

Evolutionary Strategies

Solution 1: CMA-ES

Pick $\mu = 3$ parents with highest fitness values, i.e., $\text{Id} = 1, 2, 5$ which we denote with $\mathbf{x}_{1:\mu}$ and respective weights $w_i = \frac{f_i}{\sum_{i=1}^{\mu} f_i} \approx (0.432, 0.265, 0.303)$.

$$\mathbf{m}^{[1]} = \mathbf{m}^{[0]} + 0.5 \sum_{i=1}^3 w_i (\mathbf{x}_i - \mathbf{m}^{[0]}) \approx (1.05, 0.84)^{\top}$$

$$\begin{aligned} \mathbf{C}_{\mu} &= \frac{1}{3-1} \sum_{i=1}^3 (\mathbf{x}_i - \mathbf{m}^{[0]})(\mathbf{x}_i - \mathbf{m}^{[0]})^{\top} \\ &\approx \begin{pmatrix} 0.187 & -0.617 \\ -0.617 & 2.139 \end{pmatrix} \end{aligned}$$

$$\begin{aligned} \mathbf{C}^{[1]} &= 0.9 \cdot \mathbf{I}_3 + 0.1 \cdot \mathbf{C}_{\mu} \\ &\approx \begin{pmatrix} 0.919 & -0.062 \\ -0.062 & 1.114 \end{pmatrix} \end{aligned}$$