Swarm Intelligence

Bio-Inspired Algorithms

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Swarm Intelligence based algorithms Introduction, category

- Nature Inspired algorithms
  - Bio-inspired Algorithms
    - **Swarm Intelligence based algorithms**
    - Non Swarm intelligence based algorithms
  - Physics and Chemistry based algorithms
  - Other algorithms

Swarm Intelligence based algorithms Introduction, Characteristic

- Heuristic nonlinear optimization
- Static optimization parameters taken as n-Dimentions
- Escape from local minima
- Convergence towards global minima
- Balance between exploration(escape from local minima) and exploitation(approach towards minima)

Swarm Intelligence based algorithms Introduction, General Implementation

- Cost function to be optimized
  - N parameters
  - f(x) functions to be optimized, h(x),g(x) constrains

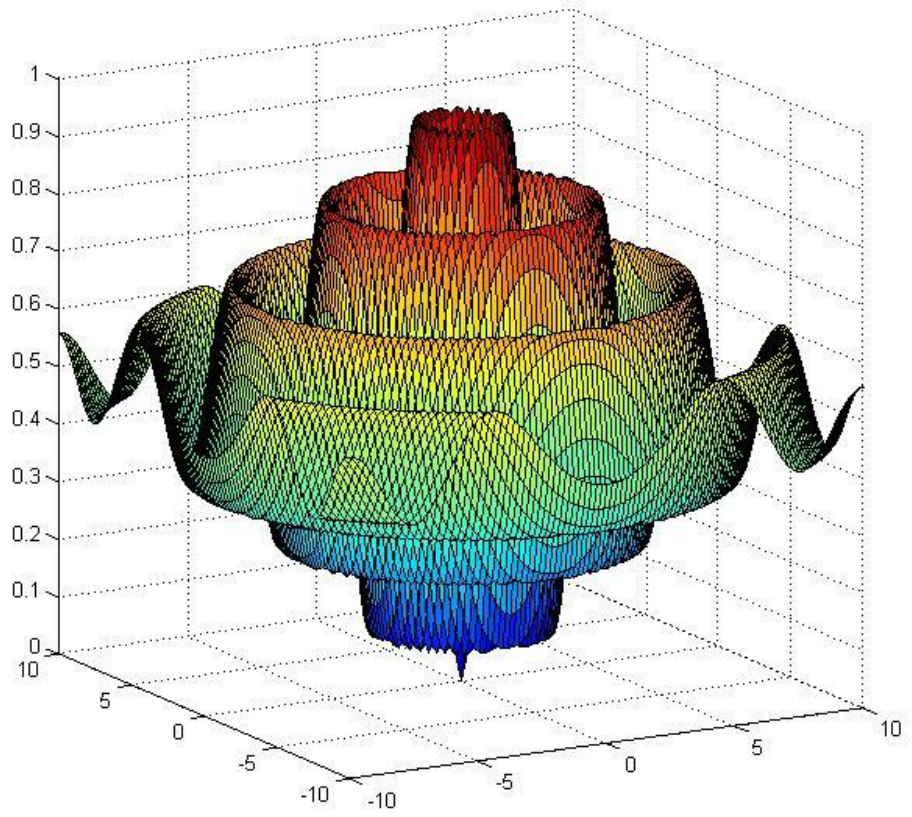
$$\min_{x \in \Re^n} f_i(x),\ (i = 1, 2, ...M)$$

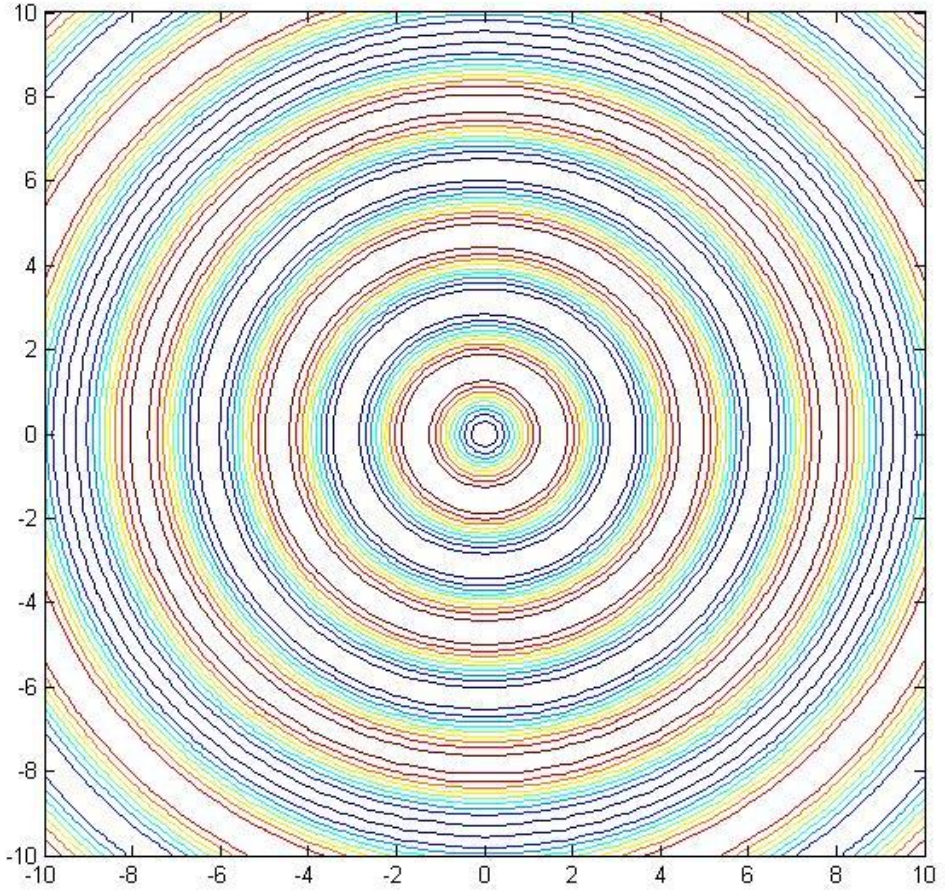
$$Subject\ to\ h_j(x) = 0,\ (j = 1, 2, ...J)$$

$$g_k(x) \leq 0, (k = 1, 2, ..., K)$$

Schaffer's F6 cost function

$$f(x) = 0.5 + \frac{\sin^2\sqrt{x^2 + y^2} - 0.5}{(1 + 0.001 \times (x^2 + y^2))^2}$$





Swarm Intelligence based algorithms Introduction, General Implementation

- Random Walk
  - Uniform distribution
  - Levi's distribution
  - Normal distribution
- Chaos maps based walk

Swarm Intelligence based algorithms Introduction, Limitation

- Not guaranteed to reach global minima
  - As random stochastic path can not be predicted
- Can get stuck in local minima
- Requires parameters tuning for balance between exploration and exploitation for better result.
  - Parameters can vary based on cost functions used.
- Computation intensive

Different Swarm based algorithms

- Particle Swarm optimization algorithms
- Wolf based search algorithms
  - Gray wolf optimization algorithm
- Bat Algorithms
- Firefly Algorithms
- Artificial Fish swarm algorithm
- Artificial Bee colony
- Etc…

Wolf Based Search algorithm Introduction

- Social predators, hunt in pack
- Commute as a nuclear family
- Semi-cooperative, move in group in loosely coupled formation
- When hunting, simultaneously search for prey
- Hunting individually, or in a group
- If sign of prey found, howl and call other wolf
- If sign of threats like hunter, run away to a far position

Demo

- Wolf based Search algorithm