Directional Graph Networks with Hard Weight Assignments

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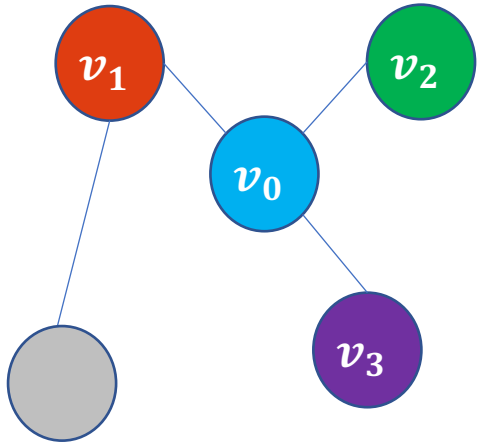
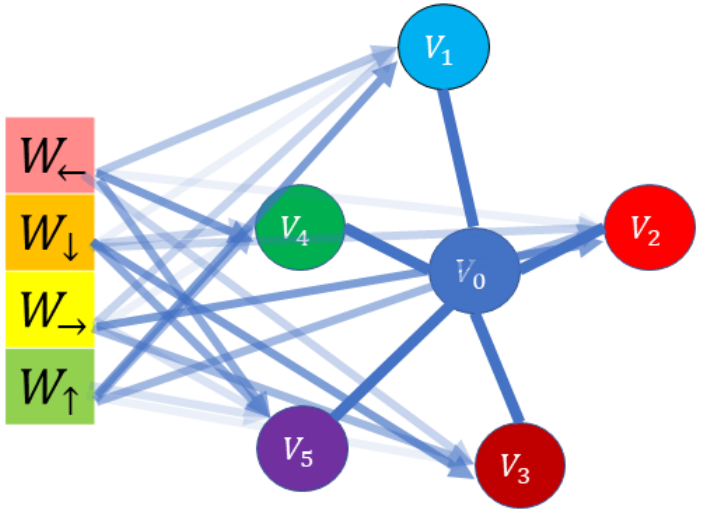
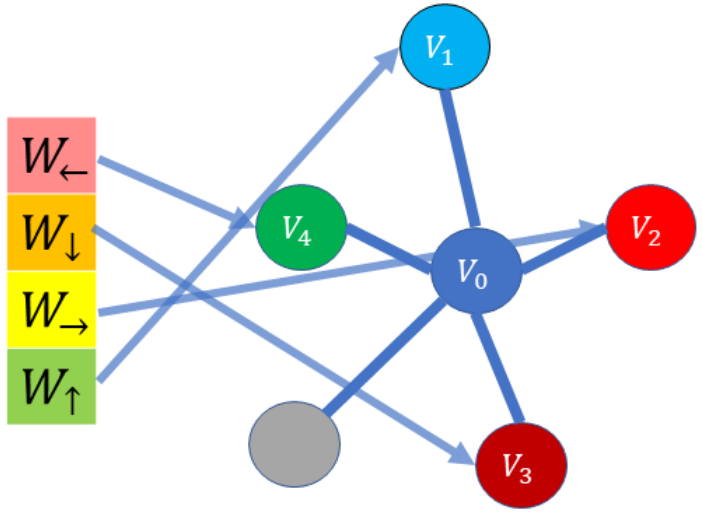
Introduction



Soft vs Hard Assignment

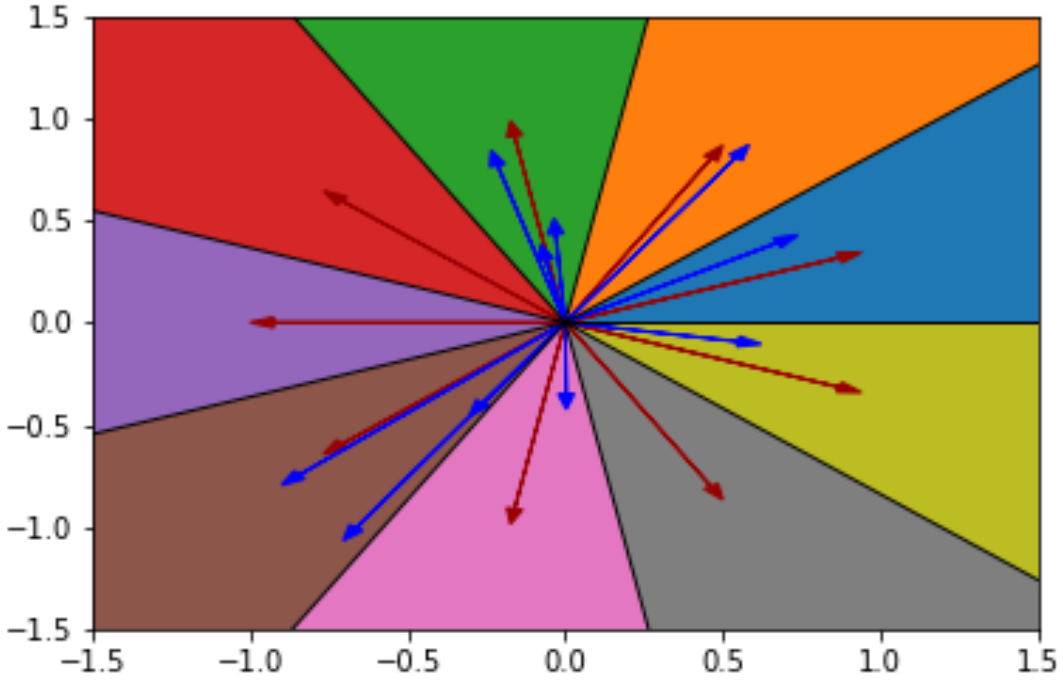


a)



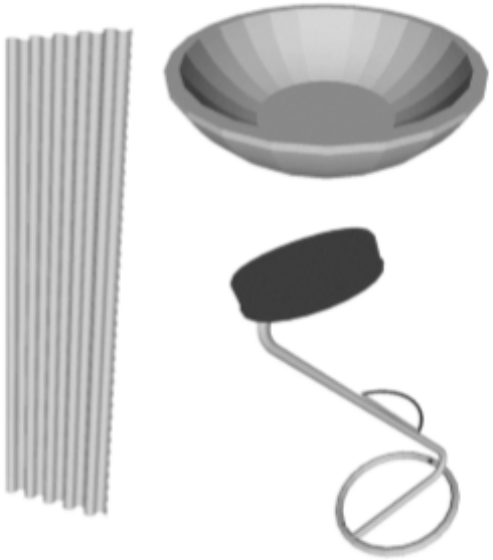
b)

Making Hard Assignments

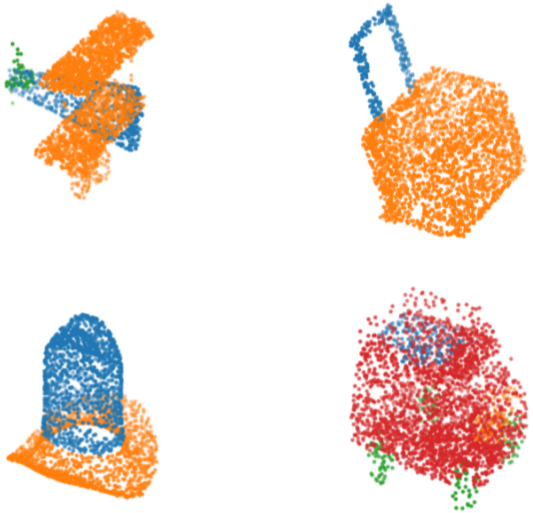


Benchmark Datasets

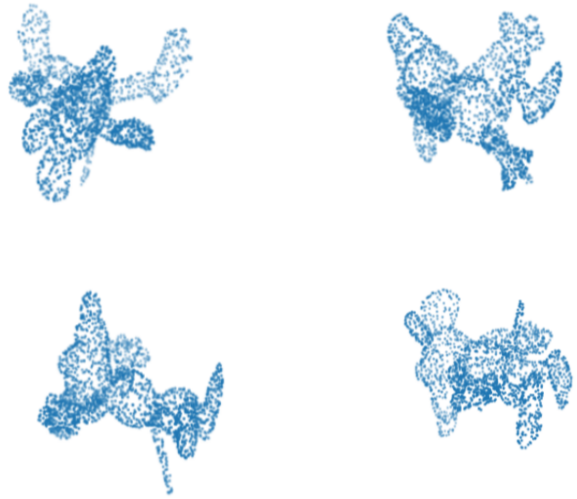
ModelNet40 Classification (40 classes)	ShapeNet Part Segmentation (50 classes)	SHREC'15 Classification (50 classes)



(Wu et al. "3D ShapeNets: A Deep Representation for Volumetric Shapes." CVPR 2015.) [6]



(Yi et al. "A Scalable Active Framework for Region Annotation in 3D Shape Collections." SIGGRAPH Asia 2016.) [8]



Pickup et al. "SHREC'14 track: Shape Retrieval of Non-Rigid 3D Human Models." EG3DOR 2014. [3]

Lian et al. "SHREC'11 track: shape retrieval on non-rigid 3D watertight meshes." EG3DOR 2011. [2]

Results

Network	MN40 (1k)	ShapeNet	SHREC'15
PointNet++ [4]	91.9%	85.1	94.1%
DGCNN [5]	92.9%	85.2	-
SpiderCNN [7]	92.4%	85.3	95.8%
PointCNN [1]	92.2%	**86.1**	-
HDGN (Ours)	**93.9%**	85.4	**100%**

Future Work

- We were able to reduce one source of excess complexity in point cloud networks while still retaining strong performance
- Focus on further reducing common point cloud network overhead:
  - Computing and storing graph structures
  - Efficiently aggregating neighbors that are not close in memory

Works Cited

- [1] Li et al. “PointCNN: Convolution on X-Transformed Points.” NeurIPS 2018.
- [2] Lian et al. “SHREC’11 track: shape retrieval on non-rigid 3D watertight meshes.” EG3DOR 2011.
- [3] Pickup et al. “SHREC'14 track: Shape Retrieval of Non-Rigid 3D Human Models.” EG3DOR 2014.
- [4] Qi et al. “PointNet++: Deep Hierarchical Feature Learning on Point Sets in a Metric Space.” NIPS 2017.
- [5] Wang, et al. “Dynamic Graph CNN For Learning on Point Clouds.” ACM Transactions on Graphics 2019.
- [6] Wu et al. “3D ShapeNets: A Deep Representation for Volumetric Shapes.” CVPR 2015
- [7] Xu et al. “SpiderCNN: Deep Learning on Point Sets with Parameterized Convolutional Filters.” ECCV 2018.
- [8] Yi et al. “A Scalable Active Framework for Region Annotation in 3D Shape Collections.” SIGGRAPH Asia 2016.)