

Optimization: Basic Ideas

Problem Definition: Three basic steps

1. Definition of *optimization variables*: $x \in R^n$
2. Definition of a cost or many *cost functions*: minimize $f(x)$
3. Constraints - *equalities* and/or *inequalities*: $h_i(x) = 0$; $g_j(x) \leq 0$

Notes: Constraints and variables should be *normalized* for better computational performance. Functions $f(x)$, $h_i(x)$, and $g_j(x)$ could be *explicit* in terms of variables x , or *implicitly* depend on x .

Computational Algorithm: $x^{(k+1)} = x^{(k)} + \alpha_k d^{(k)}$; $k = 0, 1, 2, \dots$

Two subproblems need to be solved:

1. Search direction $d^{(k)}$ determination: *needs functions and gradients.*
2. Step size α_k calculation in the direction $d^{(k)}$: *needs function values.*

