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1 MultiObject Optimization

1.1 Basic

here is a link: `https://www.youtube.com/watch?v=b7Cgz0FQJJw` and here is another `https://www.bilibili.com/video/BV1rf4y1N75d`

In a word, we consider the problem

$$\text{to minimize}\{f_1(\mathbf{x}), \cdots, f_k(\mathbf{x})\}$$

subject to some constrains and goals, where $\mathbf{x}$ is a vector in $\mathbf{R}^n$. we need to define how to minimize that vector.

A simple way is linear weighted method, where minimizing $\{f_1(\mathbf{x}), \cdots, f_k(\mathbf{x})\}$ is equivalent to minimizing

$$\sum_{i=1}^{k} w_i f_i(\mathbf{x})$$

where $\{w_i\}$ is weight. In some problems, the weight is not given, one can make one's own decisions.

And the problem is solved.

1.2 The Constrains and Goal

Two types of constrains: 1. Goal; 2. Constrains.

$$\begin{cases} g_i(x) \leq 0 & i = 1, \cdots, m_1 \\ h_j(x) = 0 & j = 1, \cdots, m_2 \end{cases}$$

1.3 Futher reading and Ref

- `https://pymoo.org/` Python Multi-Objective Optimizationa library.
- Pareto Set, Pareto Optimization, Pareto Set Front
- The Visualization of Pareto Set Front
- Evolutionary Algorithm used in MOO