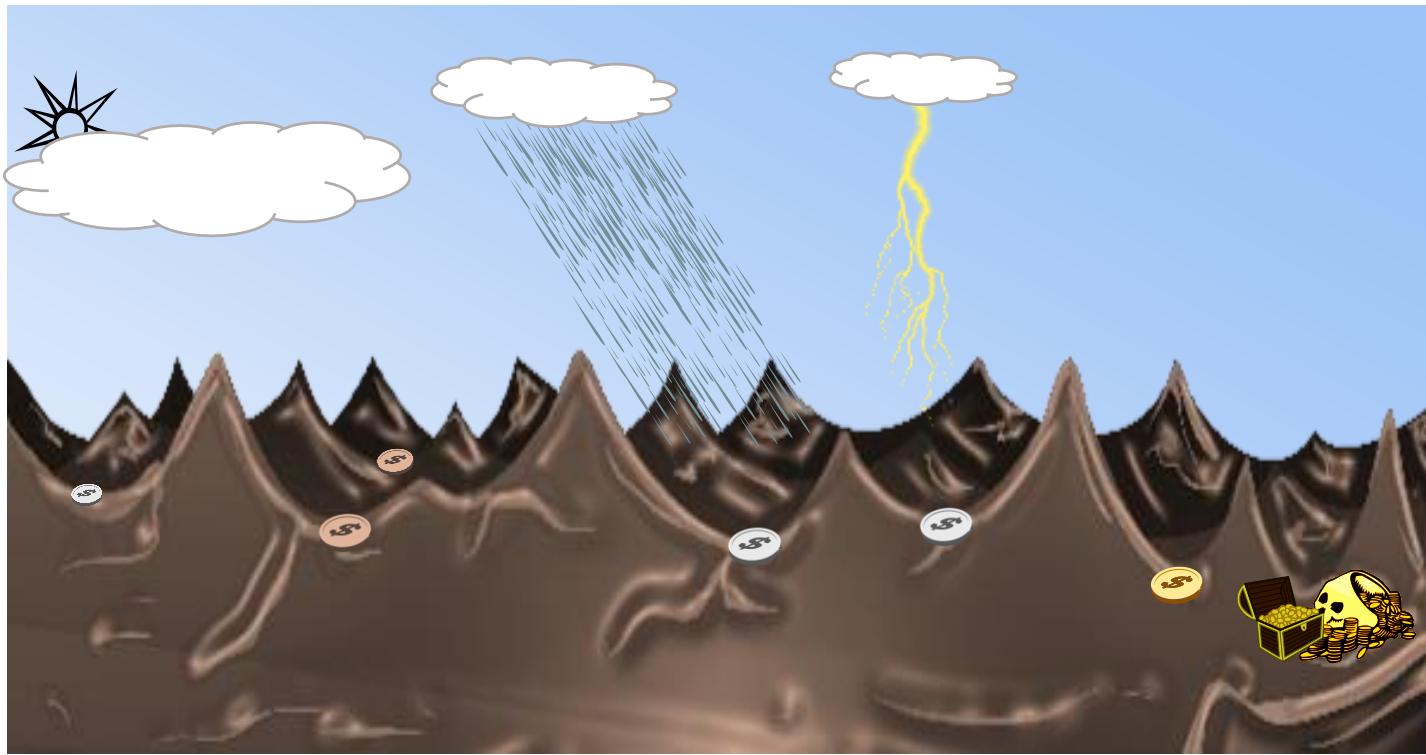
BAJ team: Bob Anthony Jennifer



Analogy



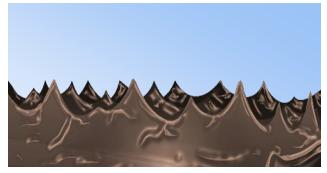
BAJ team: Bob Anthony Jennifer



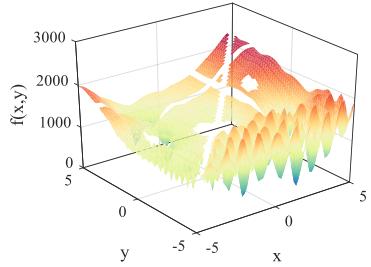
Latitude (x)
Longitude (y)
Elevation (z)

Analogy

Analogy



Landscape



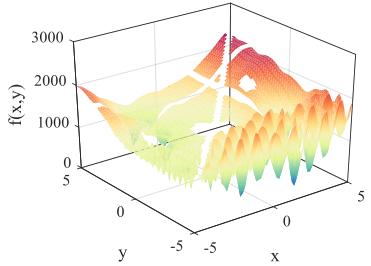
Analogy



Landscape

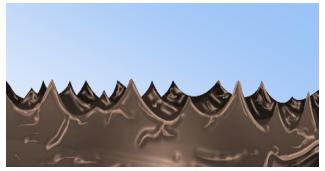


GPS: x,y



Variables

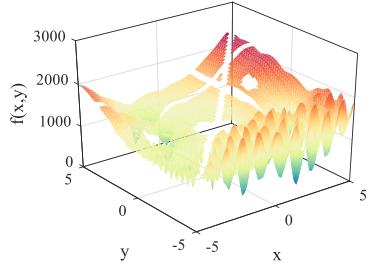
Analogy



Landscape



GPS: x,y



Variables



GPS: z

Objective value

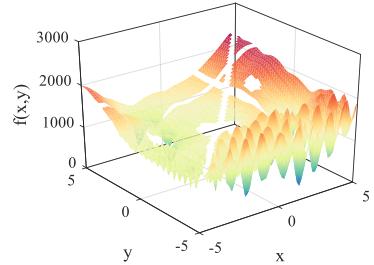
Analogy



Landscape



GPS: x,y



Variables



GPS: z

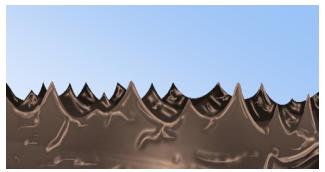
Objective value



GPS

Objective function

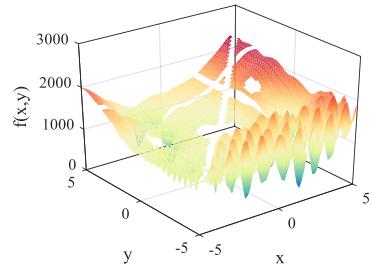
Analogy



Landscape



GPS: x,y



Variables



GPS: z

Objective value



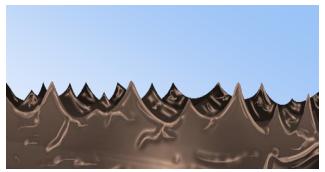
GPS

Objective function

All the possible
locations (x,y)

Search space

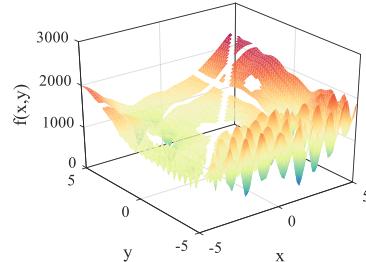
Analogy



Landscape



GPS: x,y



Variables



GPS: z

Objective value



GPS

Objective function

All the possible
locations (x,y)

Search space



Rain, flood, etc.

Constraints

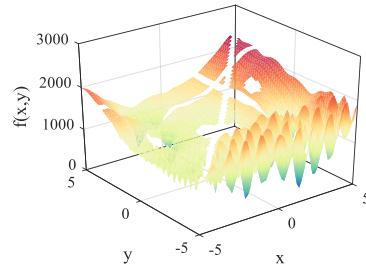
Analogy



Landscape



GPS: x,y



Variables



GPS: z

Objective value



GPS

Objective function

All the possible
locations (x,y)

Search space



Rain, flood, etc.

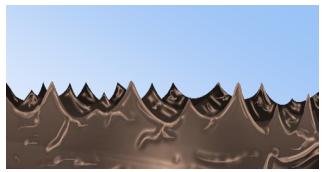


Treasure

Constraints

Global optimum

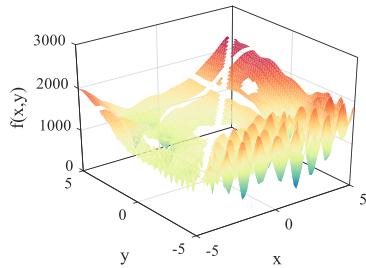
Analogy



Landscape



GPS: x,y



Variables



GPS: z

Objective value



GPS

Objective function

All the possible locations (x,y)

Search space



Rain, flood, etc.

Constraints



Treasure

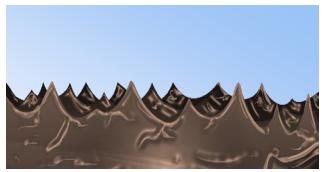
Global optimum



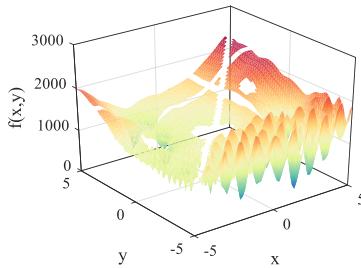
Small coins

Local optima

Analogy



Landscape



GPS: x,y

Variables



GPS: z

Objective value



GPS

Objective function

All the possible locations (x,y)

Search space



Rain, flood, etc.

Constraints



Treasure

Global optimum



Small coins

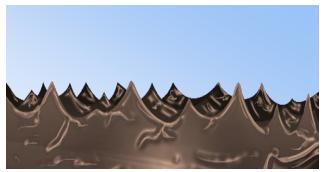
Local optima



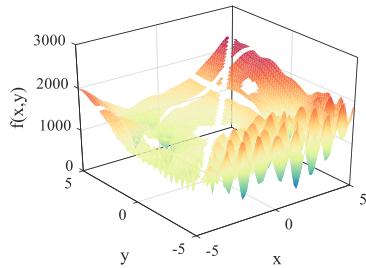
Bob, Anthony,
Jennifer

Search agents

Analogy



Landscape



GPS: x,y



GPS: z



GPS

All the possible locations (x,y)

Variables

Objective value

Objective function

Search space



Rain, flood, etc.



Treasure



Small coins



Bob, Anthony, Jennifer



Search strategy (BAJ)

Constraints

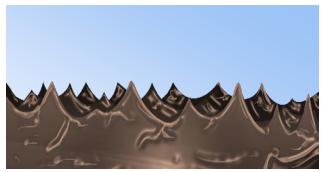
Global optimum

Local optima

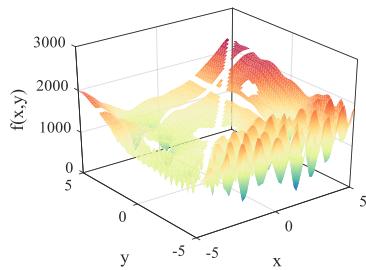
Search agents

Optimization algorithm

Analogy



Landscape



GPS: x,y



GPS: z



GPS

All the possible locations (x,y)

Variables

Objective value

Objective function

Search space



Rain, flood, etc.



Treasure



Small coins



Bob, Anthony, Jennifer



Search strategy (BAJ)



Days

Constraints

Global optimum

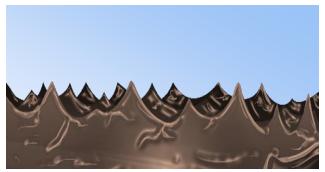
Local optima

Search agents

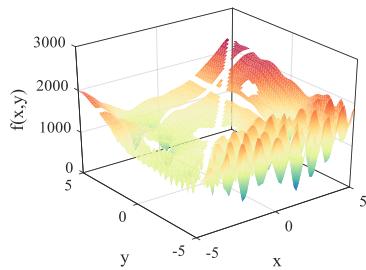
Optimization algorithm

Iterations

Analogy



Landscape



GPS: x,y



GPS: z



GPS

All the possible locations (x,y)

Variables

Objective value

Objective function

Search space



Rain, flood, etc.



Treasure



Small coins



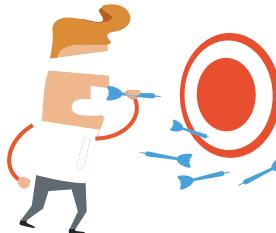
Bob, Anthony,
Jennifer



Search strategy
(BAJ)



Days



The process of finding the best location to find the treasure

Constraints

Global optimum

Local optima

Search agents

Optimization algorithm

Iterations

Optimization

**Modern
Deterministic**

**vs.
vs.**

**Conventional
Stochastic**



Conventional (deterministic) optimization algorithms

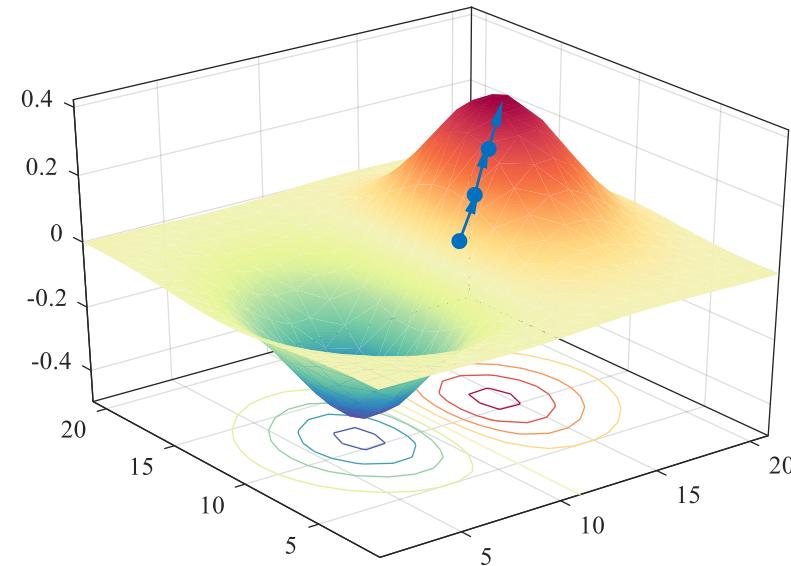


- Gradient descent algorithm

Conventional (deterministic) optimization algorithms



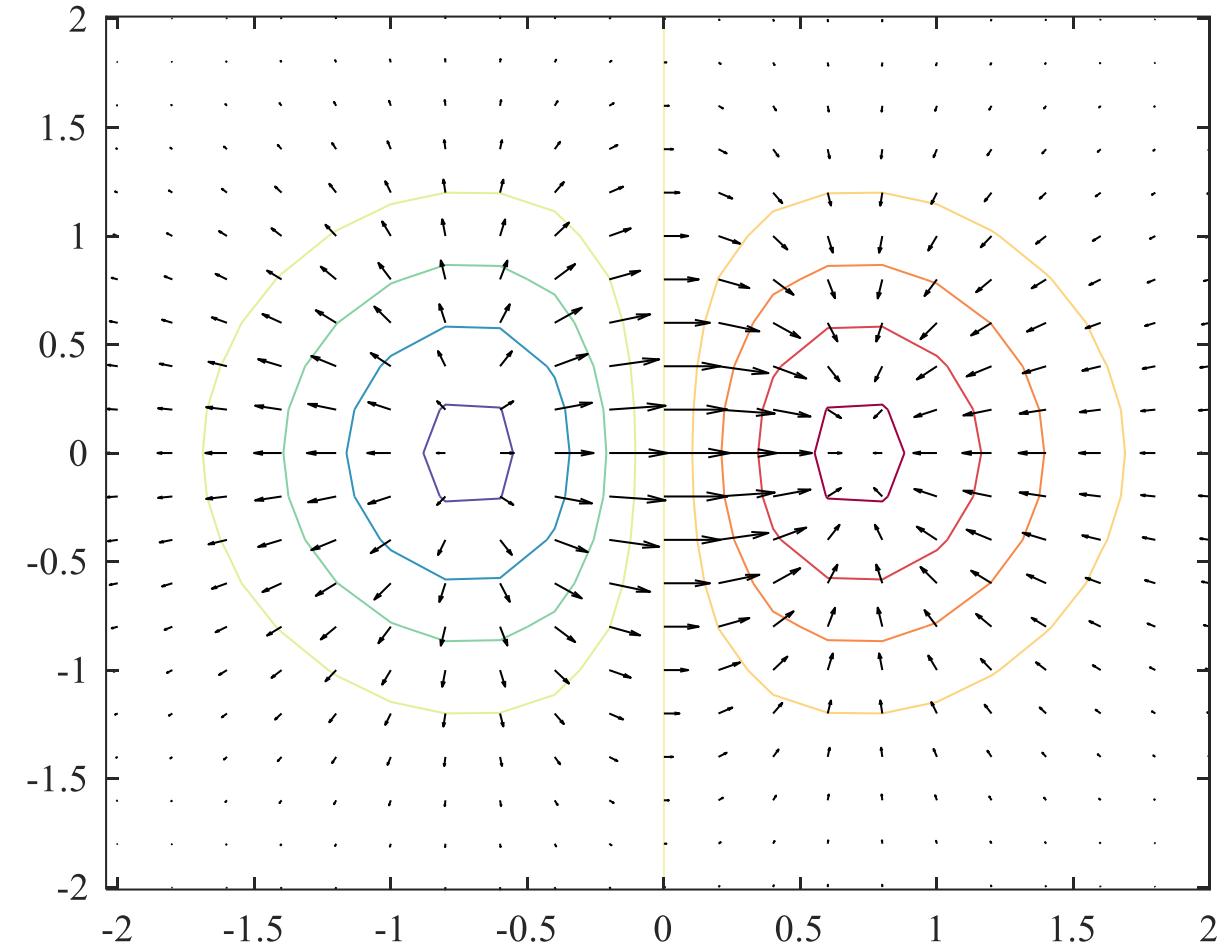
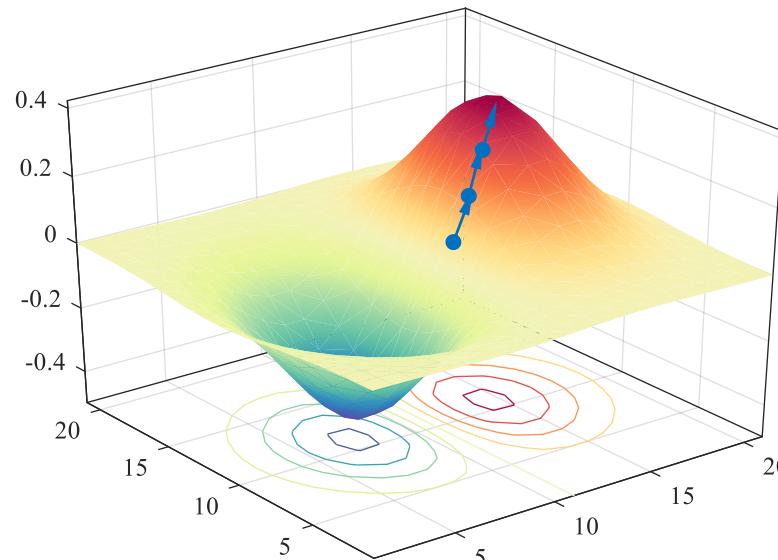
- Gradient descent algorithm



Conventional (deterministic) optimization algorithms



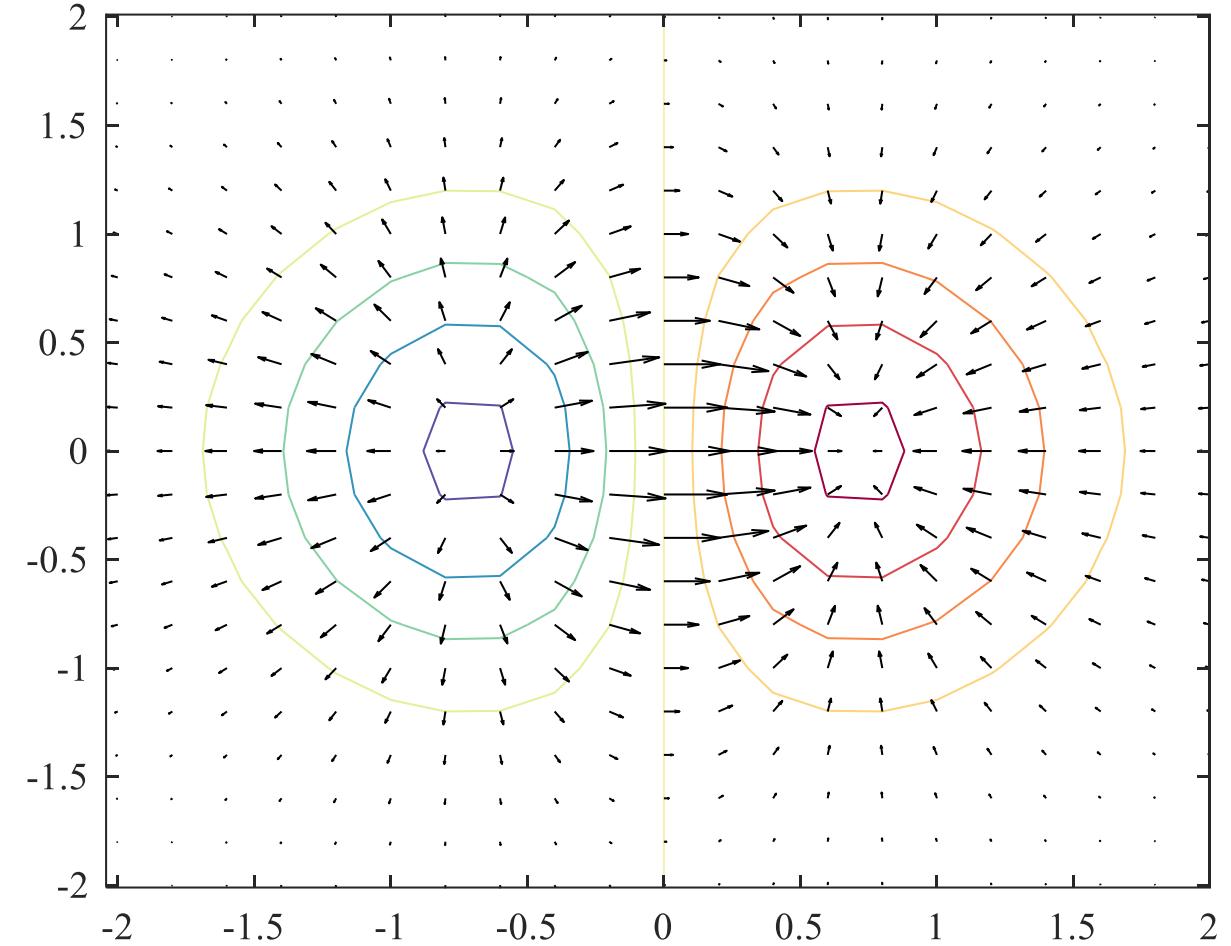
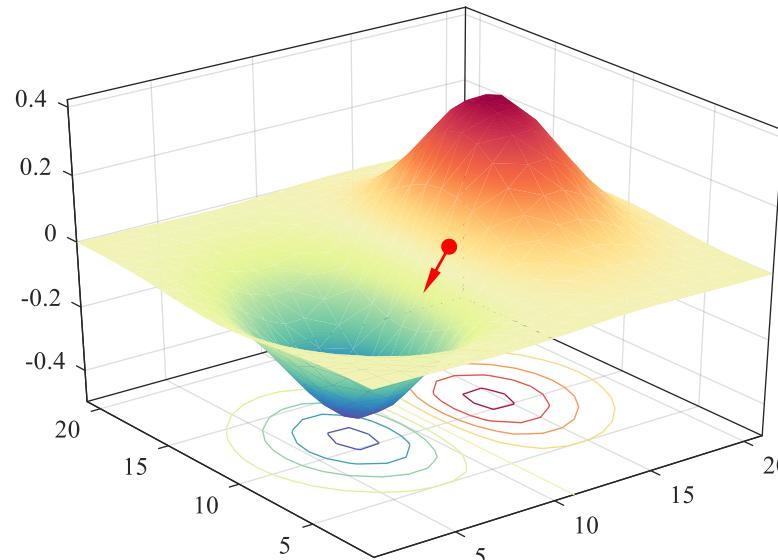
- Gradient descent algorithm



Conventional (deterministic) optimization algorithms



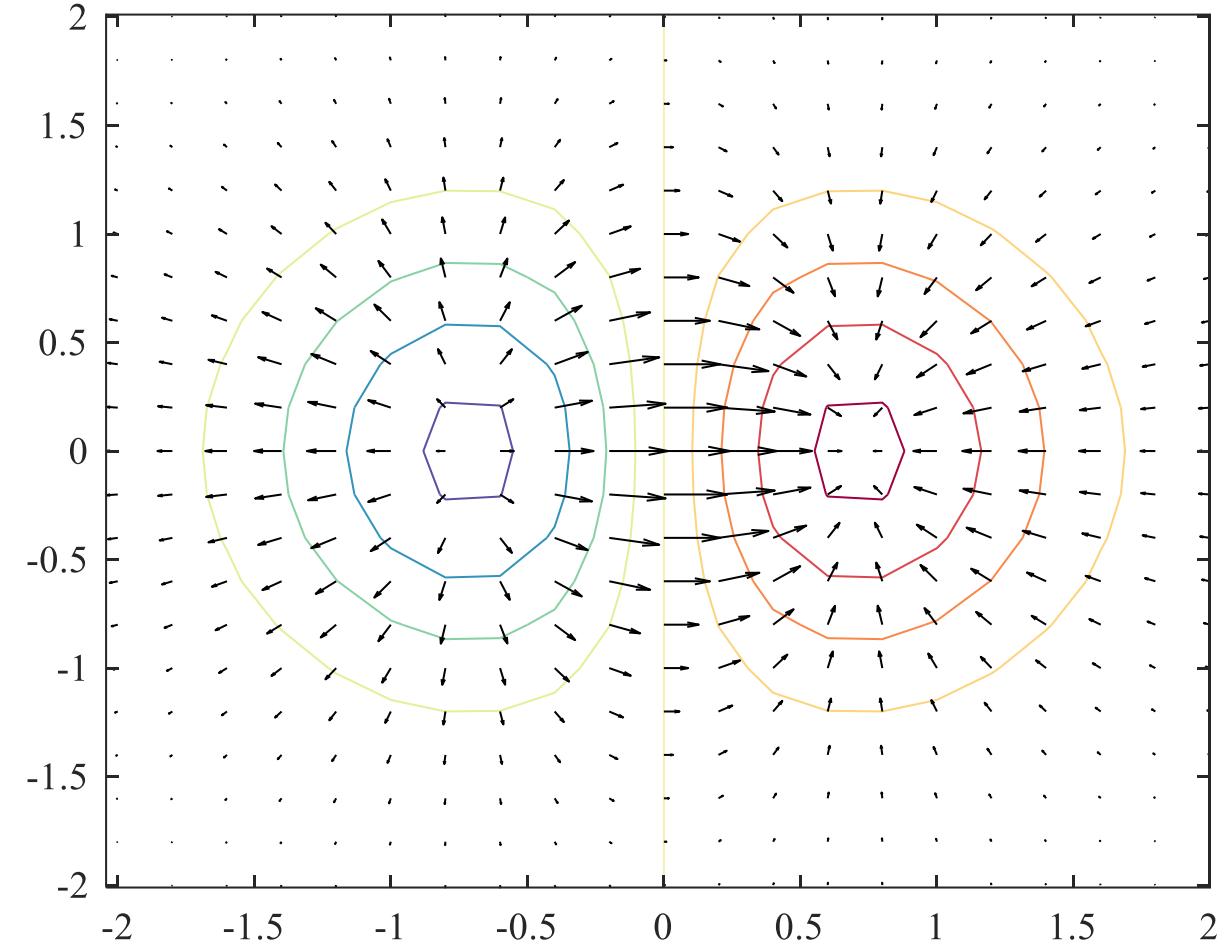
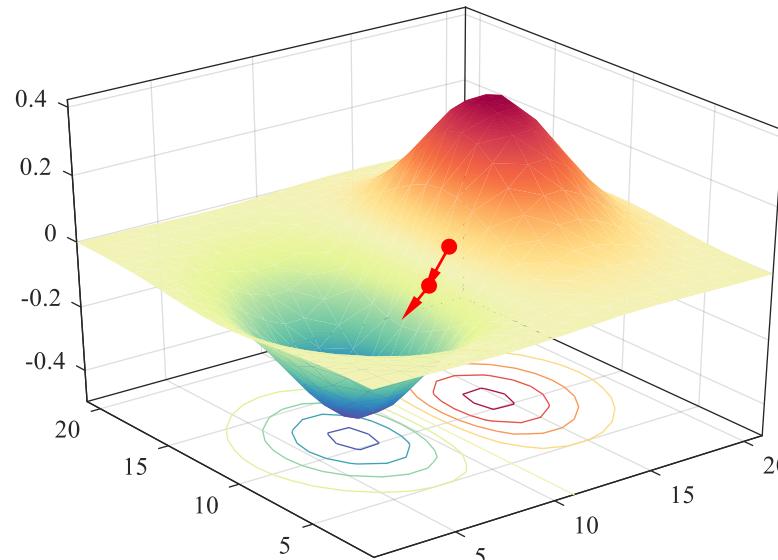
- Gradient descent algorithm



Conventional (deterministic) optimization algorithms



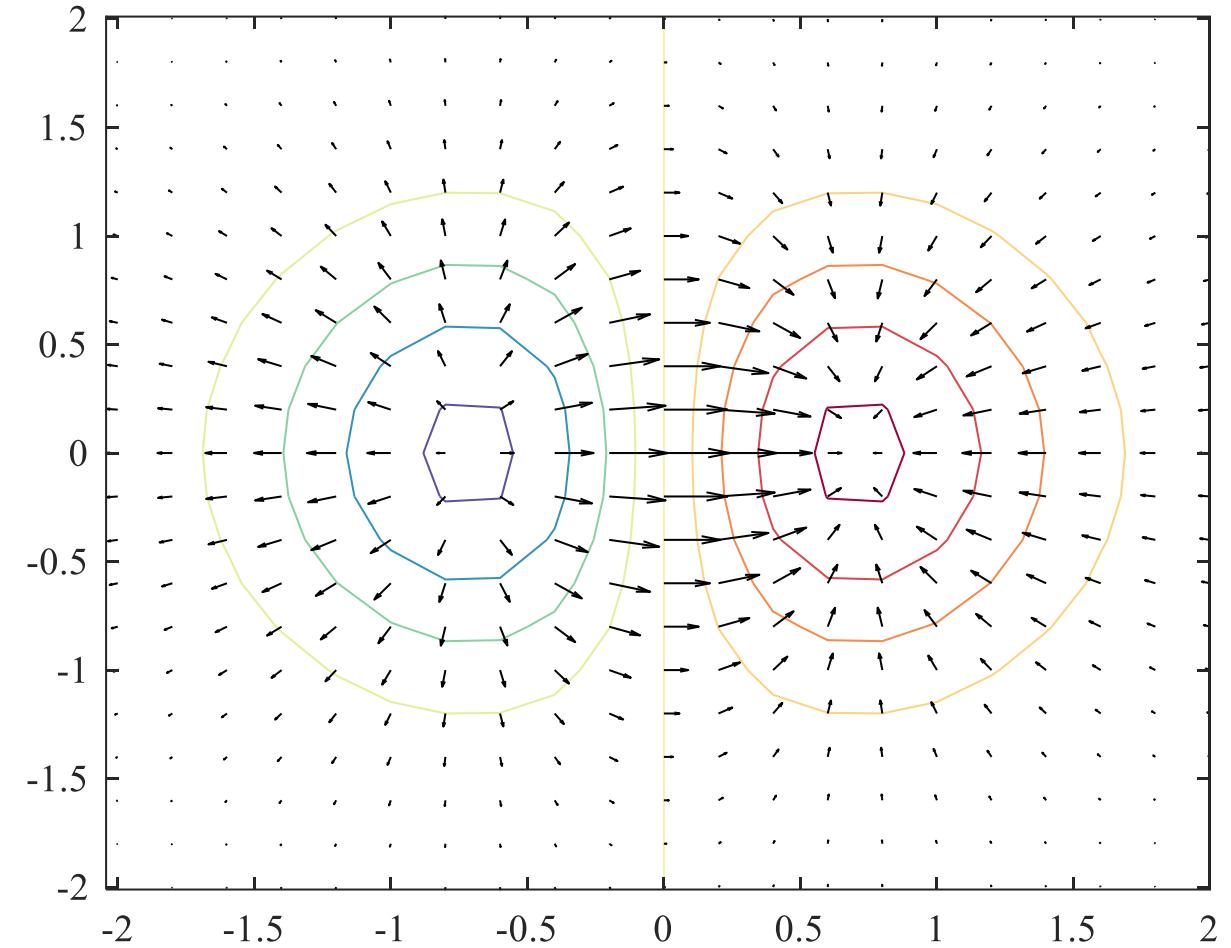
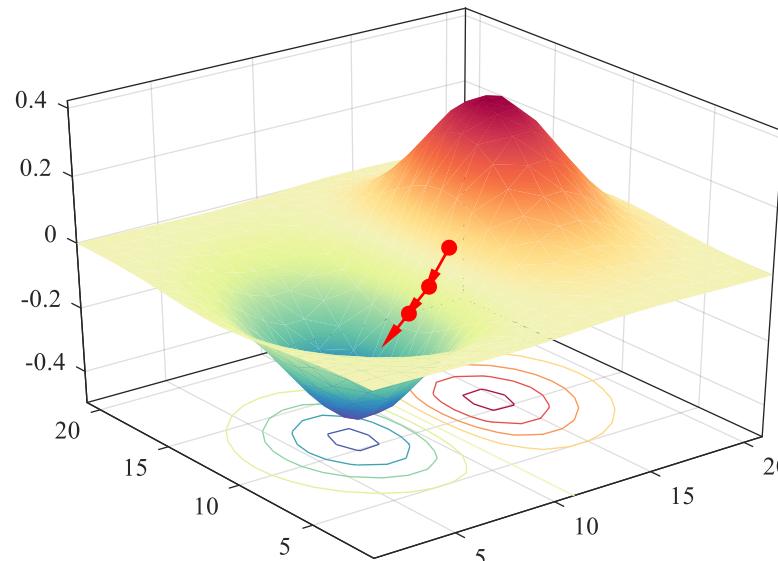
- Gradient descent algorithm



Conventional (deterministic) optimization algorithms



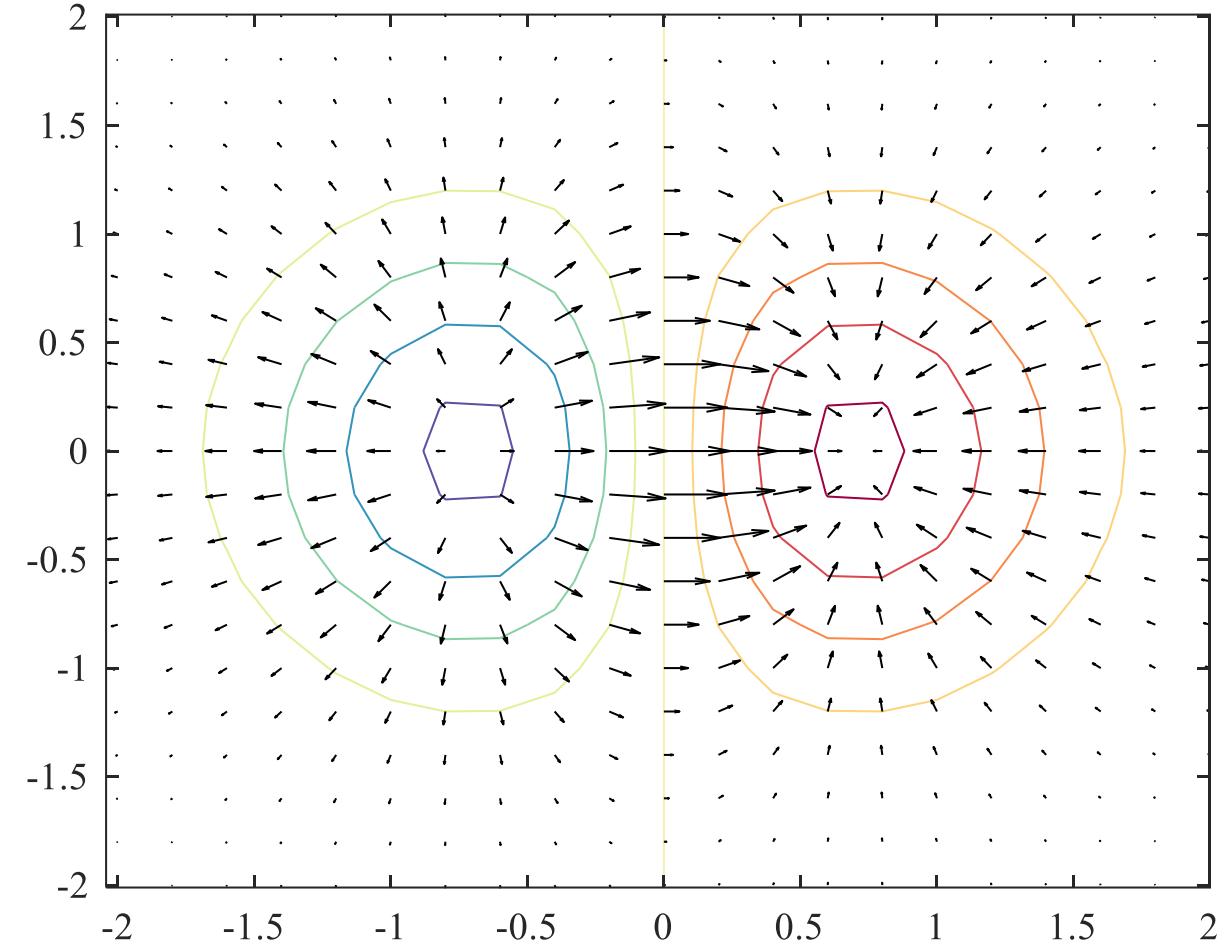
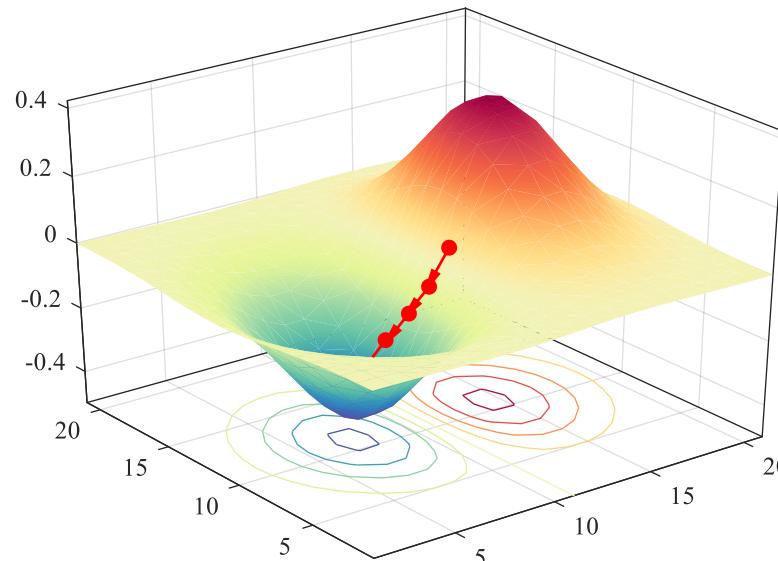
- Gradient descent algorithm



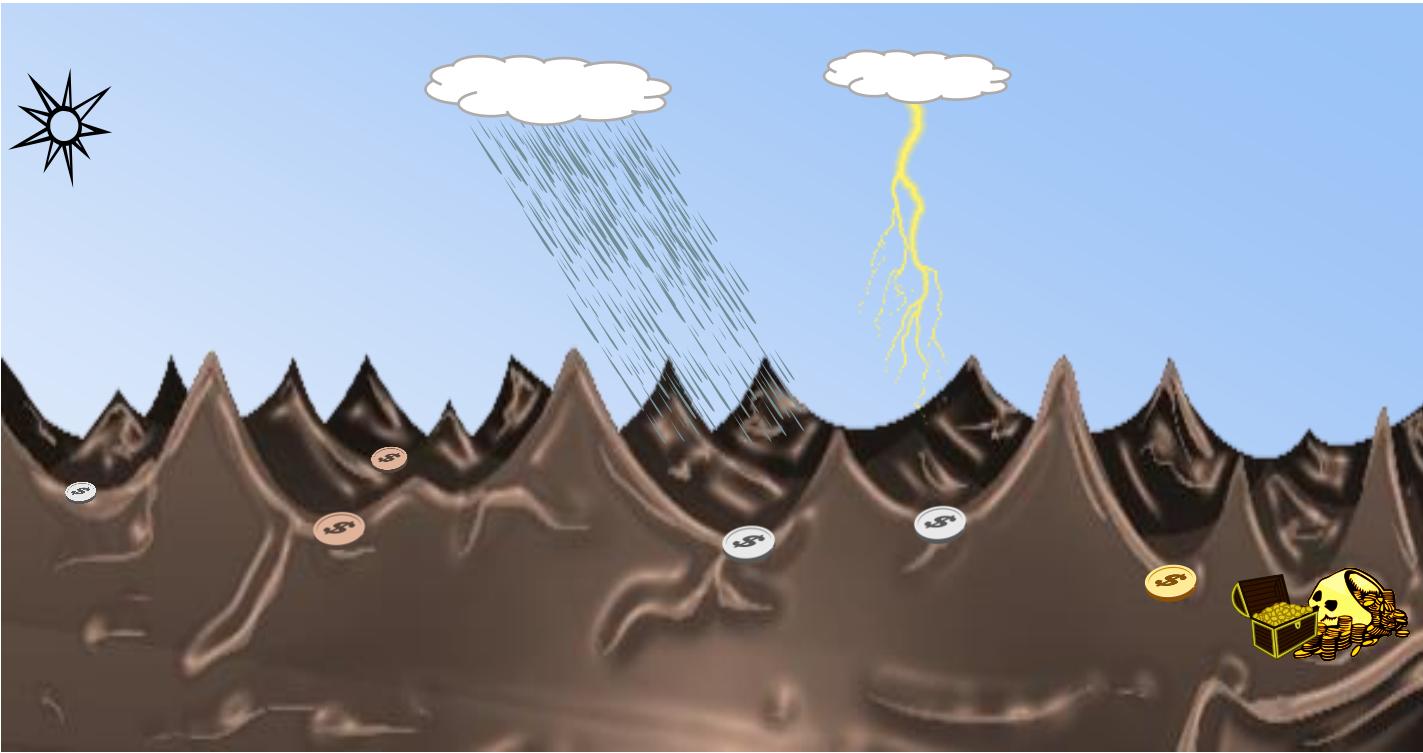
Conventional (deterministic) optimization algorithms



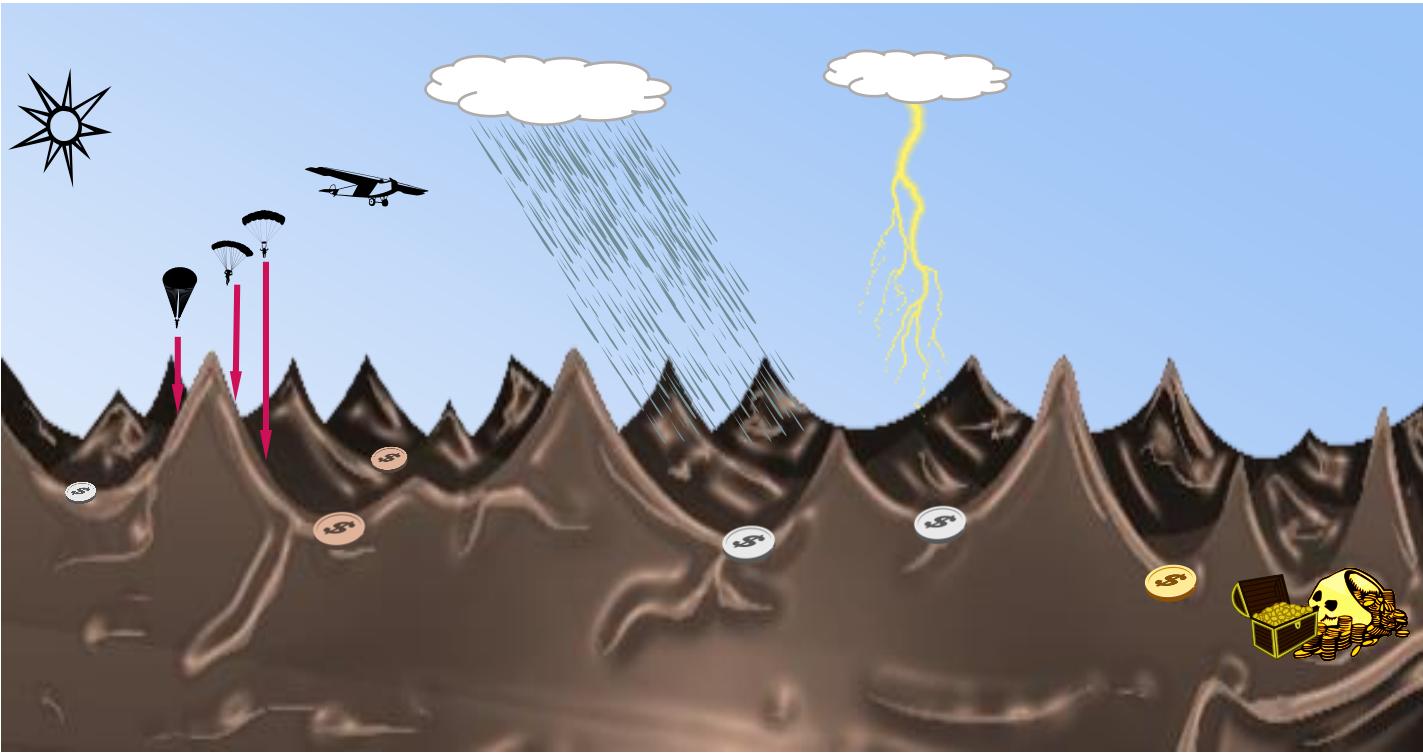
- Gradient descent algorithm



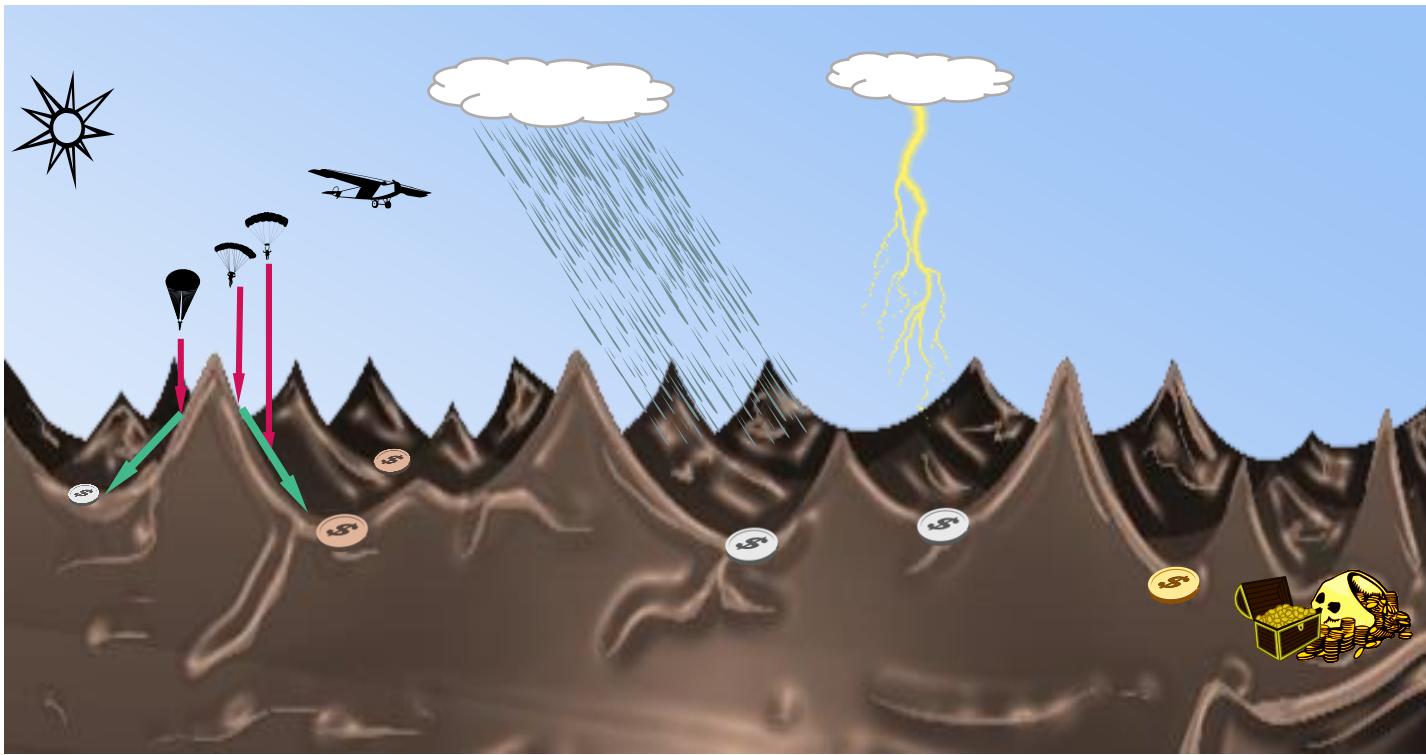
Gradient descent algorithm



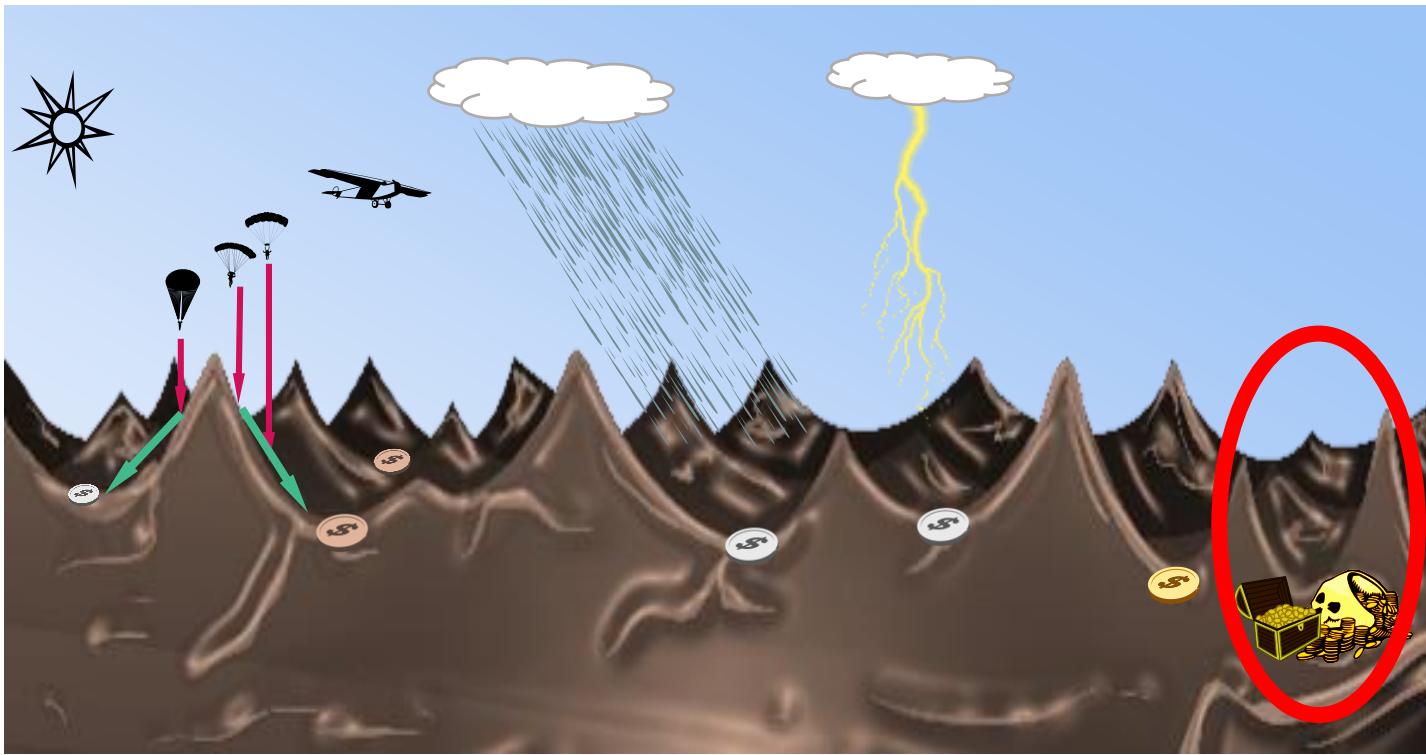
Gradient descent algorithm



Gradient descent algorithm



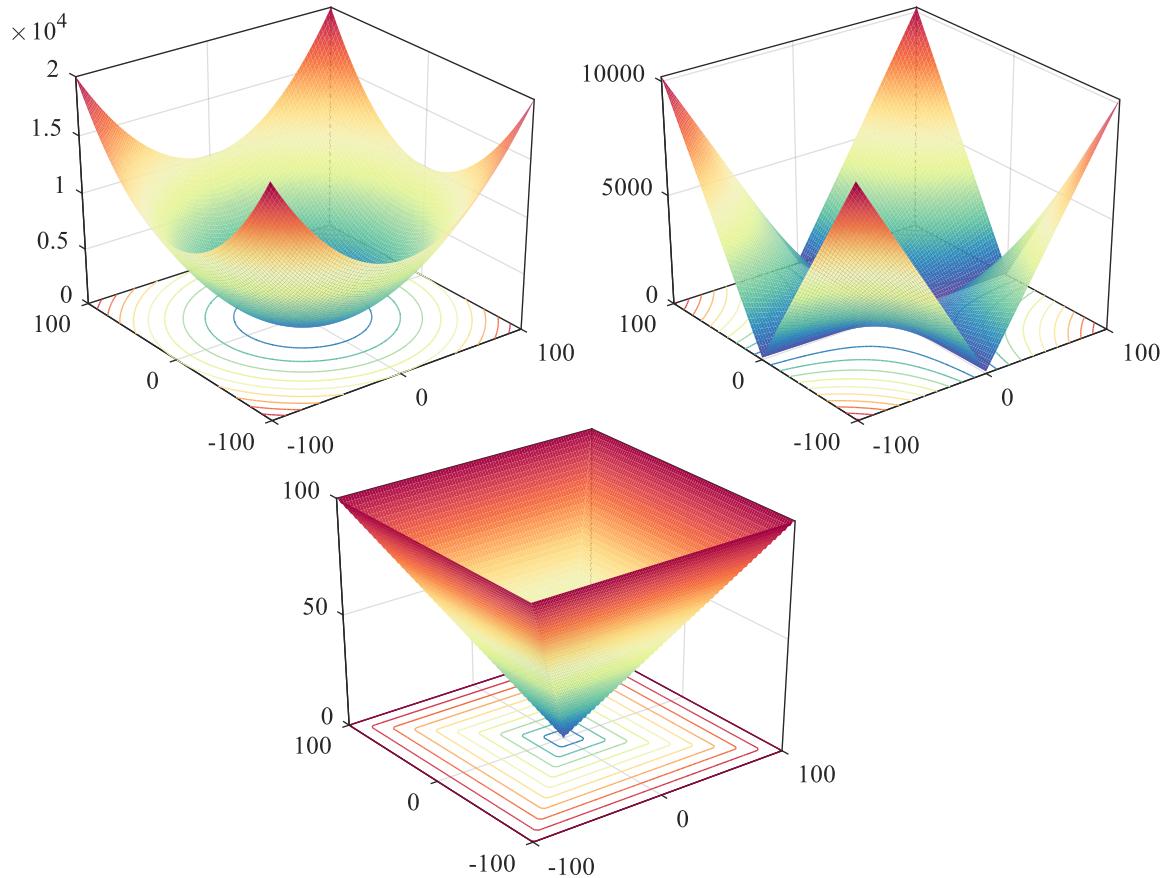
Gradient descent algorithm



Gradient descent algorithm

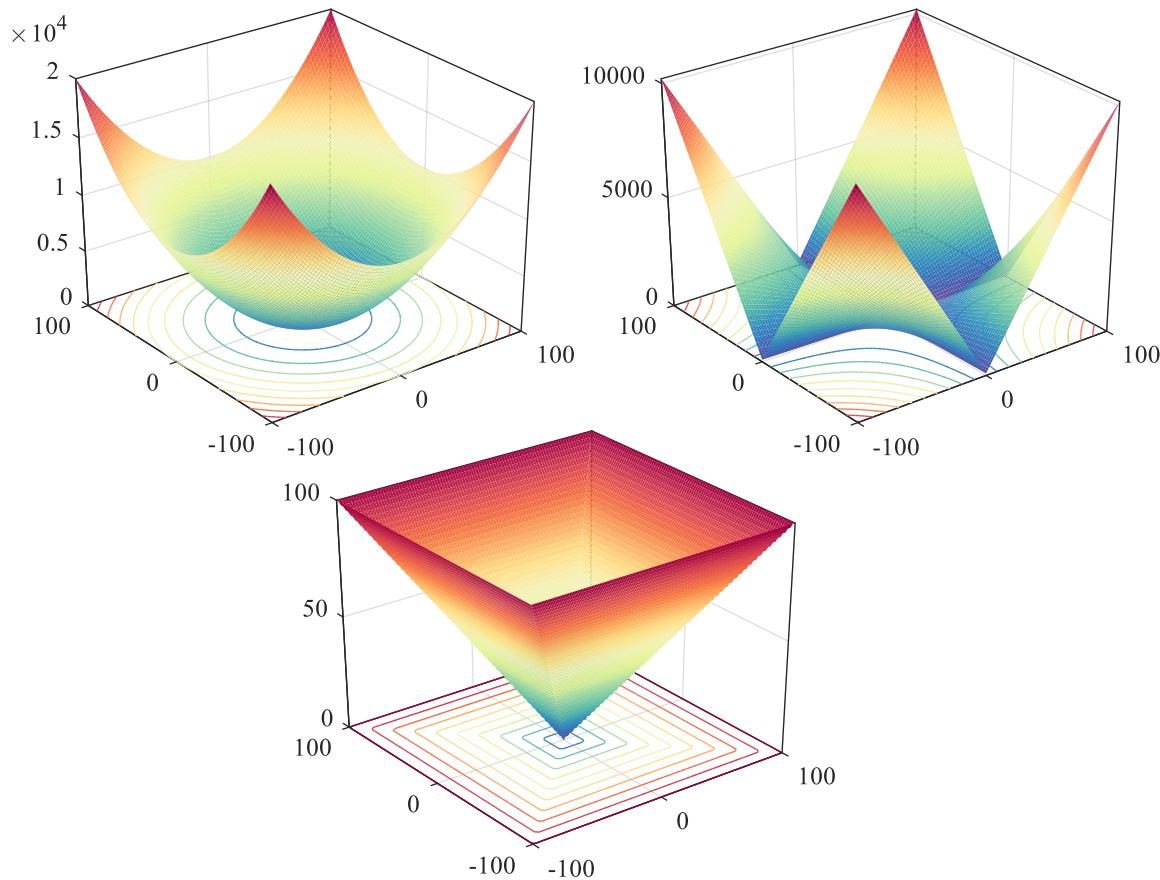
Gradient descent algorithm

Efficient for unimodal landscapes

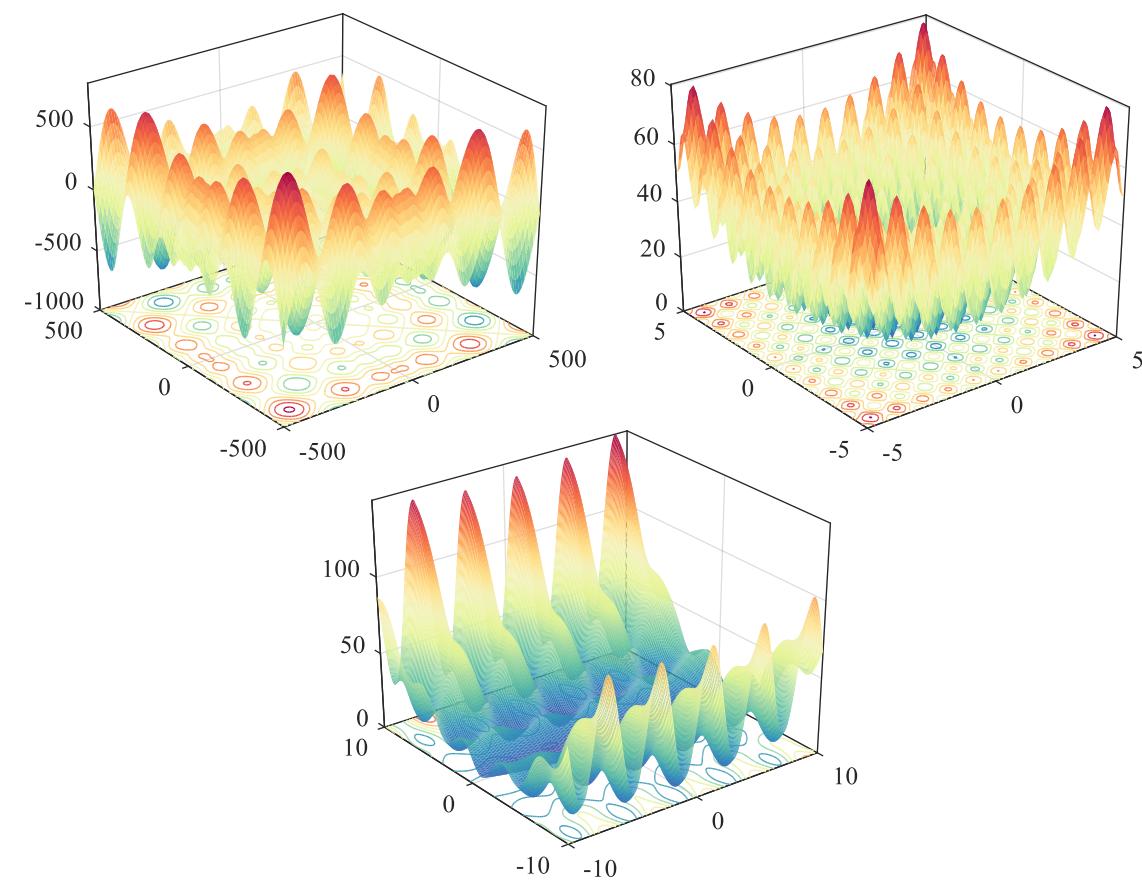


Gradient descent algorithm

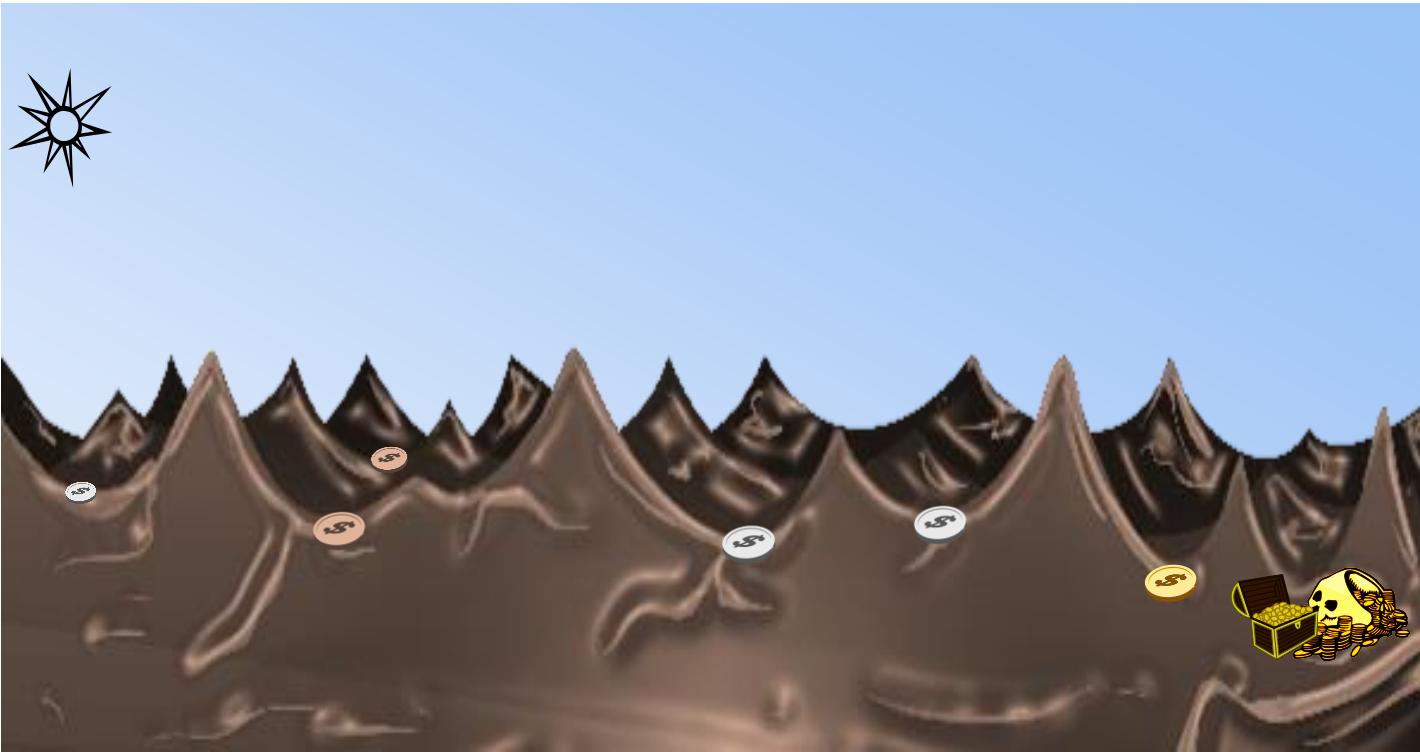
Efficient for unimodal landscapes



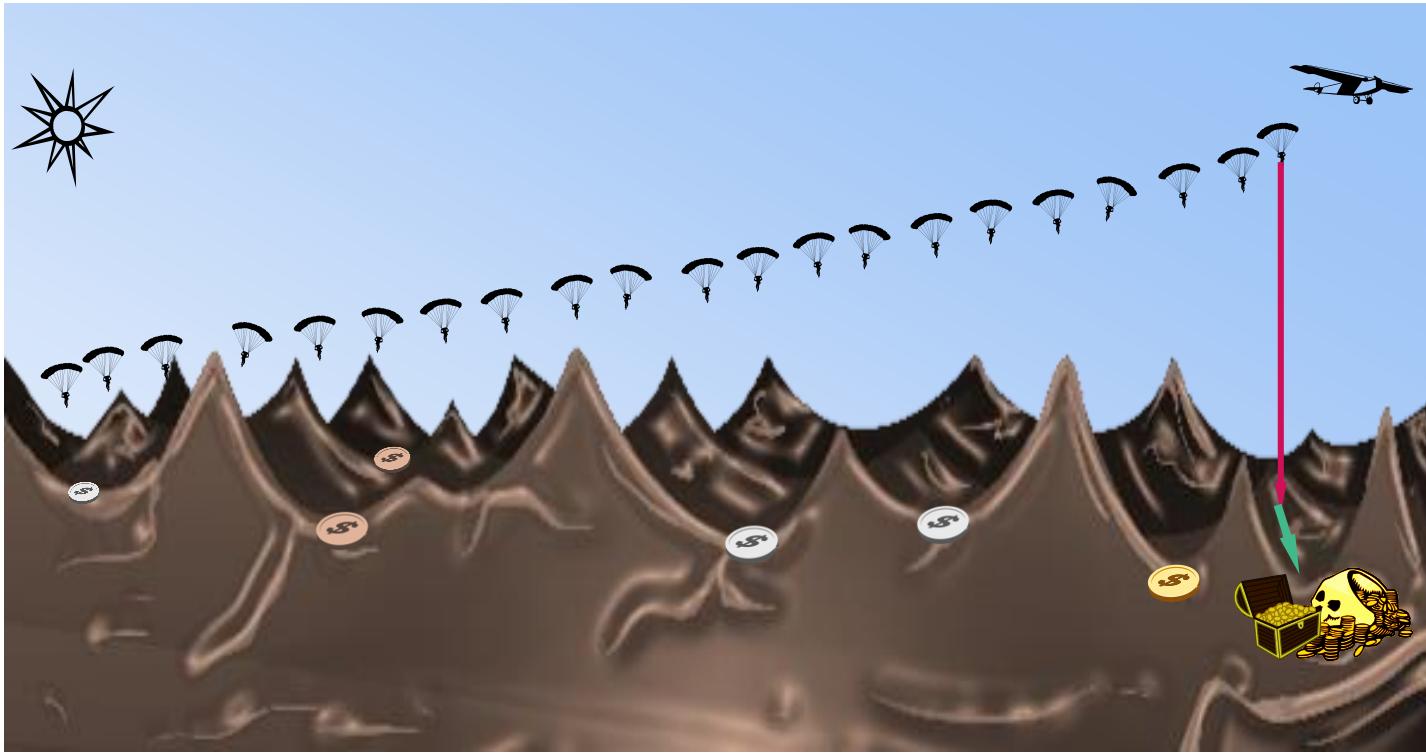
Not efficient for unimodal landscapes
Highly depends on the starting point



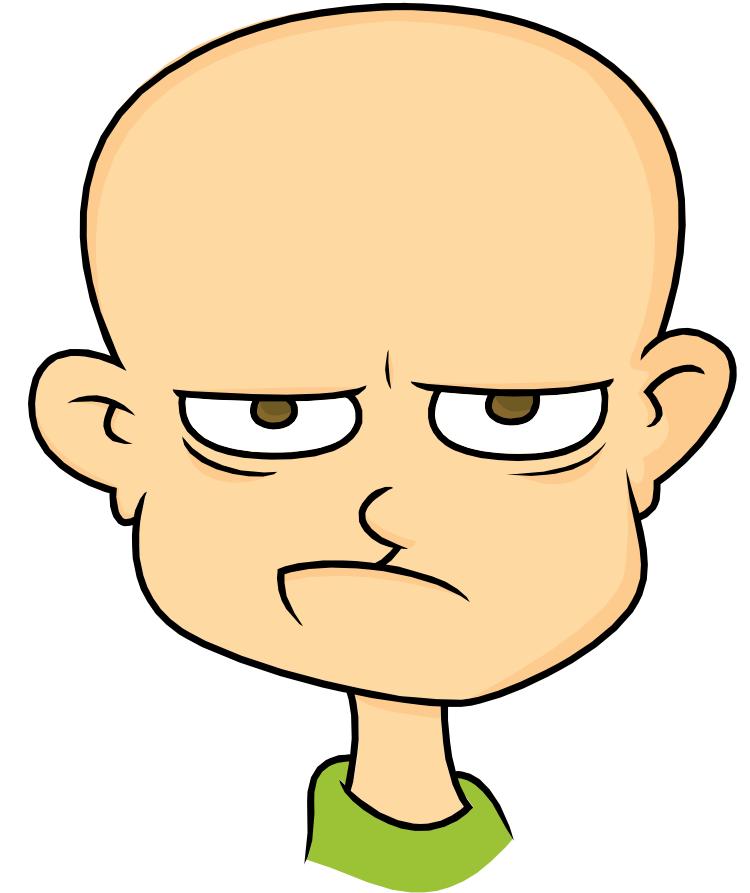
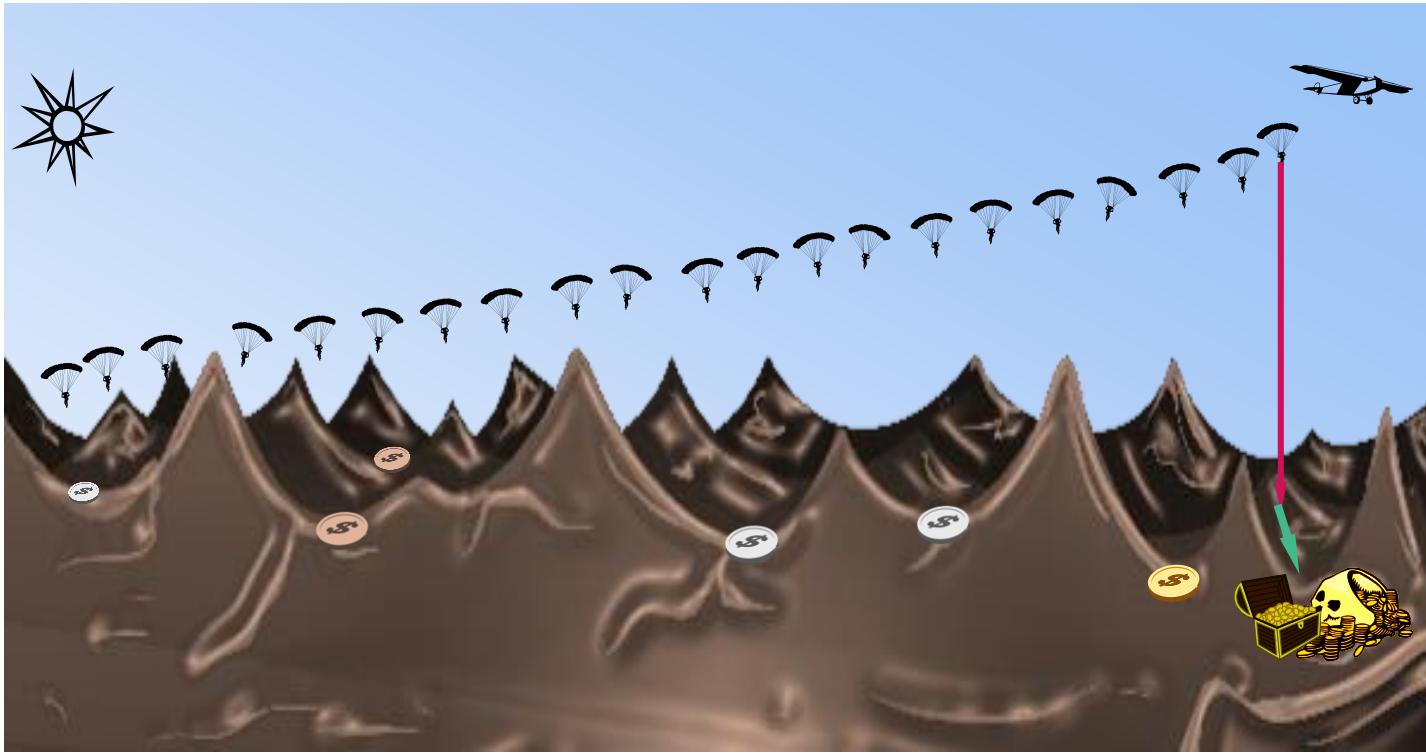
Gradient descent algorithm



Gradient descent algorithm



Gradient descent algorithm



Modern (stochastic) optimization algorithms



Deterministic algorithms

- Gradient descent algorithm

Deterministic algorithms

- Gradient descent algorithm

It gives the same output

No random component



Deterministic algorithms

- Gradient descent algorithm

It gives the same output

No random component



Stochastic algorithms

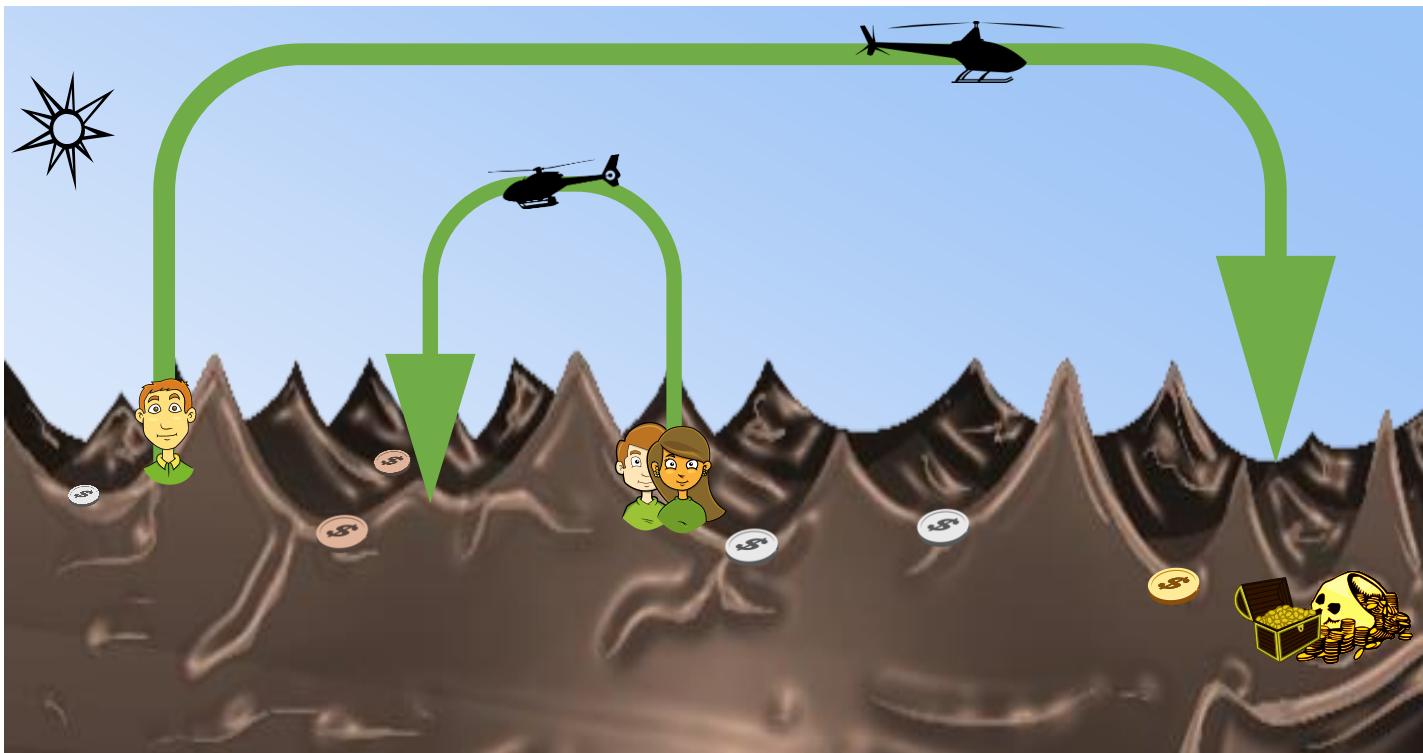
- Modern algorithms

It gives different outputs

There are random components



Modern (stochastic) optimization algorithms



Modern (stochastic) optimization algorithms



Deterministic

Advantages:

- Reliable in finding the same solution
- Require less number of function evaluation
- Fast convergence

Drawbacks:

- Local optima stagnation
- Low chance of finding the global optimum
- High dependency on the initial solution
- Mostly need gradient

Stochastics

Advantages:

- Avoid local solutions
- Higher chance of finding the global optimum
- Low dependency on the initial solution
- Mostly do not need gradient

Drawbacks:

- Slow convergence speed
- Finding different answers in each run

Modern (stochastic) optimization algorithms



High local optima
avoidance



Gradient-free
mechanism