Heuristic Optimization Algorithms Project

Converting REMARK's single-objective optimization algorithm to multi-objective

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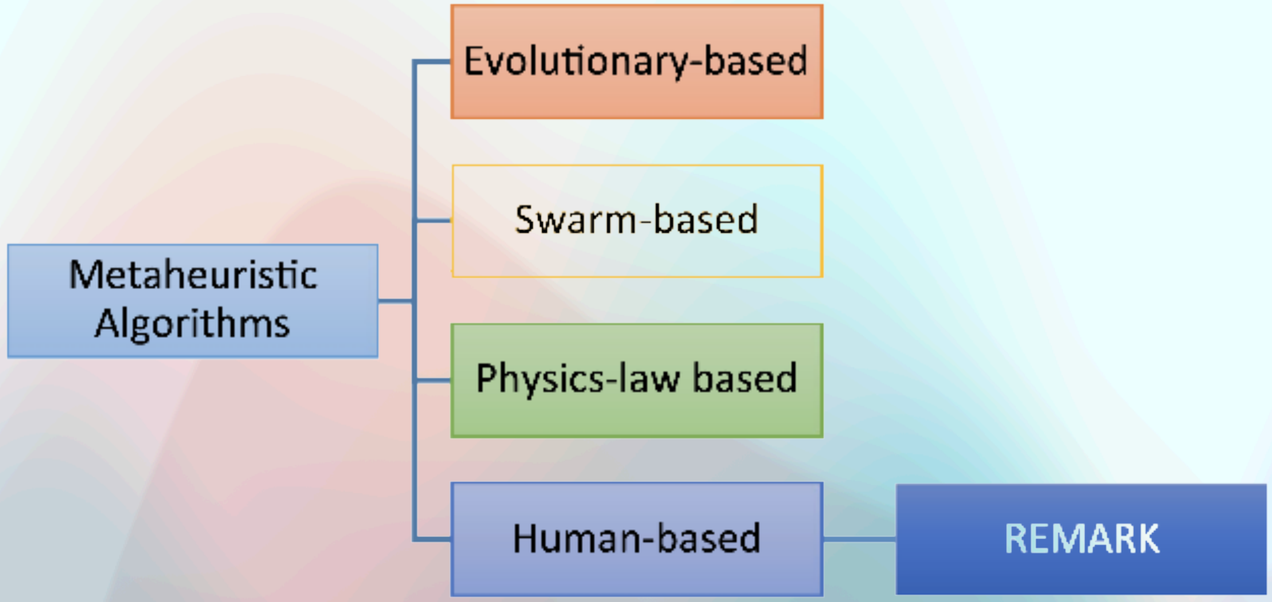
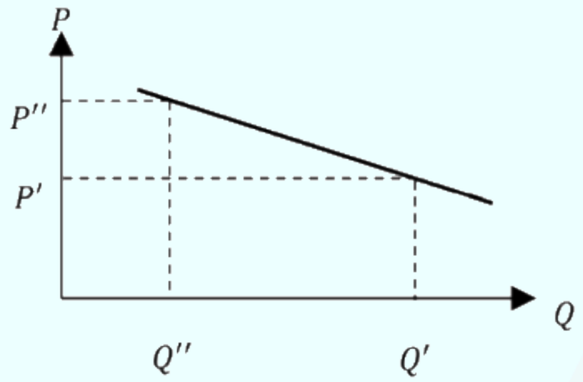
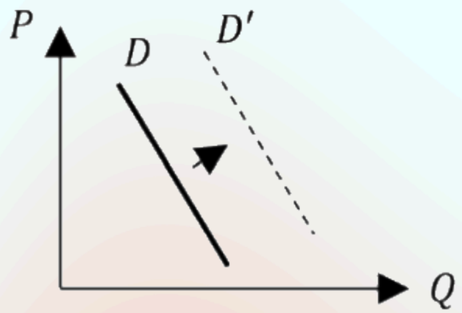
Metaheuristic Optimization Algorithm

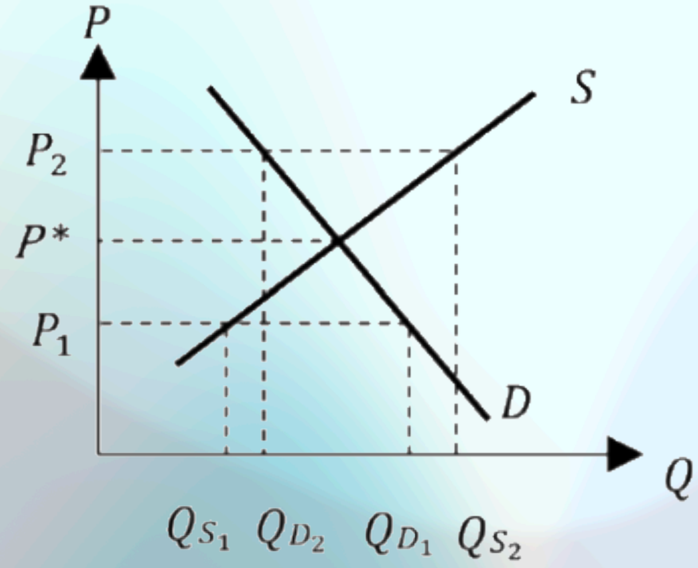


Real Estate Market-Based Optimization Algorithm

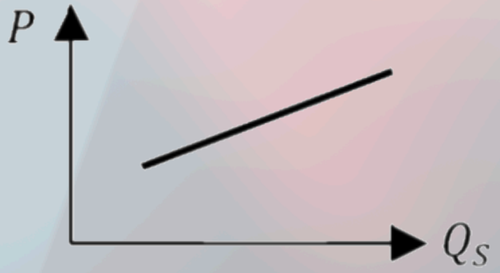
human based


P
P''
P'
Q
Q''
Q'


P
D
D'
Q


P
S
P2
P*
P1
D
Q
QS1
QD2
QD1
QS2


P
QS


P
QS

Demand Model

$$q_{D_{ix}} = \alpha - d_{D_{ix}}$$

$$Q_{D_x} = \frac{1}{\alpha n_D} \sum_{i=1}^{n_D} q_{D_{ix}}$$

Supply Model

$$q_{S_{ix}} = \alpha - d_{S_{ix}}$$

$$Q_{S_x} = \frac{1}{\alpha n_S} \sum_{i=1}^{n_S} q_{S_{ix}}$$

Price Adjustment

$$Pr_x^{new} = K_p \left(Q_{D_x} - Q_{S_x} \right) + Pr_x$$

$$\rho = Q_{D_x} - Q_{S_x}$$

Interactions

$$\beta_i(x) = \exp(-\frac{\overline{d_{D_{ix}}}^2}{2})$$

$$\overline{d_{D_{ix}}} = \sqrt{-2 \ln \beta_i(x)}$$

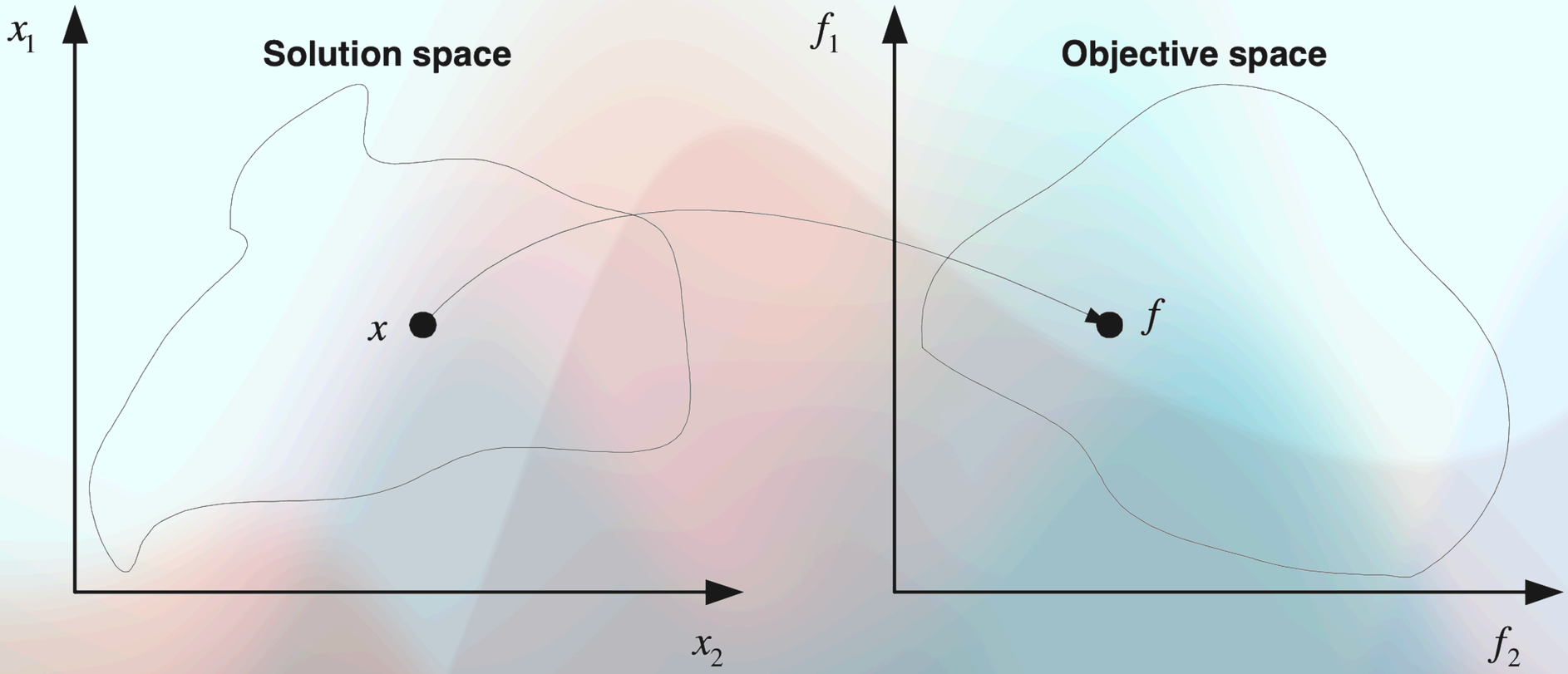
$$d_{D_{ix}}^{new} = K_{\sigma_D} \parallel \rho_x \parallel \overline{d_{D_{ix}}}$$

$$\pi_{ix} = q_{S_{ix}} Pr(Q_{S_x} - Q_{D_x}) - C_{ix}(q_{S_{ix}})$$

$$q_{S_{ix}}^* = \frac{1 - \overline{V}}{1 + K_{n_S} n_s}$$

$$d_{s_{ix}}^{new} = K_{\sigma_S} q_{S_{ix}}^*$$

Multi-Objective Optimization



Pareto Optimal

$$f_i(x) \leq f_i(x^*) \quad \forall i$$

Weak Pareto Optimality

$$f_i(x) < f_i(x^*) \quad \forall i$$

Dominated and Non-Dominated

$f_i \leq f_i^*$ $\forall i$ and $f_i < f_i^*$ for at least one i

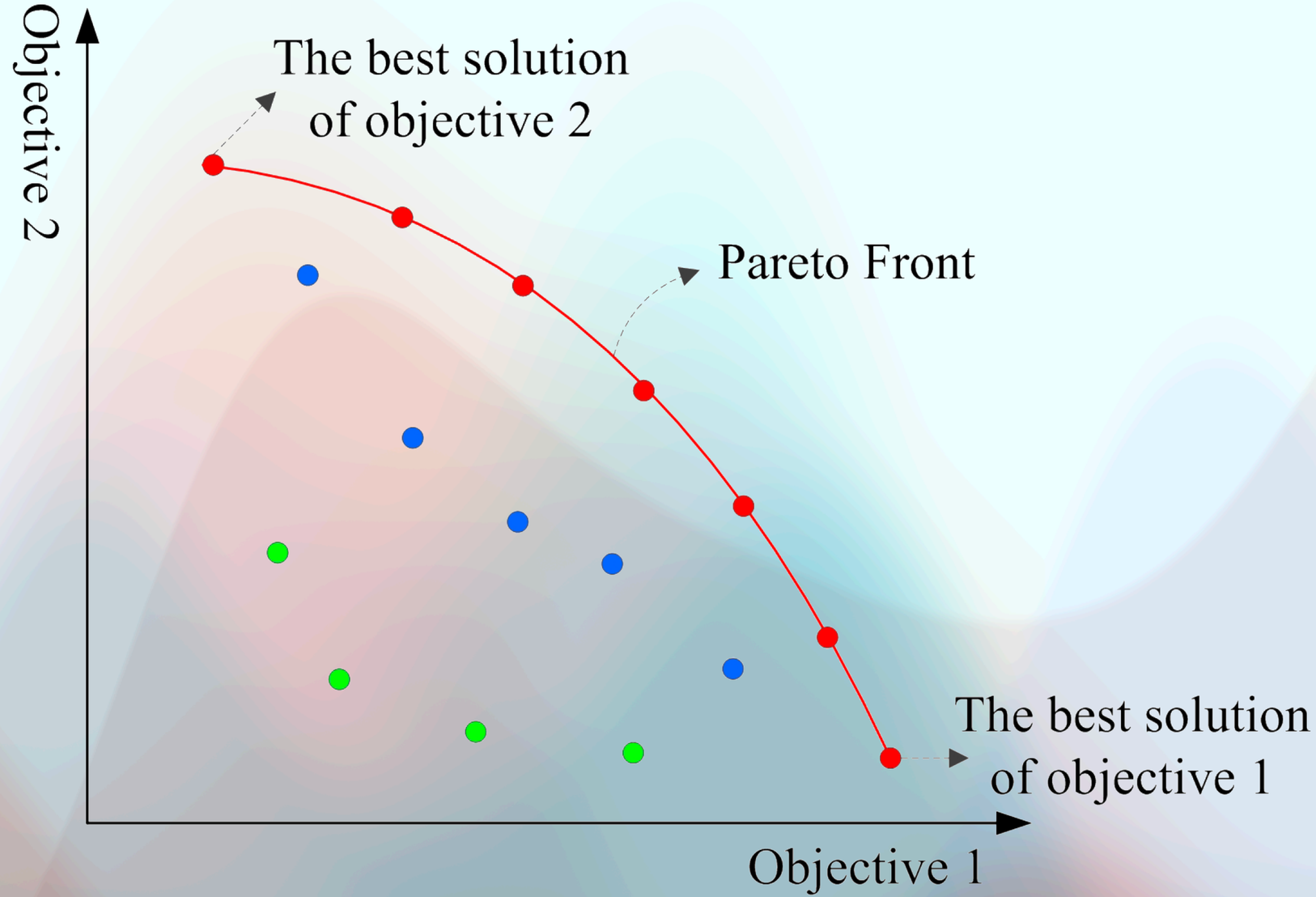
Difference

Market Model

Demand Model

Supply Model

Interaction Model



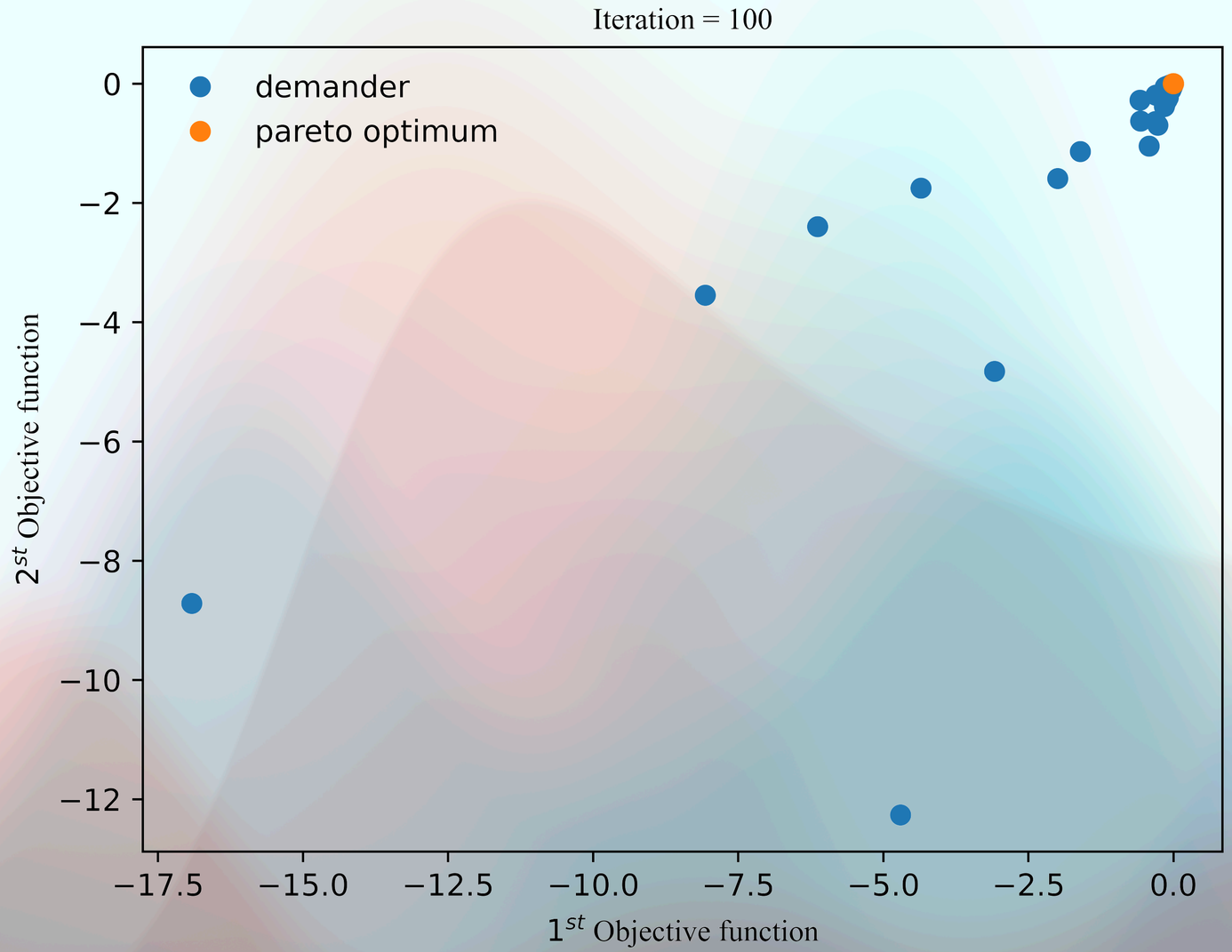
Results

Optimum point is equal to all objective function

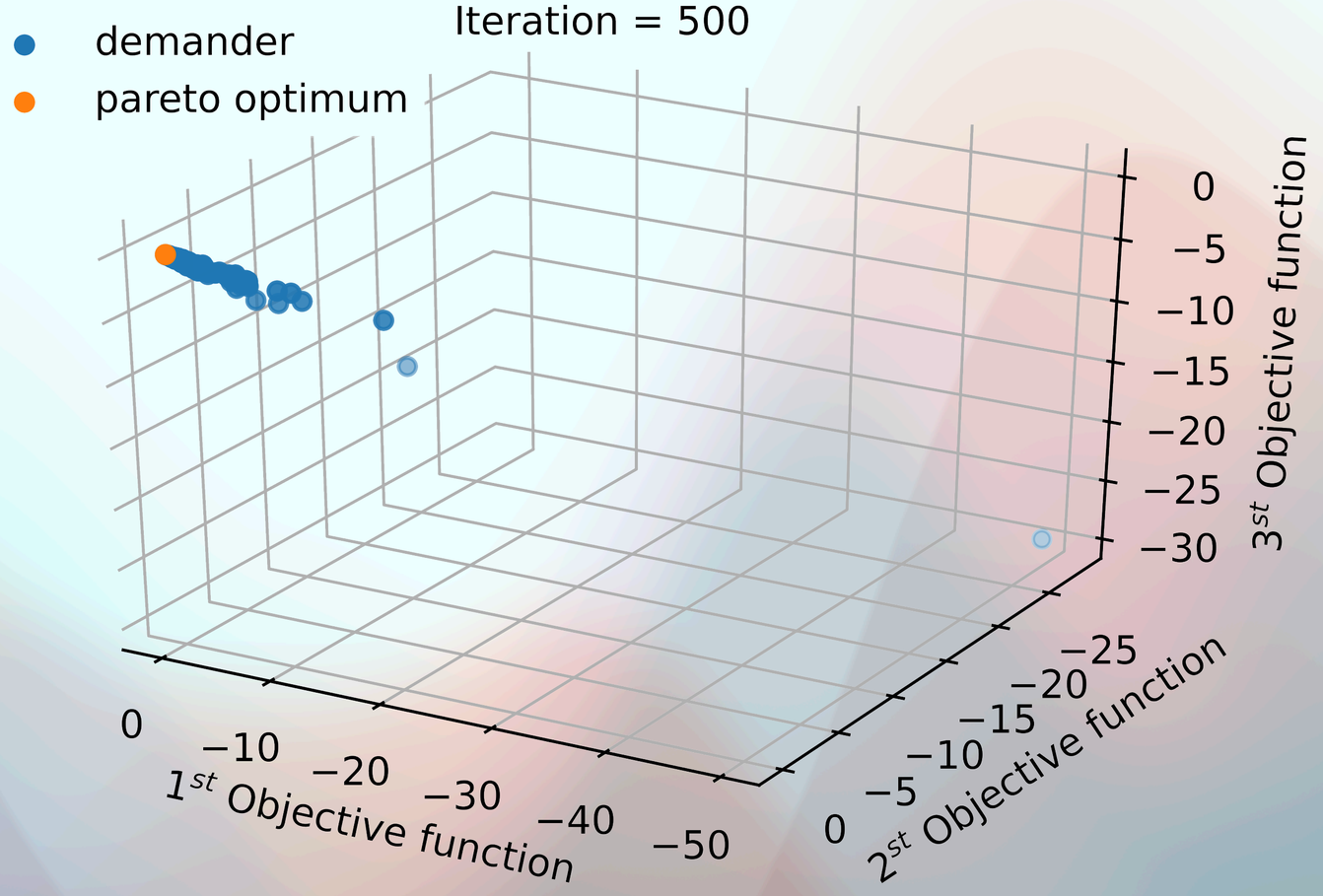
$$f = \begin{cases} \sum_{i=0}^{D} z_j^2 \\ \left(\sum_{i=1}^{D} \left(\sum_{j=1}^{i} z_j \right)^2 \right) (1 + 0.4 \parallel N(0,1)) \parallel) \end{cases}$$

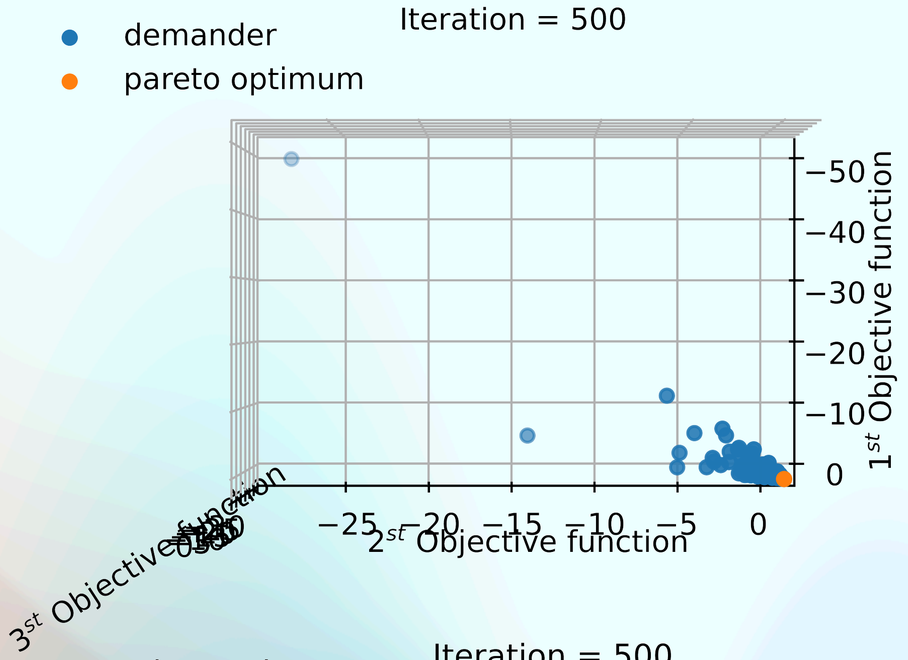
$$f = \begin{cases} \sum_{i=0}^{D} z_j^2 \\ \left(\sum_{i=1}^{D} \left(\sum_{j=1}^{i} z_j \right)^2 \right) \\ \left(\sum_{i=1}^{D} \left(\sum_{j=1}^{i} z_j \right)^2 \right) (1 + 0.4 \parallel N(0,1)) \parallel) \end{cases}$$

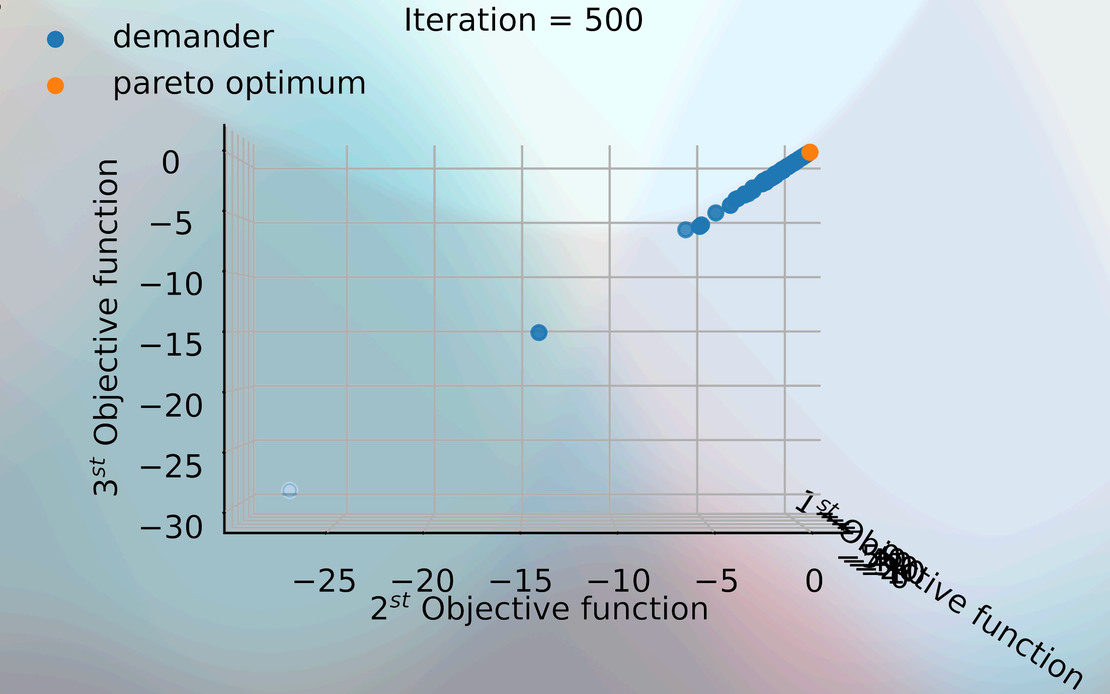
2D Results


Iteration = 100
demander
pareto optimum
0
−2
−4
−6
−8
−10
−12
−17.5
−15.0
−12.5
−10.0
−7.5
−5.0
−2.5
0.0
2st Objective function
1st Objective function

3D Results


demander
pareto optimum
Iteration = 500
0
−10
−20
−30
−40
−50
1st Objective function
0
−5
−10
−15
−20
−25
2st Objective function
0
−5
−10
−15
−20
−25
−30
3st Objective function


demander
pareto optimum
Iteration = 500
−25
−20
−15
−10
−5
0
2st Objective function
0
−10
−20
−30
−40
−50
1st Objective function


demander
pareto optimum
Iteration = 500
0
−5
−10
−15
−20
−25
−30
3st Objective function
−25
−20
−15
−10
−5
0
2st Objective function

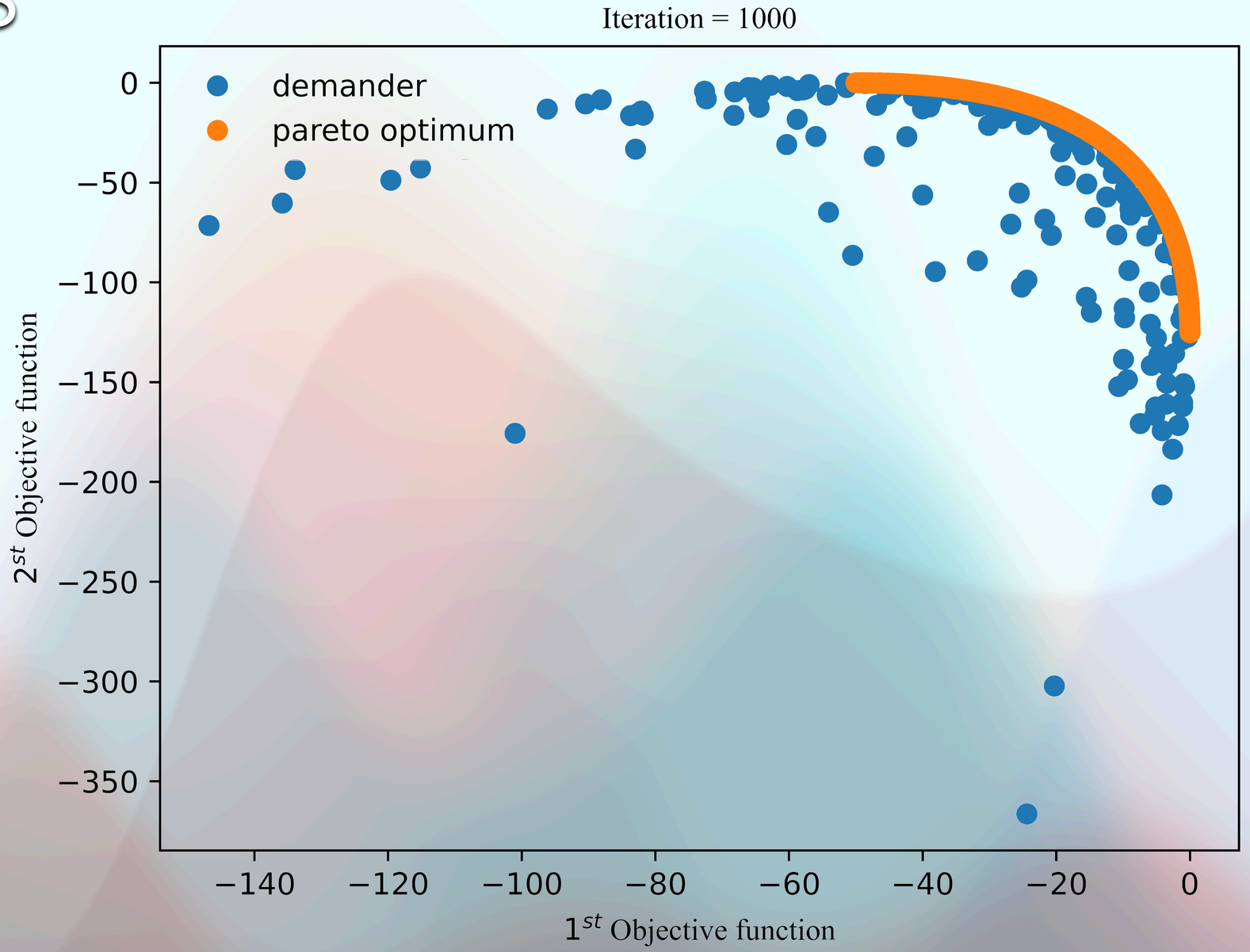
Results

Optimum point is not equal to all objective function

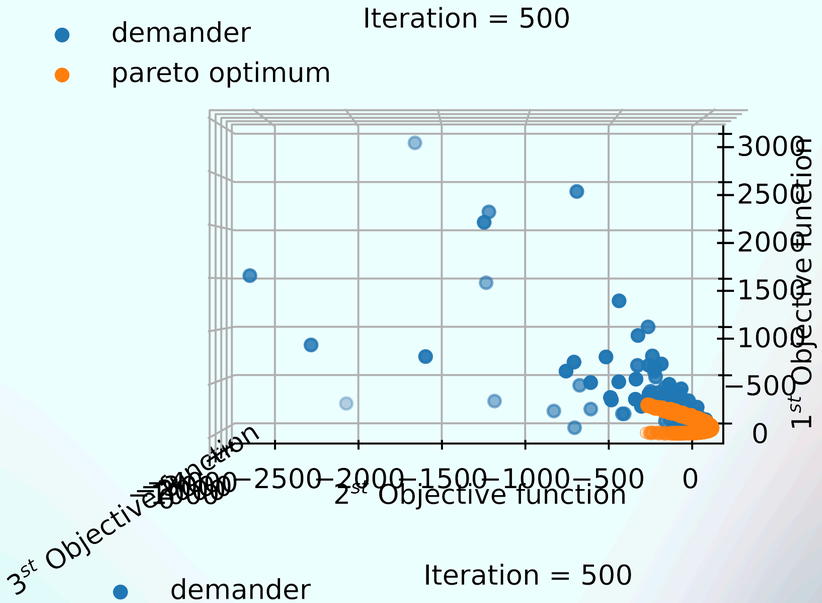
$$f = \begin{cases} \sum_{i=0}^{D} (z_j - 5)^2 \\ \left(\sum_{i=1}^{D} \left(\sum_{j=1}^{i} z_j \right)^2 \right) \end{cases}$$

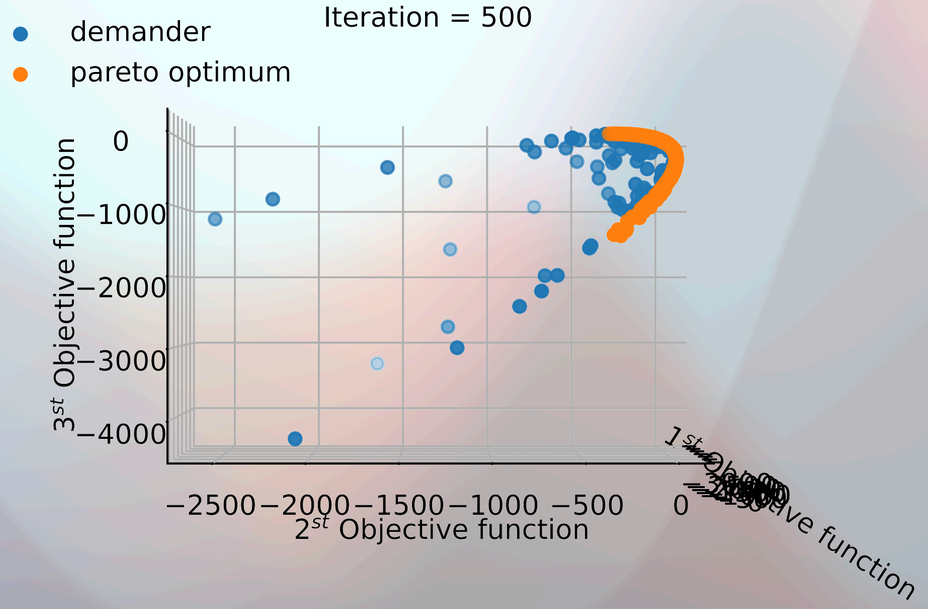
$$f = \begin{cases} \sum_{i=0}^{D} (z_j - 5)^2 \\ \left(\sum_{i=1}^{D} \left(\sum_{j=1}^{i} z_j \right)^2 \right) \\ \left(\sum_{i=1}^{D} \left(\sum_{j=1}^{i} (z_j + 5) \right)^2 \right) (1 + 0.4 \parallel N(0,1)) \parallel) \end{cases}$$

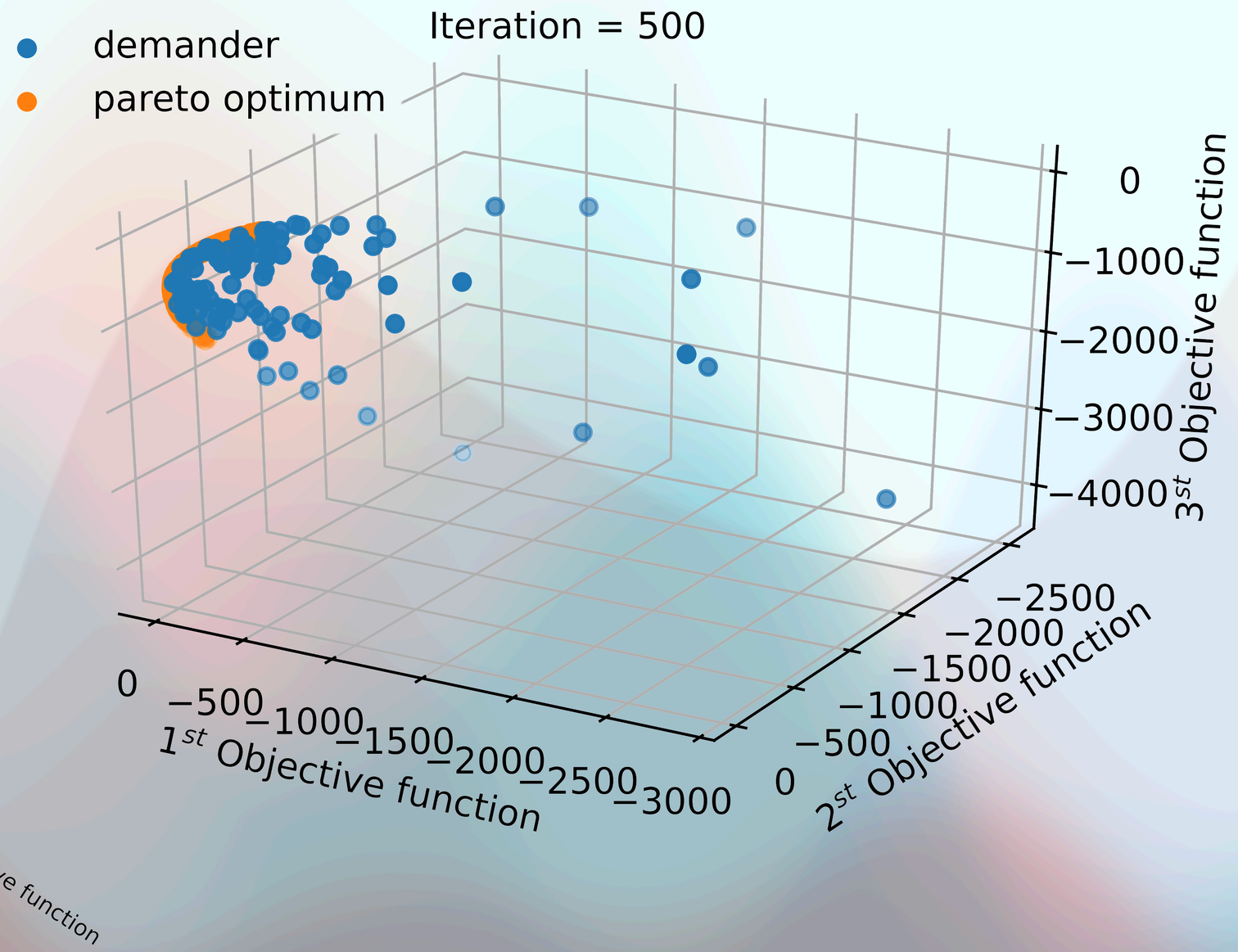
2D Results


Iteration = 1000
demander
pareto optimum
0
−50
−100
−150
−200
−250
−300
−350
2st Objective function
−140
−120
−100
−80
−60
−40
−20
0
1st Objective function

3D Results


demander
pareto optimum
Iteration = 500
3000
2500
2000
1500
1000
500
0
1st Objective function
−2500 −2000 −1500 −1000 −500 0
2st Objective function


demander
pareto optimum
Iteration = 500
0
−1000
−2000
−3000
−4000
3st Objective function
−2500 −2000 −1500 −1000 −500 0
2st Objective function


demander
pareto optimum
Iteration = 500
0
−500
−1000
−1500
−2000
−2500
−3000
1st Objective function
0
−1000
−2000
−3000
−4000
3st Objective function
0
−500
−1000
−1500
−2000
−2500
2st Objective function

GitHub

GitLab

AUTHORISED RESELLER

https://github.com/alibaniasad1999/Heuristic-optimization-algorithms

Thank You For Your Attention