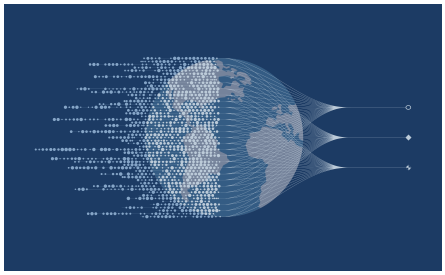

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Preliminary Design of Deep Learning-Based Link Quality Estimation Using Signal to Interference and Noise Ratio (LQE-SINR) for GSM Communication in Indonesia's Seismic Network

Friday 12 September 2025 09:00 (1 hour)

A total of 332 seismic stations operated by the Meteorology, Climatology, and Geophysics Agency (BMKG) utilize Global System for Mobile Communication (GSM) to transmit seismic data. Stable communication ensures the quality of transmission and the availability of seismic station data. Link Quality Estimation (LQE) can measure link quality based on physical metrics, thereby improving network stability by selecting communication links before they become unstable. This study proposes an LQE-SINR design with a temporal feature extraction concept from SINR data. The simulation is conducted on ten seismic stations located on Java Island. The design is built using data sets recorded under the environmental conditions of seismic stations, employing RNN, LSTM, GRU, and BiLSTM algorithms. The RNN model demonstrated the best performance with an RMSE of 0.71 and MAE of 0.56 at site GEJI, while LSTM performed best with an RMSE of 2.21 and MAE of 1.33 at site MLJI. The GRU model excelled at site CSJI with an RMSE of 2.35 and MAE of 1.56, while BiLSTM achieved the best results at site PRJI with an RMSE of 1.43 and MAE of 1.08. Overall, each seismic site exhibited different SINR patterns, but the RNN model showed the best performance across most sites.

E-mail

andri.setiyaji21@ui.ac.id

In-person or online preference

Primary author: Mr SETIYAJI, andri (Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG))

Co-authors: Prof. RAMLI, Kalamullah (University of Indonesia); Mr YASIN HIDAYATULLAH, zulkifli (Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG)); Dr BUDHI DHARMAWAN, Gregorius Setyadhi (Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG))

Presenter: Mr SETIYAJI, andri (Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG))

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