Exploration of Graph Attention Networks for Graph Neural Networks

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Abstract. In this paper, we present the implementation of various attention-based graph neural networks. Graph neural networks (GNNs) have shown promising results in various graph-related tasks such as node classification, link prediction, and graph classification. However, traditional GNNs treat all nodes equally and do not consider the importance of different nodes in the graph. Attention mechanisms provide a solution to this problem by allowing GNNs to focus on relevant nodes during message passing. In this paper, we explore different attention mechanisms, including graph attention networks (GAT, GATv2 and GAtv3), to enhance the performance of GNNs on graph-based tasks. We evaluate the proposed models on benchmark datasets and compare their performance with traditional GNNs. Our experimental results demonstrate that attention-based GNNs achieve similair or improved performance in terms of accuracy and convergence speed. Furthermore, we provide an in-depth analysis of the learned attention weights to gain insights into the importance of different nodes in the graph. Overall, our work contributes to the understanding and advancement of attention-based GNNs for graph-related tasks.

Keywords: Graph Attenion Networks · Graph Neural Networks · Attention Mechanism

1 Introduction

Graphs are found everywhere in our daily lives, such as in social networks, transportation networks, scientific publication networks, and in the chemical domain. Graphs offer a multitude of information due to their expressive power. Graph neural networks (GNNs) aim to lelarn a level of representation from the graph in a lower dimendinsonal representation space to apply in downstream tasks sush as node classification, link prediction and query and anwsering.

Graph convolutional neural networks (GCNs) are in particular a firmly established architecture in the context of machine learning applied into graphs.

Subsequent paragraphs, however, are indented.

Sample Heading (Third Level) Only two levels of headings should be numbered. Lower level headings remain unnumbered; they are formatted as run-in headings.

Sample Heading (Fourth Level) The contribution should contain no more than four levels of headings. Table 1 gives a summary of all heading levels.

Table 1. Table captions should be placed above the tables.

Heading level	Example	Font size and style
Title (centered)	**Lecture Notes**	14 point, bold
1st-level heading	**1 Introduction**	12 point, bold
2nd-level heading	**2.1 Printing Area**	10 point, bold
3rd-level heading	**Run-in Heading in Bold.** Text follows	10 point, bold
4th-level heading	*Lowest Level Heading.* Text follows	10 point, italic

2 Methods

3 Experiments

3.1 Datasets

4 Results

5 Conclusion

Displayed equations are centered and set on a separate line.

$$x + y = z \tag{1}$$

Please try to avoid rasterized images for line-art diagrams and schemas. Whenever possible, use vector graphics instead (see Fig. 1).

Theorem 1. *This is a sample theorem. The run-in heading is set in bold, while the following text appears in italics. Definitions, lemmas, propositions, and corollaries are styled the same way.*

Proof. Proofs, examples, and remarks have the initial word in italics, while the following text appears in normal font.

For citations of references, we prefer the use of square brackets and consecutive numbers. Citations using labels or the author/year convention are also acceptable. The following bibliography provides a sample reference list with entries for journal articles [1], an LNCS chapter [2], a book [3], proceedings without editors [4], and a homepage [5]. Multiple citations are grouped [1–3], [1, 3–5].

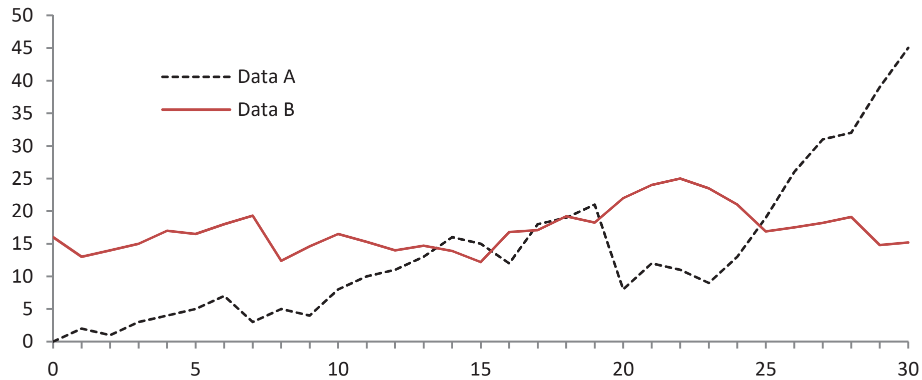

Fig. 1. A figure caption is always placed below the illustration. Please note that short captions are centered, while long ones are justified by the macro package automatically.

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