National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: A GCN-GAT Based Approach for Oscillatory Mode Identification using Degraded PMU Measurements in Power System
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Venue	: Seminar Room (EE-205)
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Abstract	: The increasing complexity of modern power systems, driven by renewable energy integration and evolving grid dy namics, demands advanced automation solutions to ensure sta bility, reliability, and resilience. Wide-Area Monitoring Systems (WAMS), powered by Phasor Measurement Units (PMUs), have emerged as an integral component of power system automation, enabling real-time situational awareness and predictive control. However, PMU data quality often suffers from missing values, outliers, and noise due to communication disruptions, hardware failures and cyberattacks posing threats to power system stability. Since PMU data involves both the locations (spatial features) and measurements over time (temporal features), this paper introduces a Graph Convolutional Network-Graph Attention Net work (GCN-GAT) approach that establishes a robust framework by harnessing the spatial dependencies of PMUs data within the power grid and temporal continuity of signal behaviour to effectively restore the true signal components from the corrupted PMU measurements. GCN first detects outliers in the PMU data by treating each time sample as a graph node connected to neighboring time steps. It propagates information to identify abnormal data points, converting the detected outliers into missing values. Following this, GAT imputes missing values by assigning attention weights to neighboring time steps, prioritizing reliable data while preserving temporal consistency for accu rate signal recovery. Consequently, the restored data is passed to the TLS-ESPRIT technique to evaluate modal parameters, aiding in the detection of low-frequency oscillations essential for grid stability. The effectiveness of the suggested scheme is checked using the real world measurements from the Western Electricity Coordinating Council (WECC), a synthetic test signal and oscillatory ringdown signal from an IEEE 39-bus system, verified by a Real-Time Digital Simulator (RTDS), highlighting the importance of accurate mode evaluation in advancing power system automation, improving grid stability, and guaranteeing the robust and resilient operation of modern power networks.