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Stability of Stochastic Optimization Problems - Nonmeasurable Case

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Abstract: This paper deals with stability of stochastic optimization problems in a general setting. Objective function is defined on a metric space and depends on a probability measure which is unknown, but, estimated from empirical observations. We try to derive stability results without precise knowledge of problem structure and without measurability assumption. Moreover, ε-optimal solutions are considered.

The setup is illustrated on consistency of a ε-M-estimator in linear regression model.

Keywords: stability of stochastic optimization problem; weak convergence of probability measures; estimator consistency; metric spaces;

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References

[1] X. R. Chen and Y. H. Wu: Strong consistency of M-estimates in linear model. J. Multivariate Anal. 27 (1988), 1, 116–130.

[2] Y. Dodge and J. Jurečková: Adaptive Regression. Springer-Verlag, New York 2000.

[3] J. Dupačová: Stability and sensitivity analysis for stochastic programming. Ann. Oper. Res. 27 (1990), 115–142.

[4] J. Dupačová and R. J.-B. Wets: Asymptotic behavior of statistical estimators and of optimal solutions of stochastic problems. Ann. Statist. 16 (1988), 4, 1517–1549.

[5] J. Hoffmann-Jørgensen: Probability with a View Towards to Statistics I, II. Chapman and Hall, New York 1994.

[6] P. J. Huber: Robust Statistics. Wiley, New York 1981.

[7] J. Jurečková: Asymptotic representation of M-estimators of location. Math. Oper. Statist. Sec. Statist. 11 (1980), 1, 61–73.

[8] J. Jurečková: Representation of M-estimators with the second-order asymptotic distribution. Statist. Decision 3 (1985), 263–276.

[9] J. Jurečková and P. K. Sen: Robust Statistical Procedures. Wiley, New York 1996.

[10] A. J. King and T. Rockafellar: Asymptotic theory for solutions in statistical estimation and stochastic programming. Math. Oper. Res. 18 (1993), 148–162.

[11] J. L. Kelley: General Topology. D. van Nostrand, New York 1955.

[12] K. Knight: Limiting distributions for L_1-regression estimators under general conditions. Ann. Statist. 26 (1998), 2, 755–770.

[13] P. Lachout: Stochastic optimization sensitivity without measurability. In: Proc. 15th Internat. Conference on Mathematical Methods in Economics and Industry (K. Cechlárová, M. Halická, V. Borbeová, V. Lacko, eds.), Herany, Slovakia, June 2007, pp. 131–136.

[14] P. Lachout and E. Liebscher, and S. Vogel: Strong convergence of estimators as ε_n-minimizers of optimization problems. Ann. Inst. Statist. Math. 57 (2005), 2, 291–313.

[15] P. Lachout and S. Vogel: On continuous convergence and epi-convergence of random functions. Part I: Theory and relations. Kybernetika 39 (2003), 1, 75–98.

[16] A. M. Leroy and P. J. Rousseeuw: Robust Regression and Outlier Detection. Wiley, New York 1987.

[17] S. M. Robinson: Analysis of sample-path optimization. Math. Oper. Res. 21 (1996), 3, 513–528.

[18] T. Rockafellar and R. J.-B. Wets: Variational Analysis. Springer-Verlag, Berlin 1998.

[19] R. Schultz: Some aspects of stability in stochastic programming. Ann. Oper. Research 100 (1996), 55–84.

[20] A. W. van der Vaart and J. A. Wellner: Weak Convergence and Empirical Processes. Springer, New York 1996.

[21] L. Wang and J. Wang: Limit distribution of statistical estimators for stochastic programs with dependent samples. Z. Angew. Math. Mech. 79 (1999), 4, 257–266.

[22] I. Vajda and M. Janžura: On asymptotically optimal estimates for general observations. Stochastic Proc. Appl. 72 (1997), 1, 27–45.

[23] A. Ruszczyński and A. Shapiro (eds.): Stochastic Programming. Elsevier, Amsterdam 2003.