

# AliGraph: A Comprehensive Graph Neural Network Platform

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## ABSTRACT

An increasing number of machine learning tasks require dealing with large graph datasets, which capture rich and complex relationship among potentially billions of elements. Graph Neural Network (GNN) becomes an effective way to address the graph learning problem by converting the graph data into a low dimensional space while keeping both the structural and property information to the maximum extent and constructing a neural network for training and referencing. However, it is challenging to provide an efficient graph storage and computation capabilities to facilitate GNN training and enable development of new GNN algorithms. In this paper, we present a comprehensive graph neural network system, namely AliGraph, which consists of distributed graph storage, optimized sampling operators and runtime to efficiently support not only existing popular GNNs but also a series of in-house developed ones for different scenarios. The system is currently deployed at Alibaba to support a variety of business scenarios, including product recommendation and personalized search at Alibaba's E-Commerce platform. By conducting extensive experiments on a real-world dataset with 492.90 million vertices, 6.82 billion edges and rich attributes, Ali-Graph performs an order of magnitude faster in terms of graph building (5 minutes vs hours reported from the state-of-the-art PowerGraph platform). At training, AliGraph runs 40%-50% faster with the novel caching strategy and demonstrates around 12 times speed up with the improved runtime. In addition, our in-house developed GNN models all showcase their statistically significant superiorities in terms of both effectiveness and efficiency (e.g., 4.12%–17.19% lift by F1 scores).

## CCS Concepts/ACM Classifiers

Design and analysis of algorithms → Graph algorithms analysis

## Author Keywords

Graph Neural Network; Large Scale; E-Commerce; Platform

## BIOGRAPHY

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## REFERENCES

- [1] Vincent, Z., Sha, M., Li, Y., Yang, H., Fang, Y., Zhang, Z. and Chang, K., Heterogeneous Embedding Propagation for Large-Scale E-Commerce User Alignment. IEEE International Conference on Data Mining series (ICDM), 2018.
- [2] Cen, Y., Zou, X., Zhang, J., Yang, H., Zhou, J. and Tang, J., Representation Learning for Attributed Multiplex Heterogeneous Network. 25th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD), 2019.
- [3] Liu, N., Tan, Q., Li, Y., Yang, H., Zhou, J. and Hu, X., Is a Single Vector Enough? Exploring Node Polysemy for Network Embedding. 25th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD), 2019.

- [4] Chen, Q., Lin, J., Zhang, Y., Yang, H., Zhou, J. and Tang, J., Towards Knowledge-Based Personalized Product Description Generation in E-commerce. 25th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD), 2019.
- [5] Du, Z., Wang, X., Yang, H., Zhou, J. and Tang, J., Sequential Scenario-Specific Meta Learner for Online Recommendation. 25th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD), 2019.
- [6] Zhu, R., Zhao, K., Yang, H., Lin, W., Zhou, C., Ai, B., Li, Y. and Zhou, J., AliGraph: A Comprehensive Graph Neural Network Platform. 45th International Conference on Very Large Data Bases (VLDB), 2019.
- [7] Zhao, Y., Wang, X., Yang, H., Song, L., Tang, J., Large Scale Evolving Graphs with Burst Detection. 28th International Joint Conference on Artificial Intelligence (IJCAI), 2019.
- [8] Li, C., Shen, D., Jia, K. and Yang, H., Hierarchical Representation Learning for Bipartite Graphs. 28th International Joint Conference on Artificial Intelligence (IJCAI), 2019.
- [9] Ding, M., Zhou, C., Chen, Q., Yang, H. and Tang, J., Cognitive Graph for Multi-Hop Reading Comprehension at Scale. 57th Annual Meeting of the Association for Computational Linguistics (ACL), 2019.