

On the Numerical Inversion Techniques for Quantitative Remote Sensing

Yanfei Wang¹, Jindi Wang² and Xiaowen Li²

¹Institute of Geology and Geophysics, Chinese Academy of Sciences

²Research Center for Remote Sensing and GIS, Beijing Normal University

To estimate structural parameters and spectral component signatures of Earth surface cover type, quantitative remote sensing seems to be an appropriate way to deal with these problems. Since the real physical system that couples the atmosphere and the land surface is very complicated, sometimes it requires a comprehensive set of parameters to describe such a system, so any practical physical model can only be approximated by a model which includes only a limited number of the most important parameters that capture the major variation of the real system. The pivot problem for quantitative remote sensing is the inversion. Inverse problems are typically ill-posed. The ill-posed nature is characterized by: (1) the solution may not exist; (2) the dimension of the solution space may be infinity; (3) the solution is not continuous with the variation of the observed signals. These issues exist for all quantitative remote sensing inverse problems. For example, when sampling is poor, i.e., there are too few observations, or directions are poor located, the inversion process would be underdetermined, which leads to the large condition number of the normalized system and the significant noise propagation. Hence (2) and (3) would be the highlight difficulties for quantitative remote sensing inversion. We study sparse regularization methods in this paper, and demonstrate its robustness with examples. The results show its potential in applications.

Corresponding author: Yanfei Wang

Yanfei Wang

Associate professor

Institute of Geology and Geophysics, Chinese Academy of Sciences, P. O. Box 9825, Beijing, 100029, P. R. China

Email: yfwang@mail.iggcas.ac.cn

Jindi Wang

Professor

Research Center for Remote Sensing and GIS, Beijing Normal University, Beijing, 100875, P. R. China

Email:

Xiaowen Li

Professor

Research Center for Remote Sensing and GIS, Beijing Normal University, Beijing, 100875, P. R. China

Email: