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Introduction to Artificial Intelligence with Python

Optimization

Linear Programming

Linear Programming

- Minimize a cost function $c_1x_1 + c_2x_2 + \ldots + c_nx_n$
- With constraints of form $a_1x_1 + a_2x_2 + \ldots + a_nx_n \leq b$ or of form $a_1x_1 + a_2x_2 + \ldots + a_nx_n = b$
- With bounds for each variable $l_i \leq x_i \leq u_i$

Linear Programming Example

- Two machines X_1 and X_2. X_1 costs $50/hour to run, X_2 costs $80/hour to run. Goal is to minimize cost.
- X_1 requires 5 units of labor per hour. X_2 requires 2 units of labor per hour. Total of 20 units of labor to spend.
- X_1 produces 10 units of output per hour. X_2 produces 12 units of output per hour. Company needs 90 units of output.

Linear Programming Example

Cost Function: $50x_1 + 80x_2$

- X_1 requires 5 units of labor per hour. X_2 requires 2 units of labor per hour. Total of 20 units of labor to spend.
- X_1 produces 10 units of output per hour. X_2 produces 12 units of output per hour. Company needs 90 units of output.

Linear Programming Example

Cost Function: $50x_1 + 80x_2$

Constraint: $5x_1 + 2x_2 \leq 20$

- X_1 produces 10 units of output per hour. X_2 produces 12 units of output per hour. Company needs 90 units of output.

Linear Programming Example

Cost Function: $50x_1 + 80x_2$

Constraint: $5x_1 + 2x_2 \leq 20$

Constraint: $10x_1 + 12x_2 \geq 90$

Linear Programming Example

Cost Function: $50x_1 + 80x_2$

Constraint: $5x_1 + 2x_2 \leq 20$

Constraint: $(-10x_1) + (-12x_2) \leq -90$

Linear Programming Algorithms

- Simplex
- Interior-Point

Optimization

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