Lagrangian Transformation. Bregman's Distance. Dikin's Ellipsoids.

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Abstract

A class of $\psi \in \Psi$ monotone increasing, strictly concave and smooth functions with particular properties is used to transform terms of the Classical Lagrangian, which correspond to the constraint.

The Lagrangian Transformation (LT) is scaled by a positive scaling parameter.

The **Exterior Points** LT multipliers method at each step finds the primal LT minimizer following by the Lagrange Multipliers update while the scaling parameter can be fixed or updated at each step.

The LT method is equivalent to an **Interior-Prox** methods with **Bregman's** or **Bregman's type** distance function for the dual problem.

The kernel of the distance is $\varphi = -\psi^*$. The dual prox is equivalent to the **Interior Ellipsoid (IE)** Method for the dual problem- the main ingredient of the convergence analysis.

In case of MBF transformation both $-\psi$ and φ are **self -concordant** functions and the correspondent IE is **Dikin's ellipsoid.**

Application of LT method for LP leads to **I.Dikin's (1967) type affine scaling** method- one of the main building blocks of the **Interior Point Methods**.

Thus, seemingly unconnected **Exterior** and **Interior Point Methods** turned out to be **intimately** connected.