SOLVING CONVEX NONDIFFERENTIABLE OPTIMIZATION PROBLEMS USING THE METHOD OF SIMPLEX IMBEDDINGS

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In this paper we consider the problem

$$\begin{gathered} f_0(x) \to \min, \\ x \in X = \{x : f_i(x) \le 0,\ i = 1, 2, ..., m\}. \end{gathered} \tag{1}$$

where f_0 – convex function, which can be nonsmooth, $f_i(x)$, $i = 1, 2, ..., m$ – convex functions, $x \in R^n$, $X \neq \emptyset$ – feasible set. We apply the method of simplex imbeddings [1] for solving the problem (1) and describe the scheme of this method in the next manner. Let simplex S_0 be given and $x^* \in S_0$ – one of the solution of the problem (1). We find the center of simplex $x^{c,0}$, then draw the cutting plane L through the point $x^{c,0}$. Note, that L has the form: $L = \left\{x : g^T (x - x^c) = 0\right\}$, where $g \in R^n$ – subgradient of the function f in the point x^c. The part of the simplex, containing the point x^*, is imbedded into new simplex with the minimal volume. Then we find the point $x^{c,1}$ and repeat the procedure until we obtain quite small volume simplex.

One of the important theoretical result, described in [1], is the estimation of simplex volumes reduction:

$$\frac{V(S^l)}{V(S^{l-1})} = \begin{cases} \frac{1}{2}, \quad k_l = 1, \\ \left(\frac{k_l}{k_l+1}\right)^k_l \left(\frac{k_l}{k_l-1}\right)^{l_l-1}, \quad 2 \le k_l \le n, \end{cases}$$

where $V(S^l)$ – the volume of the simplex at the iteration l, and k_l – number of saved vertexes of simplex. It is obvious that the value of volume reduction depend on the number of cut vertexes. We suggest the modification of the method based on this estimation. This modification construct cutting plane, which cut as much vertexes of simplex as possible that accelerate the convergence of the method.

REFERENCES

1. E.G. Antsiferov, V.P. Bulatov *An algorithm of simplex imbeddings in convex programming.* Computational Mathematics and Mathematical Physics. Vol. 27, iss. 2, 1987, pp. 36–41.