${\bf Rebuttal}$

Table 1: Node Classification Results with Conformal Baselines (Coverage \uparrow / Inefficiency \downarrow)

Dataset	CF-GNN [1]		DAPS [2]		RR-GNN (Ours)		Cluster-RR-GNN (Ours)	
Model	Cover	Ineff	Cover	Ineff	Cover	Ineff	Cover	Ineff
Cora GraphSAGE SGC GCN GAT	$\begin{array}{c} 0.9456^{\pm0.0569} \\ 0.9461^{\pm0.0603} \\ 0.9473^{\pm0.0556} \\ 0.9464^{\pm0.0702} \end{array}$	$ \begin{array}{c} 1.6284^{\pm0.0483} \\ 1.6633^{\pm0.04415} \\ 1.6344^{\pm0.0418} \\ 1.6278^{\pm0.0334} \end{array} $	$\begin{array}{c} 0.9453^{\pm0.0535} \\ 0.9452^{\pm0.0538} \\ 0.9435^{\pm0.053} \\ 0.9480^{\pm0.065} \end{array}$	$ \begin{array}{c} 1.8025^{\pm0.0421} \\ 1.7856^{\pm0.0426} \\ 1.7120^{\pm0.0354} \\ 1.7052^{\pm0.0384} \end{array} $	$\begin{array}{c} 0.9460^{\pm0.0542} \\ 0.9462^{\pm0.0581} \\ 0.9432^{\pm0.0573} \\ 0.9475^{\pm0.0624} \end{array}$	$ \begin{array}{c} 1.6100^{\pm0.0415} \\ 1.6297^{\pm0.0428} \\ 1.6251^{\pm0.0367} \\ 1.6146^{\pm0.0351} \end{array} $	$\begin{array}{c} \textbf{0.9463}^{\pm 0.0509} \\ \textbf{0.9468}^{\pm 0.0662} \\ \textbf{0.9476}^{\pm 0.0732} \\ \textbf{0.9491}^{\pm 0.0539} \end{array}$	$ \begin{array}{c} 1.6076^{\pm 0.0397} \\ 1.6017^{\pm 0.0465} \\ 1.6315^{\pm 0.0303} \\ 1.6254^{\pm 0.0396} \end{array} $
DBLP GraphSAGE SGC GCN GAT	$0.9501^{\pm0.0523}$ $0.9451^{\pm0.0617}$ $0.9473^{\pm0.0596}$ $0.9467^{\pm0.0717}$		$\begin{array}{c} 0.9500^{\pm0.0420} \\ 0.9427^{\pm0.0526} \\ 0.9458^{\pm0.0565} \\ 0.9455^{\pm0.0685} \end{array}$	$\begin{array}{c} 1.6436^{\pm0.0627} \\ 1.6020^{\pm0.0317} \\ 1.6384^{\pm0.0703} \\ 1.6493^{\pm0.0455} \end{array}$	$\begin{array}{c} 0.9499^{\pm0.0531} \\ 0.9462^{\pm0.0528} \\ 0.9458^{\pm0.0702} \\ 0.9485^{\pm0.0589} \end{array}$	$ \begin{array}{c} 1.5351^{\pm0.0473} \\ 1.4286^{\pm0.0541} \\ 1.5512^{\pm0.0295} \\ 1.5725^{\pm0.0349} \end{array} $	$\begin{array}{c} \textbf{0.9503}^{\pm 0.0510} \\ \textbf{0.9443}^{\pm 0.0462} \\ \textbf{0.9430}^{\pm 0.0713} \\ \textbf{0.9491}^{\pm 0.0539} \end{array}$	$ \begin{array}{c} 1.5607^{\pm 0.0487} \\ 1.3921^{\pm 0.0624} \\ 1.5491^{\pm 0.0278} \\ 1.5720^{\pm 0.0322} \end{array} $
CiteSeer GraphSAGE SGC GCN GAT	$\begin{array}{c} 0.9528^{\pm0.0203} \\ 0.9525^{\pm0.0257} \\ 0.9496^{\pm0.0392} \\ 0.9508^{\pm0.0309} \end{array}$	$ \begin{array}{c} 1.1680^{\pm0.0439} \\ 1.1827^{\pm0.0552} \\ 1.2310^{\pm0.0332} \\ 1.2396^{\pm0.0416} \end{array} $	$\begin{array}{c} 0.9501^{\pm0.0195} \\ 0.9513^{\pm0.0245} \\ \textbf{0.9520}^{\pm0.036} \\ 0.9513^{\pm0.0291} \end{array}$	$1.3425^{\pm 0.0412} \\ 1.3578^{\pm 0.0525} \\ 1.4026^{\pm 0.0327} \\ 1.4152^{\pm 0.039}3$	$\begin{array}{c} 0.9538^{\pm0.0853} \\ 0.9579^{\pm0.0536} \\ 0.9512^{\pm0.0358} \\ 0.9535^{\pm0.0447} \end{array}$	$\begin{array}{c} 1.1621^{\pm0.0552} \\ 1.1782^{\pm0.0415} \\ 1.2189^{\pm0.0276} \\ 1.2085^{\pm0.0361} \end{array}$	$\begin{array}{c} \textbf{0.9540}^{\pm 0.0926} \\ \textbf{0.9594}^{\pm 0.0926} \\ \textbf{0.9518}^{\pm 0.0373} \\ \textbf{0.9548}^{\pm 0.0491} \end{array}$	$ \begin{array}{c} 1.1679^{\pm 0.0605} \\ 1.1898^{\pm 0.0399} \\ 1.2153^{\pm 0.0290} \\ 1.2020^{\pm 0.0392} \end{array} $

Coverage (†): Empirical coverage rate (target: $1 - \alpha = 0.95$)

Table 2: Conditional Coverage Evaluation of RR-GNN (Subgroups with Small Variations)

Condition Type	Subgroup	$\alpha = 0.1$	$\alpha = 0.2$	$\alpha = 0.3$
3*Cluster-Conditional	Cluster 1 Cluster 2 Cluster 3	0.9023 0.9015 0.8967	0.8041 0.8034 0.7945	0.7124 0.7085 0.6845
4*Class-Conditional	Class A Class B Class C Class D	0.9018 0.8986 0.9047 0.8935	0.8075 0.7914 0.8035 0.7942	0.7064 0.6947 0.7016 0.6964

Table 3: Overall Coverage at Different α Values on Edge Weight Prediction Task on Cora(Close to $1-\alpha$, within $\pm 5\%$)

α Value	Ineff
0.05	1.6315
0.10	1.5576
0.15	1.5528
0.20	1.2468
0.25	1.1178
0.30	1.0373

Response:

Table 4: Coverage Across Different Set Sizes (Close to $1 - \alpha$, within $\pm 1\%$)

Set Size	Node Count	Coverage ($\alpha = 0.1$)
Small (2DatasetTwitter)	81,306	0.8957
Medium (5: Dataset: CiteSeer)	3,327	0.9036
Large (¿10: Dataset: OGBN-Arxiv)	169,343	0.9014

Table 5: Performance(AUC) Comparison of Graph Transformer Models with RR Enhancement on dataset Mol-

Model	Method	Cora	${\bf Cite Seer}$	${\bf PubMed}$	OGB-Arxiv
2*Graphormer	Original + RR	0.763 ± 0.012 0.781 ± 0.011	0.691 ± 0.015 0.705 ± 0.013	0.792 ± 0.008 0.803 ± 0.007	0.718 ± 0.005 0.729 ± 0.004
2*Graphormer with Spatial Encoding	$\begin{array}{c} \text{Original} \\ + \text{RR} \end{array}$	0.772 ± 0.010 0.789 ± 0.009	0.702 ± 0.014 0.715 ± 0.012	0.801 ± 0.007 0.812 ± 0.006	0.725 ± 0.005 0.736 ± 0.004
2*Graphormer with Graph Structure	$\begin{array}{c} \text{Original} \\ + \text{RR} \end{array}$	0.781 ± 0.011 0.796 ± 0.010	0.712 ± 0.013 0.724 ± 0.011	0.808 ± 0.007 0.819 ± 0.006	0.732 ± 0.004 0.742 ± 0.003

Table 6: Performance of Graph Transformer Networks (GT) with RR Enhancement

Node Classification	F1 Score	ACM	DBLP	IMDB
2*Base GT	Original + RR		0.938 ± 0.034 0.942 ± 0.025	

Table 7: Node Classification Results with Conformal Baselines (Coverage ↑ / Inefficiency ↓)

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Dataset	CF-GNN [1]		SAN		RR-GNN (Ours)		Cluster-RR-GNN (Ours)	
Model	Cover	Ineff	Cover	Ineff	Cover	Ineff	Cover	Ineff
Cora								
GraphSAGE	$0.9456^{\pm0.0569}$	$1.6284^{\pm0.0483}$	$0.9476^{\pm0.0532}$	$1.6825^{\pm0.0541}$	$0.9460^{\pm0.0542}$	$1.6100^{\pm0.0415}$	$0.9463^{\pm0.0509}$	$1.6076^{\pm0.0397}$
SGC	$0.9461^{\pm0.0603}$	$1.6633^{\pm0.04415}$	$0.9482^{\pm0.05348}$	$1.6956^{\pm0.0236}$	$0.9462^{\pm0.0581}$	$1.6297^{\pm0.0428}$	$0.9468^{\pm0.0662}$	$1.6017^{\pm0.0465}$
GCN	$0.9473^{\pm0.0556}$	$1.6344^{\pm0.0418}$	$0.9426^{\pm0.0453}$	$1.6520^{\pm0.0344}$	$0.9432^{\pm0.0573}$	$1.6251^{\pm0.0367}$	$0.9476^{\pm0.0732}$	$1.6315^{\pm0.0303}$
GAT	$0.9464^{\pm0.0702}$	$1.6278^{\pm0.0334}$	$0.9473^{\pm0.065}$	$1.6752^{\pm0.0364}$	$0.9475^{\pm0.0624}$	$1.6146^{\pm0.0351}$	$0.9491^{\pm 0.0539}$	$1.6254^{\pm0.0396}$
DBLP								
GraphSAGE	$0.9501^{\pm0.0523}$	$1.5723^{\pm0.0683}$	$0.9501^{\pm0.0420}$	$1.5524^{\pm0.0637}$	$0.9499^{\pm0.0531}$	$1.5351^{\pm0.0473}$	$0.9503^{\pm0.0510}$	$1.5607^{\pm0.0487}$
\overline{SGC}	$0.9451^{\pm0.0617}$	$1.5274^{\pm0.0416}$	$0.9235^{\pm0.0526}$	$1.4520^{\pm0.0345}$	$0.9462^{\pm0.0528}$	$1.4286^{\pm0.0541}$	$0.9443^{\pm0.0462}$	$1.3921^{\pm0.0624}$
GCN	$0.9473^{\pm 0.0596}$	$1.5644^{\pm0.0733}$	$0.9445^{\pm0.0565}$	$1.5984^{\pm0.0743}$	$0.9458^{\pm0.0702}$	$1.5512^{\pm0.0295}$	$0.9430^{\pm0.0713}$	$1.5491^{\pm0.0278}$
GAT	$0.9467^{\pm0.0717}$	$1.5729^{\pm0.0463}$	$0.9456^{\pm0.0624}$	$1.5943^{\pm0.0425}$	$0.9485^{\pm0.0589}$	$1.5725^{\pm0.0349}$	$0.9491^{\pm 0.0539}$	$1.5720^{\pm0.0322}$
CiteSeer			1					1
GraphSAGE	$0.9528^{\pm0.0203}$	$1.1680^{\pm0.0439}$	$0.9502^{\pm0.0164}$	$1.2523^{\pm0.0416}$	$0.9538^{\pm0.0853}$	$1.1621^{\pm0.0552}$	$0.9540^{\pm 0.0926}$	$1.1679^{\pm0.0605}$
$\overline{\operatorname{SGC}}$	$0.9525^{\pm0.0257}$	$1.1827^{\pm0.0552}$	$0.9505^{\pm0.0645}$	$1.2678^{\pm0.0532}$	$0.9579^{\pm0.0536}$	$1.1782^{\pm0.0415}$	$0.9594^{\pm0.0582}$	$1.1898^{\pm0.0399}$
GCN	$0.9496^{\pm0.0392}$	$1.2310^{\pm0.0332}$	$0.9502^{\pm0.0536}$	$1.3024^{\pm0.0324}$	$0.9512^{\pm0.0358}$	$1.2189^{\pm0.0276}$	$0.9518^{\pm0.0373}$	$1.2153^{\pm0.0290}$
GAT	$0.9508^{\pm0.0309}$	$1.2396^{\pm0.0416}$	$0.9515^{\pm0.0251}$	$1.3112^{\pm0.0123}$	$0.9535^{\pm0.0447}$	$1.2085^{\pm0.0361}$	$0.9548^{\pm0.0491}$	$1.2020^{\pm0.0392}$