Dedicated to Professor Yeol Je Cho on the occasion of his retirement

# Subgradient algorithm for split hierarchical optimization problems

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## ABSTRACT.

In this paper we emphasize a split type problem of some integrating ideas of the split feasibility problem and the hierarchical optimization problem. Working on real Hilbert spaces, we propose a subgradient algorithm for approximating a solution of the introduced problem. We discuss its convergence results and present a numerical example.

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### REFERENCES

- Ansari, Q. H., Nimana, N. and Petrot, N., Split hierarchical variational inequality problems and related problems, Fixed Point Theory Appl., 2014, 2014:208, 14 pp.
- [2] Attouch, H., Czarnecki, M.-O. and Peypouquet, J., Coupling forward-backward with penalty schemes and parallel splitting for constrained variational inequalities, SIAM J. Optim., 21 (2011), No. 4, 1251–1274
- [3] Bagirov, A., Karmitsa, N. and Mäkelä, M. M., Introduction to Nonsmooth Optimization: Theory, Practice and Software, Springer, New York, 2014
- [4] Byrne, C., Iterative oblique projection onto convex sets and the split feasibility problem, Inverse Probl., 18 (2002), 441–453
- [5] Cegielski, A., Iterative Methods for Fixed Point Problems in Hilbert Spaces, Lecture Notes in Math., vol. 2057, Springer, Heidelberg, 2012.
- [6] Censor, Y. and Elfving, T., A multiprojection algorithm using Bregman projections in product space, Numer. Algor., 8 (1994), 221–239
- [7] Censor, Y., Gibali, A. and Reich, S., Algorithms for the split variational inequality problem, Numer. Algor., 59 (2012), 301–323
- [8] Censor, Y. and Segal, A., The split common fixed point problems for directed operators, J. Convex Anal., 16 (2009), 587–600
- [9] Chang, S.-S., Kim, J. K., Cho, Y. J. and Sim, J. Y., Weak-and strong-convergence theorems of solutions to split feasibility problem for nonspreading type mapping in Hilbert spaces, Fixed Point Theory Appl., 2014, 2014:11, 12 pp.
- [10] Combettes, P. L., Quasi-Fejerian analysis of some optimization algorithms. In: Inherently Parallel Algorithm for Feasibility and Optimization (D. Butnariu, Y. Censor, S. Reich, Eds.), Elsevier, New York, 2001, pp. 115–152
- [11] Combettes, P. L. and Pesquet, J. C., Proximal splitting methods in signal processing. In: *Fixed-Point Algorithms for Inverse Problems in Science and Engineering* (H.H. Bauschke, R. S. Burachik, P. L. Combettes, V. Elser, D. R. Luke, H. Wolkowicz, Eds.), Springer Optimization and Its Applications vol. 49, New York, 2011, pp. 185–212
- [12] Iiduka, H., Fixed point optimization algorithm and its application to power control in CDMA data networks, Math. Program., 133 (2012), 227–242

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- [13] Iiduka, H., Fixed point optimization algorithm and its application to network bandwidth allocation, J. Comput. and Appl. Math., 236 (2012), 1733–1742
- [14] Suantai, S., Cholamjiak, P., Cho Y. J. and Cholamjiak, W., On solving split equilibrium problems and fixed point problems of nonspreading multi-valued mappings in Hilbert spaces, Fixed Point Theory Appl., 2016, No. 35, 16 pp.
- [15] Yao, Y., Yao, Z., Abdou, A. and Cho, Y. J., Self-adaptive algorithms for proximal split feasibility problems and strong convergence analysis, Fixed Point Theory Appl., 2015, 2015:205, 13 pp.
- [16] Zălinescu, C., Convex Analysis in General Vector Spaces, World Scientific, Singapore, 2002

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