**Thesis:** Graph Neural Networks in Deep Learning.

**Abstract:** With the power of Deep learning (DL) models, Euclidean data like sequences and images has been investigated heavily and the problems in a wide range of fields can be solved better. As a contrast, the graph-structured data defined in non-Euclidean domain exhibit many different properties. These leave the analysis of graph-structured data to be a sophisticated and ubiquitous challenge. Recently, neural networks that use graph-structured data as input has attracted growing interest from researchers. The so-called Graph Neural Networks (GNNs) are more powerful to learn the representation of graph-structured data comparing to traditional methods or naive DL models. The reason is that GNNs are inspired by previous DL models and designed specifically to capture the feature and structure information in the various types of graphs that exist in different domains.

In this survey, GNNs are reviewed in three fashions: The architecture of the models, the type of the graphs being dealt, and the scenario of the applications. According to the different structures, three typical categories of GNNs including Graph Convolutional

Networks (GCNs), Graph Autoencoders (GAEs), and Graph Generative Networks will be introduced and discussed by comparing the various choices of modules. Besides, GNNs variants uniquely designed for different graph types are also included. As for applications, two scenarios including the explicit and implicit cases are covered due to the way how the graph-structured data exist in different areas. In the final part of the survey, the limitations and future directions for the researches of GNNs are discussed.

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