

Single arithmetic Crossover

- Parents: $(x_1 \dots x_n)$ and $(y_1 \dots y_n)$
- Select a single gene (k) at random
- children are created

$$\text{child1: } x_1 \dots x_{k-1}, \alpha \cdot y_k + (1-\alpha) x_k, \dots x_n$$

$$\text{child2: } y_1 \dots y_{k-1}, \alpha \cdot x_k + (1-\alpha) y_k, \dots y_n$$

Example:

$$\begin{array}{l} \text{Parents} \left[\begin{array}{l} X: 0.5 \quad 0.7 \quad 0.7 \quad 0.5 \\ Y: 0.1 \quad 0.3 \quad 0.1 \quad 0.3 \end{array} \right. \end{array}$$

$$\text{children} \left[\begin{array}{l} c1: 0.5 \quad 0.7 \quad 0.7 \quad 0.5 \\ c2: 0.1 \quad 0.3 \quad 0.1 \quad 0.3 \end{array} \right.$$

$k=6$ $\alpha=0.5$

x_k	0.3	0.9	0.4
y_k	0.5	0.1	0.2

Calculation for child 1: $0.5 \cdot 0.8 + 0.5 \cdot 0.2 = 0.5$

Calculation for child 2: $0.5 \cdot 0.8 + 0.5 \cdot 0.2 = 0.5$

Whole arithmetic Crossover

- Most commonly used
- Parents: $x_1 \dots x_n$
 $y_1 \dots y_n$

- Children are created

$$\text{child1: } \alpha \cdot \bar{x} + (1-\alpha) \bar{y}$$

$$\text{child2: } \alpha \cdot \bar{y} + (1-\alpha) \bar{x}$$

For example:

Simple arithmetic Crossover

- Parents: $x_1 \dots x_n$
 $y_1 \dots y_n$
- Pick random gene k after this point mix values
- children are created

child1:

$$x_1 \dots x_k, \alpha y_{k+1} + (1-\alpha) x_{k+1}, \dots, \alpha y_n + (1-\alpha) x_n$$

child2:

$$y_1 \dots y_k, \alpha x_{k+1} + (1-\alpha) y_{k+1}, \dots, \alpha x_n + (1-\alpha) y_n$$