CARPATHIAN J. MATH. 35 (2019), No. 3, 371 - 378
Online version available at http://carpathian.ubm.ro
Print Edition: ISSN 1584 - 2851 Online Edition: ISSN 1843 - 4401

Dedicated to Prof. Qamrul Hasan Ansari on the occasion of his 60^{th} anniversary

Numerical experiments on stochastic block proximal-gradient type method for convex constrained optimization involving coordinatewise separable problems

PORNTIP PROMSINCHAI[1] and NARIN PETROT[1,2]

ABSTRACT.

In this paper, we consider convex constrained optimization problems with composite objective functions over the set of a minimizer of another function. The main aim is to test numerically a new algorithm, namely a stochastic block coordinate proximal-gradient algorithm with penalization, by comparing both the number of iterations and CPU times between this introduced algorithm and the other well-known types of block coordinate descent algorithm for finding solutions of the randomly generated optimization problems with a ℓ_1-regularization term.

Acknowledgements. P. Promsinchai is supported by the Thailand Research Fund through the Royal Golden Jubilee Ph.D. Program (Grant No. PHD/0023/2555) and Naresuan University.

REFERENCES

[1] Ansari, Q. H., Ceng, L.-C. and Gupta, H. *Triple heirarchical variational inequalities, in Nonlinear Analysis: Approximation Theory, Optimization and Applications* , Edited by Q. H. Ansari, Springer, 2014
[2] Ansari, Q. H. and Rehan, A., *An iterative method for split hierarchical monotone variational inclusions*, Fixed Point Theory Appl., **2015**, 2015:121, 10 pp.
[3] Attouch, H. and Czarnecki, M.-O., *Asymptotic behavior of coupled dynamical systems with multiscale aspects*, J. Differ. Equ., **248** (2010), 1315–1344
[4] 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), 1251–1274
[5] Beck, A., *First-Order Methods in Optimization*, Society for Industrial and Applied Mathematics; Philadelphia: Mathematical Optimization Society, 2017
[6] Beck, A. and Tetruashvili, L., *On the convergence of block coordinate descent type methods*, SIAM J. Optim., **23** (2013), No. 4, 2037–2060
[7] Bertsekas, D. P., *Parallel and Distributed Computation: Numerical Methods. Athena Scientific*, Nashua, 2003
[8] Bertsekas, D. P., *Nonlinear Programming*, Athena Scientific, Nashua, 1999
[9] Candes, E., Romberg, J. and Tao, T., *Robust uncertainty principles: exact signal reconstruction from highly incomplete frequency information*, IEEE Trans. Inf. Theory, **52**, (2006), 489–509
[10] Chen, S., Donoho, D. and Saunders, M., *Atomic decomposition by basis pursuit*, SIAM Rev., **43** (2001), 129–159
[11] Combettes, P. L. and Pesquet J.-C., *Stochastic quasi-Fejér block-coordinate fixed point iterations with random sweeping*, SIAM J. Optimiz., **25** (2015), No. 2, 1221–1248
[12] Elad, M. and Aharon, M., *Image denoising via sparse and redundant representations over learned dictionaries*, IEEE Trans. Image Process., **15** (2006), No. 12, 3736–3745

Received: 08.06.2019; In revised form: 24.08.2019; Accepted: 01.09.2019
2010 *Mathematics Subject Classification.* 49M27, 90C25, 90C52, 65K05.
Key words and phrases. *constrained optimization problem, composite objective function, block coordinate descent, proximal-gradient algorithm* .
Corresponding author: Narin Petrot; narinp@nu.ac.th

[13] Necoara, I., *Random coordinate descent algorithms for multi-agent convex optimization over networks*, IEEE Trans. Autom. Control, **58** (2013), No. 7, 1–12
[14] Necoara, I. and Patrascu, A., *A random coordinate descent algorithm for optimization problems with composite objective function and linear coupled constraints*, Comp. Optimiz. Applicat., **57** (2014), No. 2, 307–337
[15] Nesterov, Y., *Efficiency of coordinate descent methods on huge-scale optimization problems*, SIAM J. Optim., **22**(2012), No. 2, 341–362
[16] Nimana, N. and Petrot, N., *Generalized forward-backward splitting with penalization for monotone inclusion problems*, J. Global Optim., **73** (2019), No. 4, 825–847
[17] Peypouquet, J., *Coupling the gradient method with a general exterior penalization scheme for convex minimization*, J. Optim. Theory Appl., **153** (2012), No. 1, 123–138
[18] Pique-Regi, R., Monso-Varona, J., Ortega, A., Seeger, R. C., Triche, T. J. and Asgharzadeh, S., *Sparse representation and bayesian detection of genome copy number alterations from microarray data*, Bioinformatics, **24** (2008), No. 3, 309–318
[19] Qin, Z., Scheinberg, K. and Goldfarb, D., *Efficient block-coordinate descent algorithms for the group Lasso*, Math. Prog. Comp., **5** (2013), No. 2, 143–169
[20] Richtárik, P. and Takáč, M., *Iteration complexity of randomized block-coordinate descent methods for minimizing a composite function*, Math. Program., Ser. A, **144** (2014), No. 1-2, 1–38
[21] Richtárik, P. and Takáč, M., *Parallel coordinate descent methods for big data optimization*, Technical report (2012), arXiv:1212.0873
[22] Saha, A. and Tewari, A., *On the finite time convergence of cyclic coordinate descent methods*, SIAM J. Optim., **23** (2013), No. 1, 576–601
[23] Tseng, P. and Yun, S., *A coordinate gradient descent method for linearly constrained smooth optimization and support vector machines training*, Comput. Optim. Appl., **47** (2010), 179–206
[24] Tseng, P. and Yun, S., *A block-coordinate gradient descent method for linearly constrained nonsmooth separable optimization*, J. Optim. Theory Appl., **140** (2009), 513–535
[25] Wright, J., Ma, Y., Mairal, J., Sapiro, G., Huang, T. S., and Yan, S., *Sparse representation for computer vision and pattern recognition*, Proceedings of the IEEE, **98** (2010), No. 6, 1031–1044
[26] Yang, M. and Zhang, L., *Gabor feature based sparse representation for face recognition with gabor occlusion dictionary*, In European conference on computer vision, pages 448–461, Springer, 2010

[1]Department of Mathematics
Naresuan University
Faculty of Science
Phitsanulok, 65000, Thailand
E-mail address: petoypsc@gmail.com
E-mail address: narinp@nu.ac.th

[2]Center of Excellence in Nonlinear Analysis and Optimizations
Faculty of Science
Phitsanulok, 65000, Thailand
E-mail address: narinp@nu.ac.th