

Jeong, In-Seong Ph.D., Purdue University, December, 2008. Resolving Parameter Dependencies in Satellite Sensor Models. Major Professor: James Bethel.

The physical sensor model for spaceborne sensors has played a significant role by accommodating the agile imaging characteristics of modern sensors and providing consistent and optimum geometric accuracy. However, over-parameterization and the resulting dependencies among sensor model parameters are a constantly occurring problem causing instability and ambiguity during parameter estimation. Instead of applying the classical solution, i.e. an intuition-driven parameter selection approach, an automatic and systematic parameter selection method is proposed here, tailored solely to the sensor model application. The proposed procedure is built based on customizing the forward stepwise procedure, analyzing actual multivariate and groupwise dependency relationships and adopting the Leave-One-Out-Cross-Validation (LOOCV) method as a selection criterion. Owing to the parameterization of the sensor system, the procedure provides a universal framework for parameter selection regardless of the global location of satellite scenes. The feasibility of the proposed procedure is tested for Quickbird, Hyperion, SPOT-3, ASTER, PRISM, and EROS-A. Comprehensive experiments are carried out under a realistic environment influenced by the sensor type, the trajectory model, and the number of given control points. The results show the successful performance of the suggested procedure to deliver an optimal subset satisfying model accuracy and external accuracy.