Visualización de la Información
Ejercicio 02

Dr. Salvador Botello-Aceves

Divisíon de Ingenierías Campus Irapuato-Salamanca
Universidas de Guanajuato

Licenciatura en Ingeniería de Datos e Inteligencia Artificial

17 de febrero de 2025

Multi-Objective Optimization Problem

$$\min_{\mathbf{x}} \quad \mathcal{F}(\mathbf{x}),$$

where
- $\mathcal{F} = [f_1(\mathbf{x}), \ldots, f_m(\mathbf{x})]^T \in \mathbb{R}^m$, is the set of m objective functions.
- $\mathbf{x} \in \Omega \in \mathbb{R}^n$ and $x_i^{min} \leq x_i \leq x_i^{max} \ \forall i = 1, \ldots, n$ are the n optimization variables.

Pareto Concepts

Weak Pareto Dominance.

A solution $\mathbf{x}_1$ weakly dominates $\mathbf{x}_2$, $\mathbf{x}_1 \prec \mathbf{x}_2$, if

$$f_i(\mathbf{x}_1) \leq f_i(\mathbf{x}_2) \quad \forall i = 1, \ldots, m;$$

and

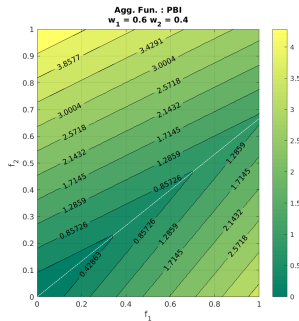$$\exists j : f_j(\mathbf{x}_1) < f_j(\mathbf{x}_2) \quad \forall j = 1, \ldots, m;$$

when one or more of these relations are not satisfied, $\mathbf{x}_1$ does not dominate $\mathbf{x}_2$, $\mathbf{x}_1 \nprec \mathbf{x}_2$.

- *Pareto optimality:* $\mathbf{x}^*$ is a Pareto optimum if $\nexists \mathbf{x} \in \mathbf{X} : \mathbf{x} \prec \mathbf{x}^*$.
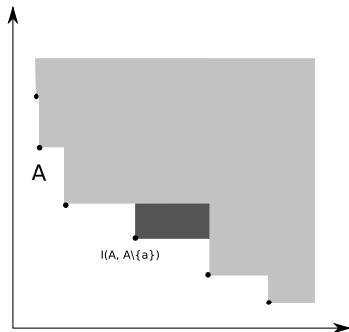
Dominance Measures

Aggregation Functions

$$g(\mathcal{F}(\mathbf{x})|\lambda) : \mathbb{R}^m \to \mathbb{R};$$

Indicator Functions

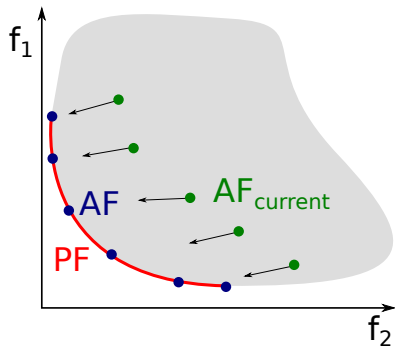$$I(\mathbf{A}, \mathbf{A} \setminus \{\mathbf{a}\}) : \mathbb{R}^n \to \mathbb{R};$$
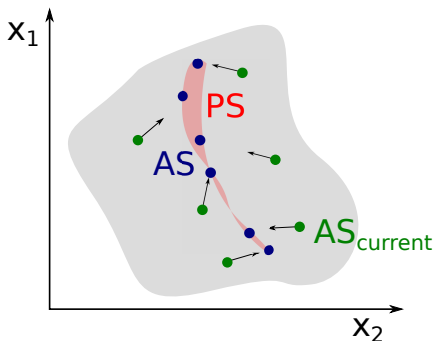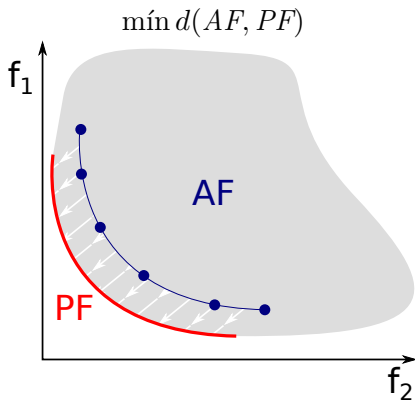
MOP Solution

- The set of all Pareto optima is the *Pareto Set (PS)*. The image of the corresponding PS is the *Pareto Front (PF)*.
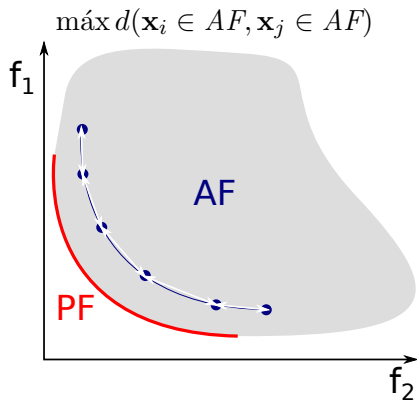
Optimization Objective:

Compute a finite set of Pareto optima solution, *Approximation Set (AS). Approximation Front (AF)* is its corresponding image.
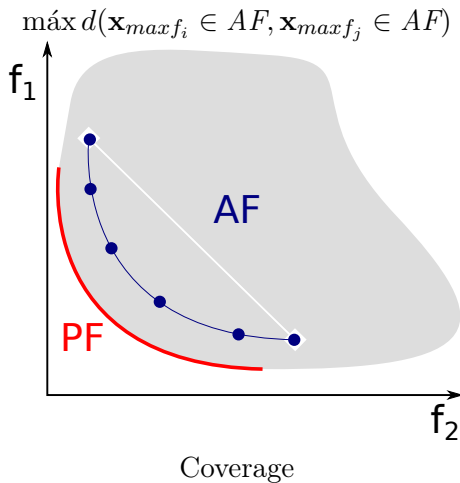
$$\text{mín}\, d(AF, PF)$$

Convergence

$$\text{máx}\, d(\mathbf{x}_i \in AF, \mathbf{x}_j \in AF)$$

Distribution

$$\text{máx}\, d(\mathbf{x}_{max f_i} \in AF, \mathbf{x}_{max f_j} \in AF)$$

Coverage

PyQt5 GUI tutorial