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on Multi-Station Phase Picking, Association and Location Based on Graph Neural Networks

In the field of seismic monitoring, the three critical tasks of phase picking, association and location are interconnected and tightly coupled. Current seismic monitoring methods typically tackle phase picking, association and location separately, and most existing phase picking methods focus on single-station waveform data processing. Graph Neural Networks (GNNs) are deep learning frameworks specifically designed to process graph-structured data. Through modeling seismic stations as graph nodes, incorporating their waveform data as node attributes, and defining inter-station geographic relationships as topological connectivity, GNNs learn graph-based knowledge to enable end-to-end multi-station phase picking, association and location. The research on multi-station phase picking, association and location based on GNNs unifies waveform feature extraction, physics-informed phase picking, phase association and event location modules together and delivers an integrated end-to-end operational pipeline for seismic monitoring.

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