World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:16, No:12, 2022

Graph Neural Network-Based Classification for Disease Prediction in Health Care Heterogeneous Data Structures of Electronic Health Record

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Abstract : In the healthcare sector, heterogenous data elements such as patients, diagnosis, symptoms, conditions, observation text from physician notes, and prescriptions form the essentials of the Electronic Health Record (EHR). The data in the form of clear text and images are stored or processed in a relational format in most systems. However, the intrinsic structure restrictions and complex joins of relational databases limit the widespread utility. In this regard, the design and development of realistic mapping and deep connections as real-time objects offer unparallel advantages. Herein, a graph neural network-based classification of EHR data has been developed. The patient conditions have been predicted as a node classification task using a graph-based open source EHR data, Synthea Database, stored in Tigergraph. The Synthea DB dataset is leveraged due to its closer representation of the real-time data and being voluminous. The graph model is built from the EHR heterogeneous data using python modules, namely, pyTigerGraph to get nodes and edges from the Tigergraph database, PyTorch to tensorize the nodes and edges, PyTorch-Geometric (PyG) to train the Graph Neural Network (GNN) and adopt the self-supervised learning techniques with the AutoEncoders to generate the node embeddings and eventually perform the node classifications using the node embeddings. The model predicts patient conditions ranging from common to rare situations. The outcome is deemed to open up opportunities for data querying toward better predictions and accuracy.

Keywords : electronic health record, graph neural network, heterogeneous data, prediction
Conference Title : ICCGGT 2022 : International Conference on Combinatorial Geometry and Graph Theory
Conference Location : Kuala Lumpur, Malaysia
Conference Dates : December 09-10, 2022

Open Science Index, Mathematical and Computational Sciences Vol:16, No:12, 2022 publications.waset.org/abstracts/157840.pdf