Assessing the Integration of Total Least Squares and Radial Basis Function Neural Network for Coordinate Transformation

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SUMMARY

Total Least Squares (TLS) is noted to be a solution approach to solving several geodetic problems. The method has the ability to estimate unknown quantities that are useful for many geodetic applications. Hence, the main objective of this study is to improve the estimation performance of TLS via Radial Basis Function Neural Network (RBFNN) in coordinate transformation. This hybrid approach called TLS-RBFNN was applied to Ghana geodetic reference network, which has a coverage area of 79857 km2 representing 33.5% of the total land mass (238540 km2). A comparative performance analysis of TLS, RBFNN and TLS-RBFNN was carried out using Root Mean Square Horizontal Error (RMSHE) and Standard Deviation (SD). Based on the testing results, it was found that the TLS-RBFNN improved the transformation accuracy of RBFNN and TLS by 20.240% and 37.240% based on the RMSHE. In addition, it was observed that the TLS-RBFNN improved the transformation precision based on SD by 0.3703% and 8.52%, respectively. Furthermore, the Bayesian Information Criterion (BIC) applied confirmed the superiority of the hybrid approach than using TLS and RBFNN as independent transformation methods. Consequently, the hybrid approach is recommended for enhanced coordinate transformation results in Ghana geodetic reference network.