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ALGORITHMS FOR SPLIT COMMON NULL POINT PROBLEM WITHOUT PRE–EXISTING ESTIMATION OF OPERATOR NORM

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Abstract. The purpose of this paper is to present iterative methods to solve a split common null point problem in real Hilbert spaces such that the implementation of proposed iterative schemes do not require any pre-existing estimation of the norm of bounded linear operator. We give the weak and strong convergence of the proposed algorithms under some mild and standard assumptions in Hilbert spaces. A numerical example is also constructed to illustrate the algorithm for strong convergence.

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REFERENCES

[1] C. BYRNE, Y. CENSOR, A. GIBALI AND S. REICH, *Weak and strong convergence of algorithms for split common null point problem*, J. Nonlinear Convex Anal. **13**, 759–775, 2012.
[2] H. H. BAUSCHKE AND J. M. BORWEIN, *On projection algorithm for solving convex feasibility problems*, SIAM Rev. **38**, 367–426, 1996.
[3] Y. CENSOR AND T. ELFVING, *A multiprojection algorithm using Bregman projections in a product space*, Numer Algor. **8 (2)**, 221–239, 1994.
[4] Y. CENSOR, A. GIBALI AND S. REICH, *The split variational inequality problem*, The Technion Institute of Technology, Haifa, `arXive:1009.3780`, 2010.
[5] Y. CENSOR, A. GIBALI AND S. REICH, *Algorithms for the split variational inequality problem*, Numer Algor. **59**, 301–323, 2012.
[6] Y. CENSOR, T. BORTFELD, B. MARTIN AND A. TROFIMOV, *A unified approach for inversion problems in intensity-modulated radiation therapy*, Phys. Med. Biol. **51**, 2353–2365, 2006.
[7] Y. CENSOR, T. ELFVING, N. KOPF AND T. BORTFELD, *The multiple-sets split feasibility problem and its applications for inverse problems*, Inverse Probl. **21**, 2071–2084, 2005.
[8] M. DILSHAD AND M. AKRAM, *Split hierarchical monotone variational inclusion problem involving finite families of firmly nonexpansive mappings*, J. Math. Anal., **8** (3), 148–156, 2017.
[9] A. GIBALI, K.-H. KÜFER AND P. SÜSS, *Reformulating the Pascoletti-Serafini problem as a bi-level optimization problem*, Contemp. Math. **636**, 121–129, 2015.
[10] K. R. KAZMI AND, S. H. RIZVI, *An iterative method for split variational inclusion problem and fixed point problem for a nonexpansive mapping*, Optim. Lett. **8** (3), 1113–1124, 2014.
[11] K. R. KAZMI, R. ALI AND M. FURKAN, *Hybrid iterative method for split monotone variational inclusion problem and hierarchical fixed point problem for a finite family of nonexpansive mappings*, Numer Algor. **79 (2)**, 499–527, 2018.
[12] L. PANISA, K. ANCHALEE AND F. ALI, *Algorithms for the common solution of the split variational inequality problems and fixed point problems with applications*, J. Inequal. Appl. **2018 (1)**, `https://doi.org/10.1186/s13660-018-1942-1`.
[13] G. LOPOZ, V. MARTÍN-MÁRQUEZ, F. WANG AND H. K. XU, *Solving the split feasibility problem without knowledge of matrix norm*, Inverse Prob. 28:085004, 2012.
[14] A. MOUDAFI, *Split monotone variational inclusions*, J. Optim. Theory Appl. **150**, 275–283, 2011.

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[15] Z. OPIAL, *Weak covergence of the sequence of successive approximations of nonexpansive mappings*, Bull. Amer. Math. Soc. **73**, 591–597, 1976.

[16] Y. SHEHU AND F. U. OGBUISI, *An iterative method for solving split monotone variational inclusion and fixed point problems*, Rev. R. Acad. Cienc. Exactas F-is. Nat. Ser. A Math. **110 (2)**, 503–518, 2016.

[17] K. SIRIYAN AND K. ATID, *Algorithm method for solving the split general system of variational inequalities problem and fixed point problem of nonexpansive mapping with application*, Math. Meth. Appl. Sci. **41 (17)**, 2018, `https://doi.org/10.1002/mma.5240`.

[18] K. SITTHITHAKERNGKIET, J. DEEPHO, J. MARTINEZ-MORENO AND P. KUMAM, *Convergence analysis of a general iterative algorithm for finding a common solution of split variational inclusion and optimization problems*, Numer Algor. **79 (3)**, 801–824, 2018.

[19] Y. TANG AND Y. J. CHO, *Convergence theorems for common solutions of split variational inclusion and systems of equilibrium problems*, Mathematics **7 (3)**, 2019, `https://doi.org/10.3390/math7030255`.

[20] F. WANG, *A new iterative method for the split common fixed poin problem in Hilbert spaces*, Optim. **66**, 407–415, 2017.

[21] H. K. XU, *Iterative algorithms for nonlinear operators*, J. Lond. Math. Soc. **66**, 240–256, 2002.

[22] Y. TANG AND A. GIBALI, *New self-adaptive step size algorithms for solving split variational inclusion problems and its applications*, Numer Algor. 2019, `https://doi.org/10.1007/s11075-019-00683-0`.

[23] S. WANG, X. LIU AND Y. S. AN, *A new iterative algorithm for generalized split equilibrium in Hilbert spaces*, Nonlinear Func. Anal. Appl. **22 (4)** 911–924, 2017.

[24] M. YUKAWA, K. SLAVAKIS AND I. YAMADA, *Learning based on splitting and adaptive projection subgradient method*, IEICE Trans. Fund. E98-A(2), 456–466, 2010.

[25] C. ZHANG AND Z. XU, *Explicit iterative algorithm for solving split variational inclusion and a fixed point problem for the infinite family of nonexpansive operators*, Nonlinear Func. Anal. Appl. **21 (4)** 669–683, 2016.