

Optimization Techniques

Laboratory 11

Integer and dynamic programming

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Integer Programming

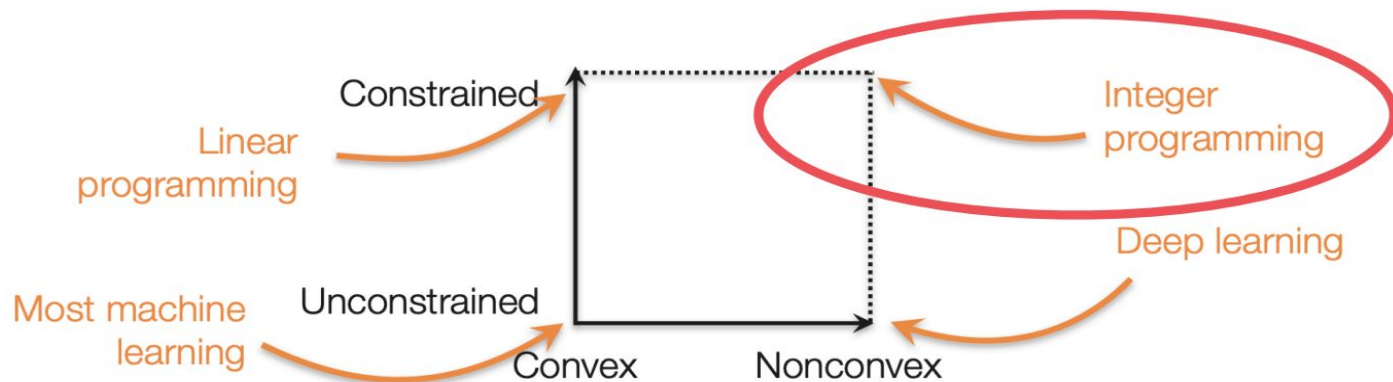
Linear programming with integer-only solutions

non-convex

can be solved using exhaustive search

branch-and-bound

$$\begin{aligned} & \underset{x}{\text{minimize}} && c^T x \\ & \text{subject to} && Gx \leq h \\ & && x \in \mathbb{Z}^n \text{ (integers)} \end{aligned}$$



Integer Programming

Branch-and-Bound

Function: Solve-Relaxation(\mathcal{C}):

- Solve linear program plus additional constraints in \mathcal{C}
- Return (objective value f^* , solution x^* , and constraint set \mathcal{C})

Algorithm: Branch-and-Bound

- Push Solve-Relaxation($\{\}$) on to frontier set
- Repeat while frontier is not empty:
 1. Get lowest cost solution from frontier: (f, x, \mathcal{C})
 2. If x is integer valued, return x
 3. Else, choose some x_i not integer valued and add
Solve-Relaxation($\mathcal{C} \cup \{x_i = 0\}$), Solve-Relaxation($\mathcal{C} \cup \{x_i = 1\}$),
to the frontier

Dynamic Programming

1. **define sub-problems**
2. **relate them (i.e. order)**
3. **solve the base problem**
4. **solve each sub-problem using the solution of the already solved ones**

