POLYHEDRONNET: Representation Learning for Polyhedra with Surface-Attributed Graph

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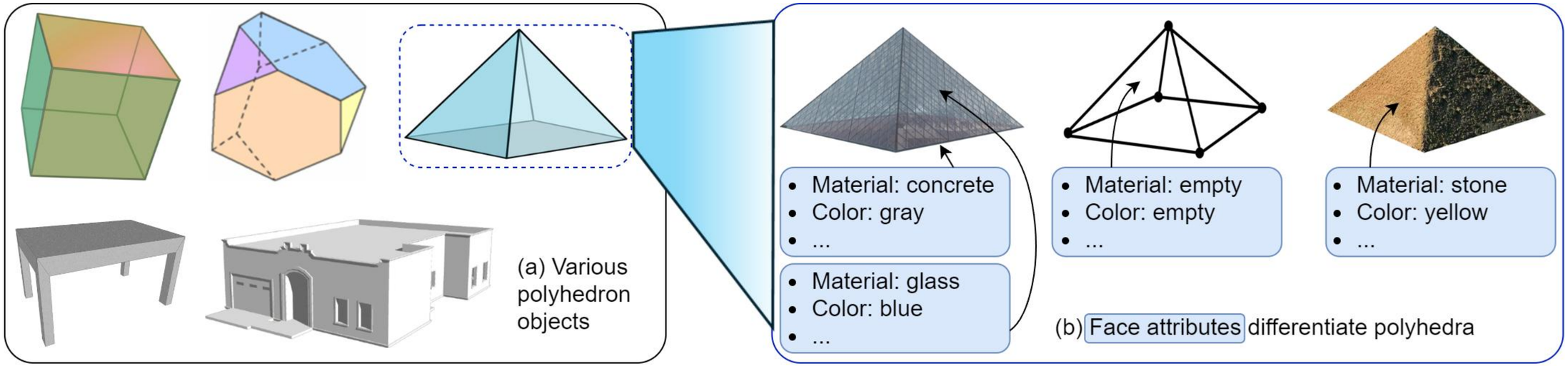
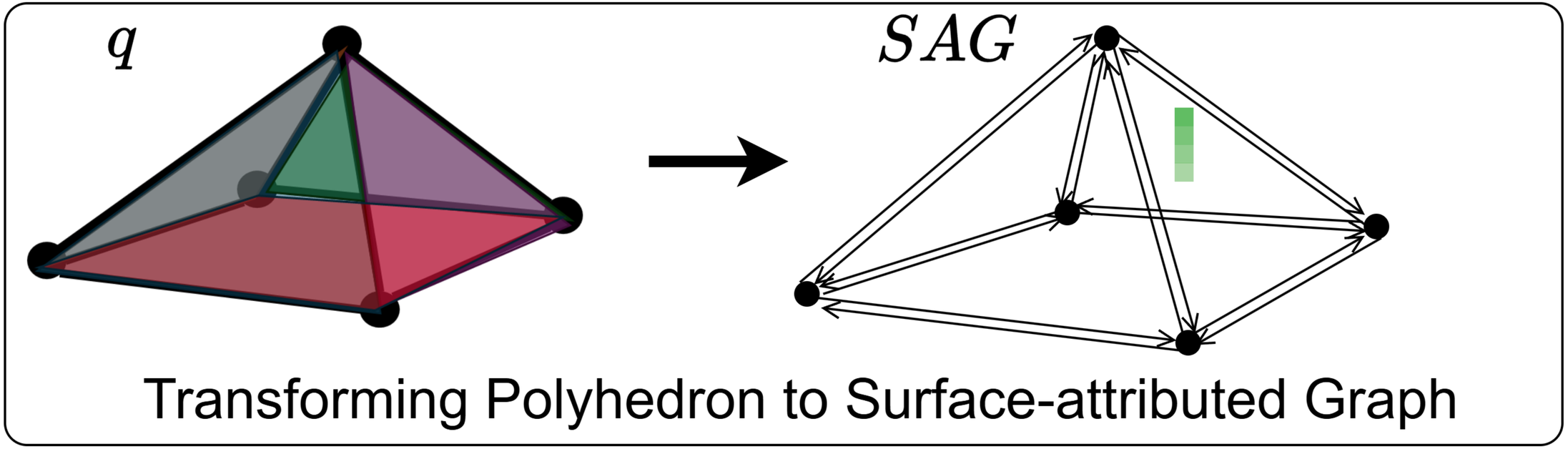
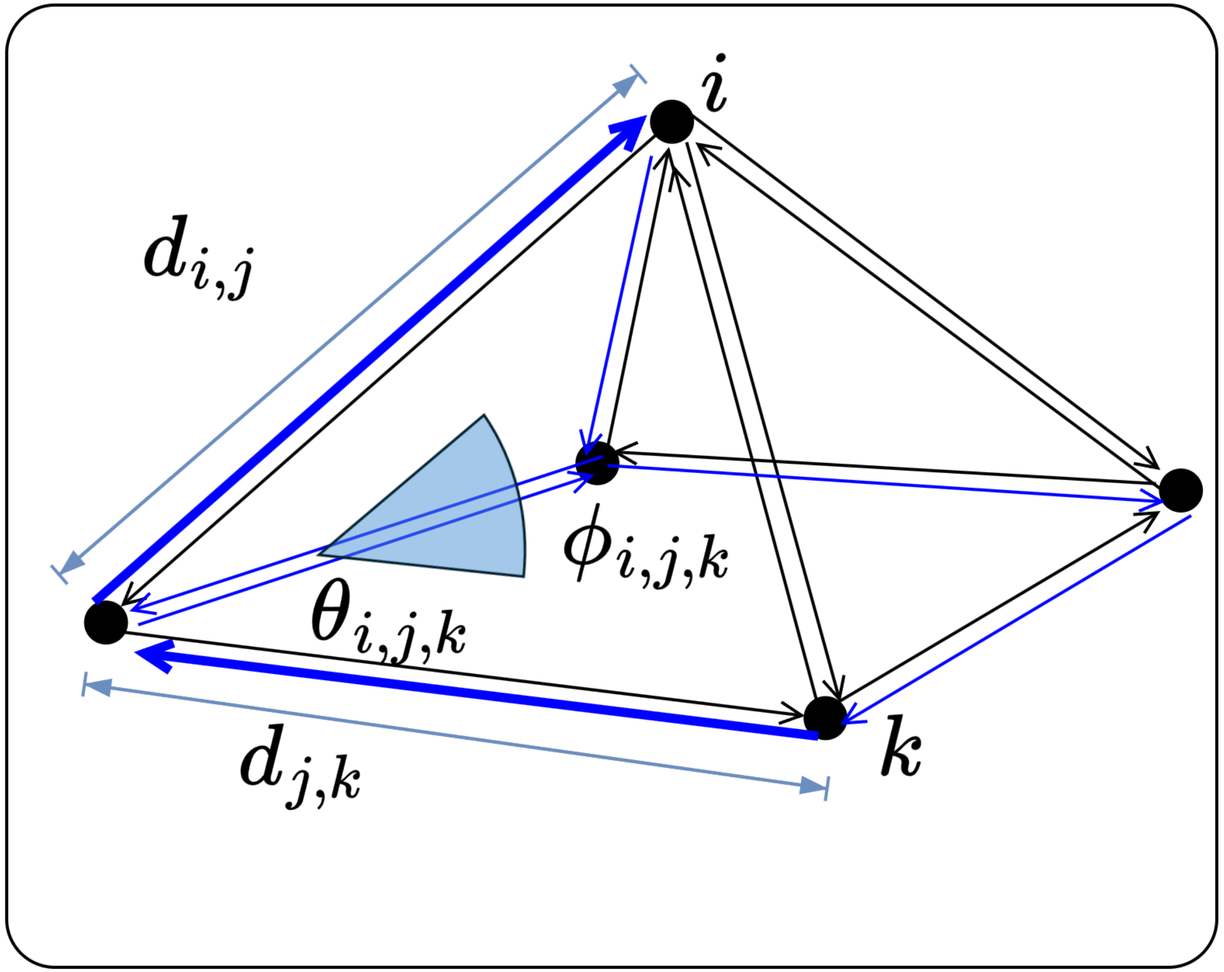
Polyhedral Representation



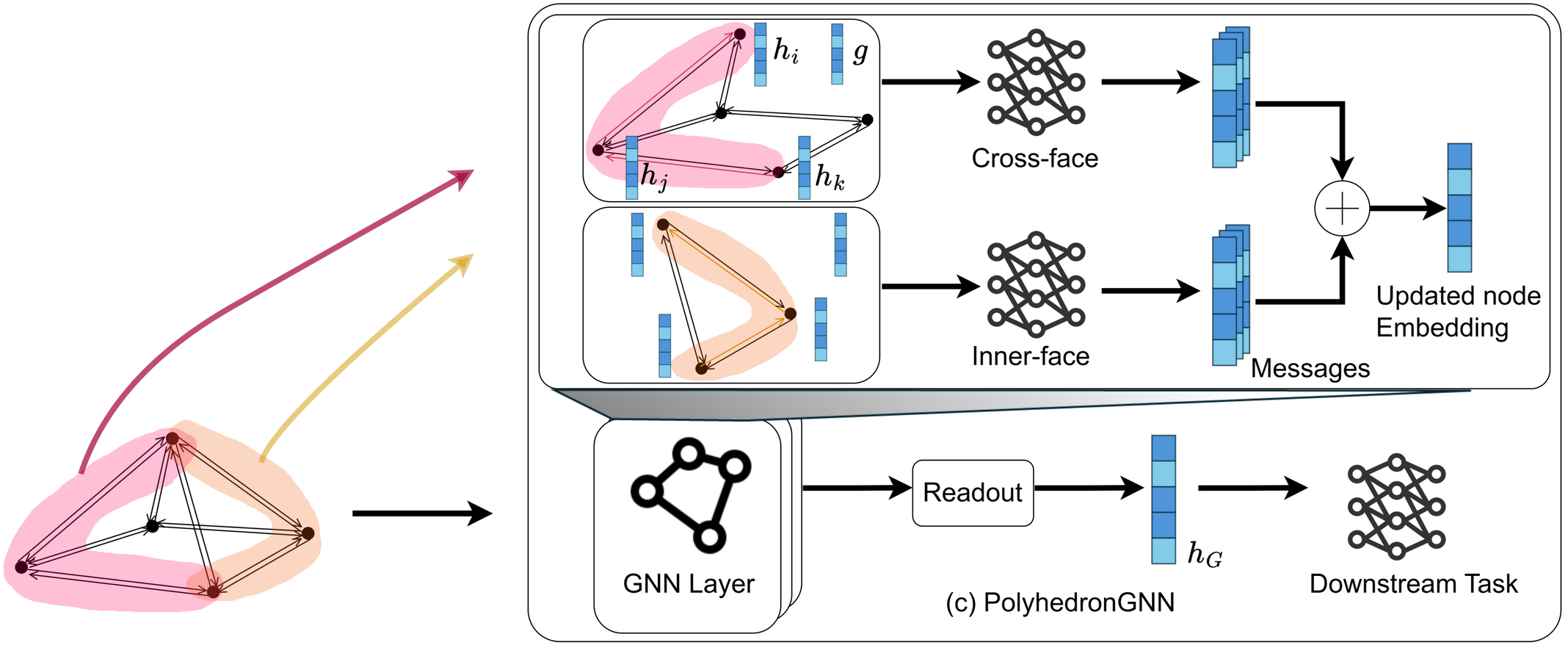
Surface-Attributed Graph



Local Rigid Representation

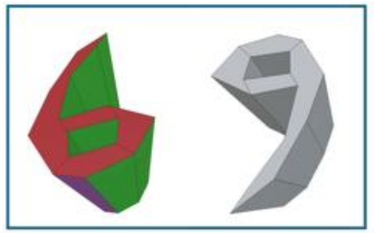


PolyhedronGNN



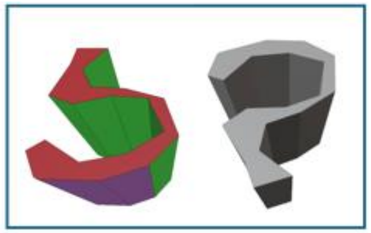
Results & Performance

Dataset	Metric	NUFT-DDSL	ResNet1D	NUFT-IFFT	VeerCNN	PolygonGNN	PolyhedronNet
MNIST-C	Acc ↑	0.148	0.152	0.239	0.127	0.435	**0.858**
	Prec↑	0.092	0.139	0.220	0.104	0.446	**0.861**
	F1↑	0.102	0.083	0.202	0.084	0.427	**0.856**
	AUC↑	0.474	0.610	0.619	0.576	0.801	**0.985**
ShapeNet-P	Acc↑	0.097	0.179	0.097	0.163	0.573	**0.627**
	Prec↑	0.103	0.142	0.082	0.158	0.589	**0.640**
	F1↑	0.092	0.147	0.083	0.148	0.570	**0.625**
	AUC↑	0.555	0.625	0.564	0.639	0.916	**0.936**



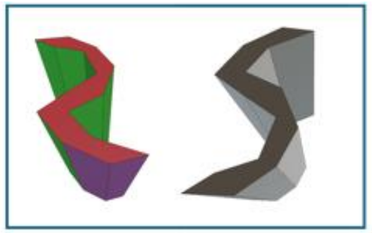
Label: 6

Prediction: 9 6 6 6



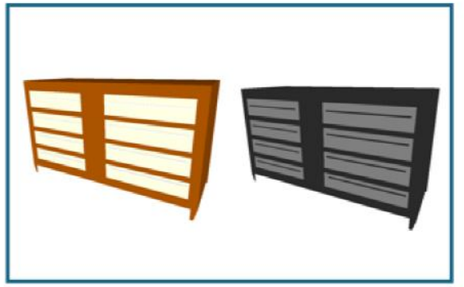
Label: 5

Prediction: 2 5 5 5

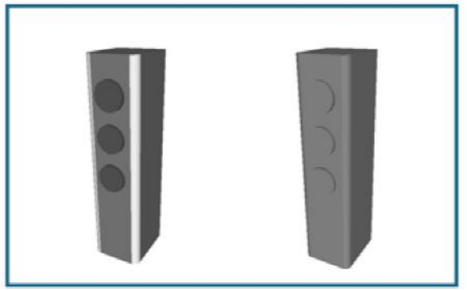


Label: 2

Prediction: 5 2 2 2



Prediction: cabinet
loudspeaker loudspeaker
loudspeaker loudspeaker



Prediction: loudspeaker
bookshelf bathtub
bookshelf pot

Summary & Future Directions

- Powerful unified representation using **Surface-Attributed Graph**
- Rotation translation invariant using **Local Rigid Encoding**
- To do:
  - Extend to segmentation
  - Systematic exploration of strengths and weaknesses across various 3D representations —— polyhedra, point clouds, voxels, multi-view images…

paper

code