Multi-Stream Concept Drift Self-Adaptation Using Graph Neural Network

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Abstract: Concept drift is when data distribution in stream changes over time, a common real-world problem. For instance, a traffic accident can alter traffic speed distribution. Existing concept drift research primarily focuses on single data streams, neglecting multi-stream environments that align better with real-world applications. To address this gap, we propose SAGN, a multi-stream concept drift self-adaptation framework that employs graph neural networks. SAGN introduces a multi-stream prediction setting, converting the prediction task into sub-graph-based online streaming data tasks. Each sub-graph represents an adaptation target, updated over time. This approach allows us to locally overcome drift in each sub-graph through a designed adaptation technique while preserving the global correlation between different data streams as a graph structure. Consequently, SAGN consistently provides accurate predictions regardless of drift occurrence in one or multiple streams. We conducted comprehensive tests on synthetic and real-world data, encompassing both drift and non-drift scenarios, for the multi-step prediction task. Experimental results demonstrate SAGN's superior performance in most cases.

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