

## REVIEWER'S REPORT

**Manuscript No.:** JNCS -086

**Title:** GRAPH NEURAL NETWORKS: FUNDAMENTALS, APPLICATIONS, AND RESEARCH DIRECTIONS.

### Recommendation:

Accept as it is .....

**Accept after minor revision.....**

Accept after major revision .....

Do not accept (*Reasons below*) .....

| Rating         | Excel.                   | Good                     | Fair | Poor |
|----------------|--------------------------|--------------------------|------|------|
| Originality    | <input type="checkbox"/> |                          |      |      |
| Techn. Quality | <input type="checkbox"/> |                          |      |      |
| Clarity        |                          | <input type="checkbox"/> |      |      |
| Significance   |                          | <input type="checkbox"/> |      |      |

**Reviewer Id:** JPR-209

### Reviewer's Comment for Publication.

The manuscript presents a comprehensive and logically organized review of Graph Neural Networks, covering fundamental concepts such as graph representation, node embeddings, message passing, and major architectures including GCNs, GraphSAGE, GATs, graph autoencoders, and spatiotemporal GNNs. The paper effectively connects these methods with applications in social networks, recommendation systems, fraud detection, biological and medical research, knowledge graphs, transportation, and IoT environments. The discussion of oversmoothing, oversquashing, scalability, interpretability, robustness, data quality, and dynamic and heterogeneous graphs provides a useful assessment of current technical limitations, while emerging directions involving self-supervised learning, graph transformers, explainable GNNs, and integration with large language models enhance the relevance of the review. However, the methodology should provide clearer literature-search and study-selection criteria, and the technical contribution could be strengthened through a more systematic comparison of major GNN architectures using computational complexity, scalability, predictive performance, and benchmark results from existing studies. Overall, the manuscript is technically relevant and informative and is suitable for publication after minor revision.