

Algorithms	Pros	Cons	Convergence
Gradient methods (Steepest descent)	(1) Simple and reliable (2) Basis of many iterative algorithms	Slow convergence	Order 1 in worst case
Newton' s method	Fast if works	(1) High complexity (need to calculate the Hessian and its inverse) (2) Hessian may not be invertible (3) Algorithm may not converge	Order of convergence is at least 2 For quadratics, it is \infty
Conjugate direction methods	(1) Much higher efficiency than the Steepest descent (2) Much lower complexity than the Newton' s method (no Hessian computation) (3) Optimality in all intermediate steps	For general nonlinear problems, the generated search directions may not be Q-conjugate after several iterations	Higher than Steepest, lower than the Newton' s method For quadratics, solves the problem in n steps
Quasi-Newton method	(1) Fast convergence like the Newton' s method (2) Lower computation complexity than the Newton' s method (3) One of the most efficient method for solving nonlinear optimization problems	May need to reinitialize the search direction after several iterations	Similar to the Newton' s method