Medical Image Seminar

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Outline

Multi-Planar UNet

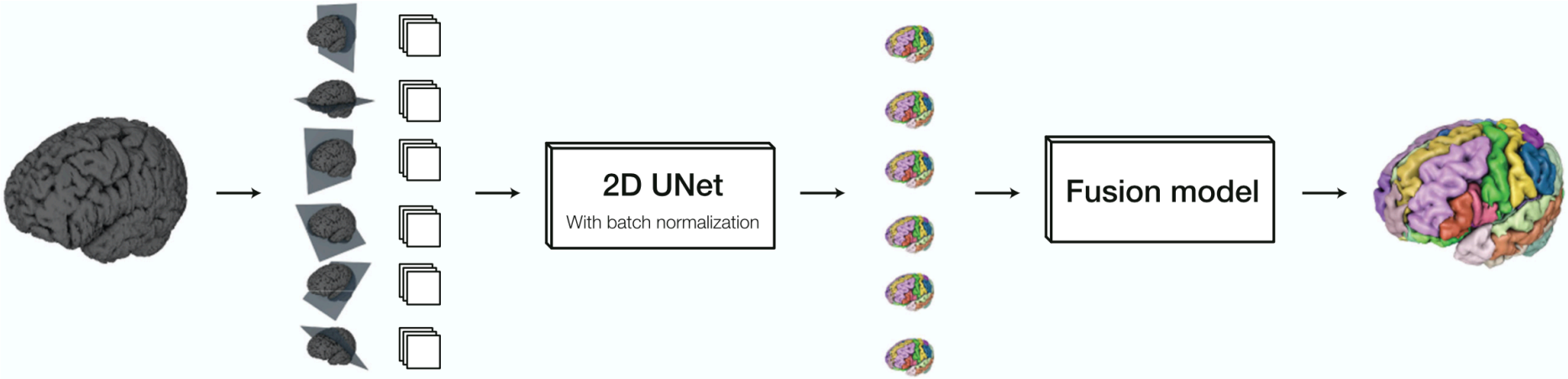
One Network to Segment Them All: A General, Lightweight System for Accurate 3D Medical Image Segmentation (MICCAI 2019)

- Often not clear how the resulting pipeline transfers to different tasks
- Proposed method requires no task-specific information
- Took part in Medical Segmentation Decathlon 2018

Multi-Planar UNet

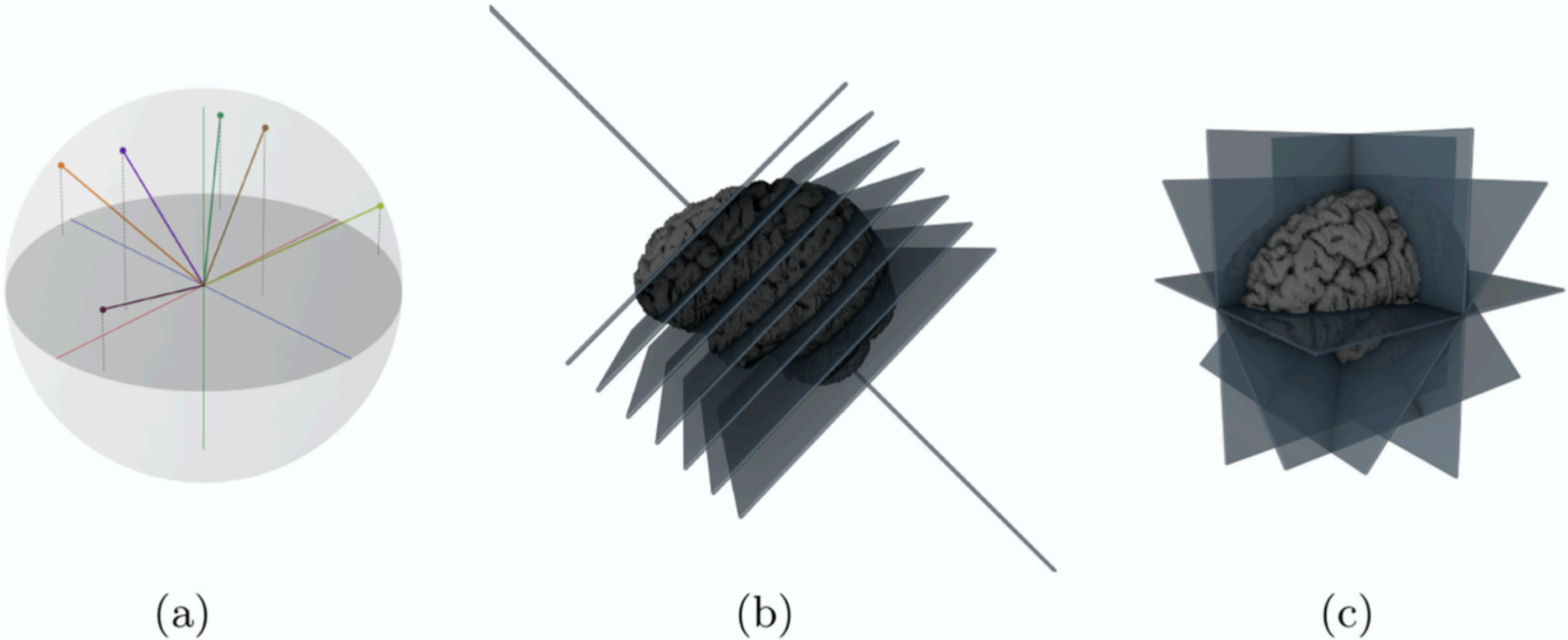
Pipeline

- i Planar slices (i=6)
- fuse 6 probability maps



Multi-Planar UNet

Apply random rotation set minimum angle



Multi-Planar UNet

Experiment on Medical Segmentation Decathlon and another 3 tasks

Dataset	Modality	Segmentation target(s)	Classes	Size	F1 score
MICCAI	MRI	Whole-Brain	135	35	0.74 ± 0.03
HarP	MRI	L+R Hippocampus	3	135	0.85 ± 0.03
OAI	MRI	Knee Cartilages	7	176	0.87 ± 0.06
2018 Medical Segmentation Decathlon					
Task 1	MRI	Brain Tumours	4	750	0.60 ± 0.24
Task 2	MRI	Cardiac, Left Atrium	2	30	0.89 ± 0.09
Task 3	CT	Liver & Tumour	2	201	0.76 ± 0.18
Task 4	MRI	Hippocampus ROI	2	394	0.89 ± 0.04
Task 5	MRI	Prostate	3	48	0.78 ± 0.10
Task 6	CT	Lung Tumours	2	96	0.59 ± 0.23
Task 7	CT	Pancreas & Tumour	3	420	0.48 ± 0.21
Task 8	CT	Hepatic Ves. & Tumour	3	443	0.49
Task 9	CT	Spleen	2	61	0.95
Task 10	CT	Colon Cancer	2	190	0.28

Multi-Planar UNet

Conclusion

- Simple mechanism for obtaining accurate segmentation
- Consider the drawback of 2D convolution
- No bells and whistles

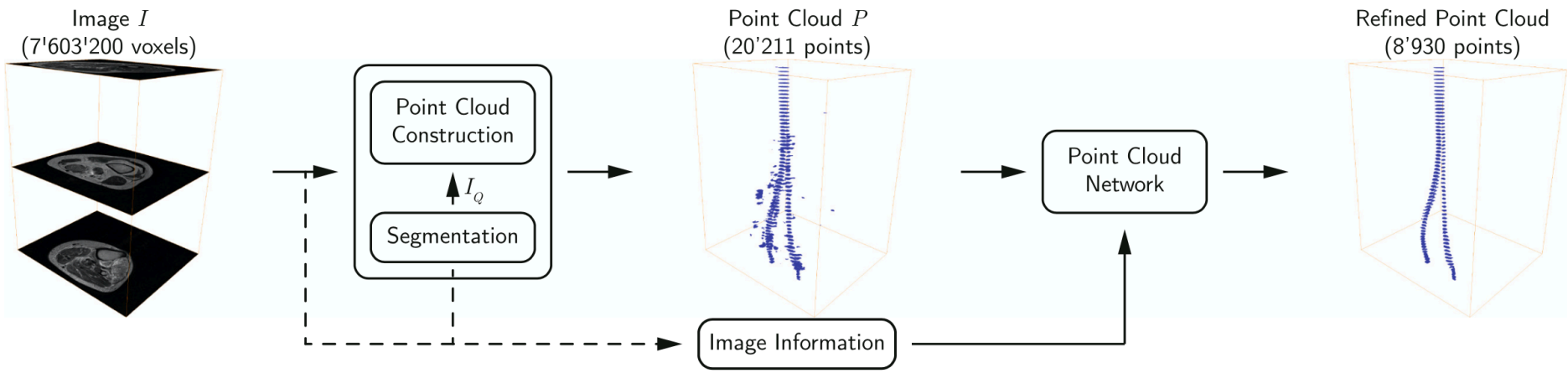
Point Cloud Segmentation

Learning Shape Representation on Sparse Point Clouds for Volumetric Image Segmentation (MICCAI 2019)

- Sparsity of point clouds allows processing of entire image volumes
- Balance highly imbalanced segmentation problems
- Build upon PointCNN

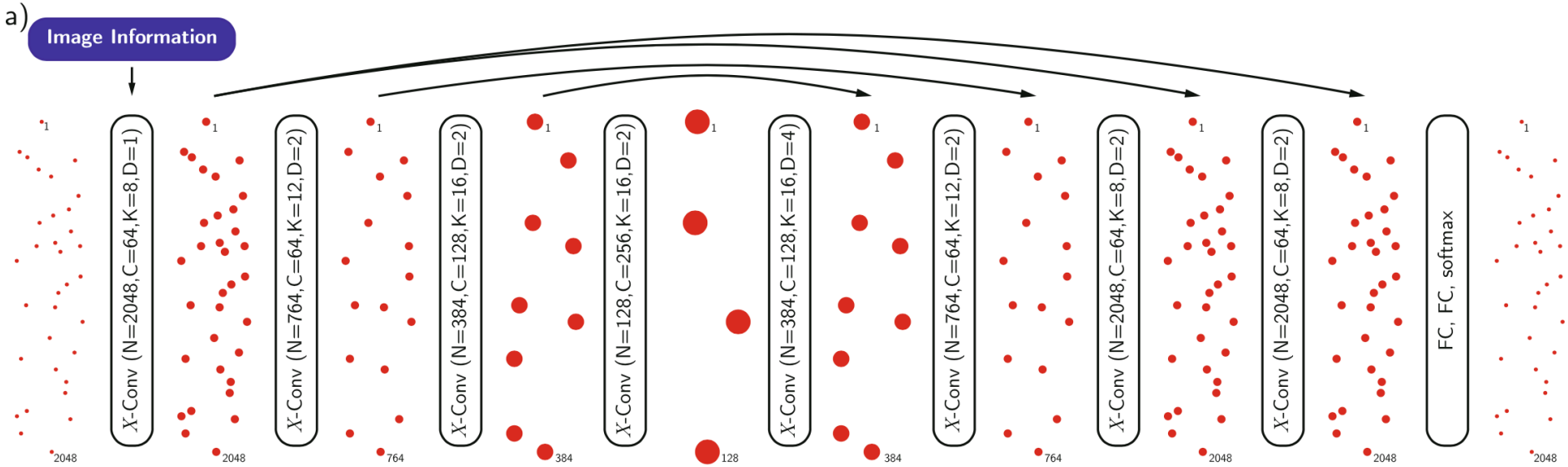
Point Cloud Segmentation

Peripheral Nerve: Tubular-like anatomical shape



Point Cloud Segmentation

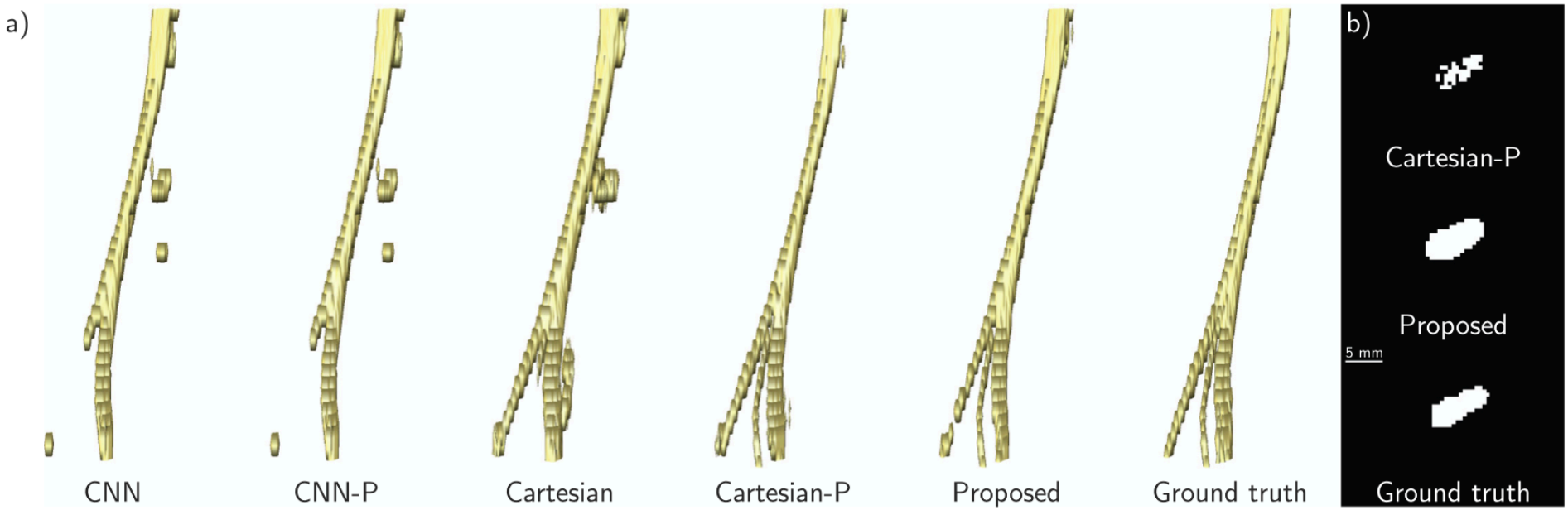
PointCNN



N: number of points, C: number of features, K: number of neighbor points, D: dilation rate, FC: fully-connected layer

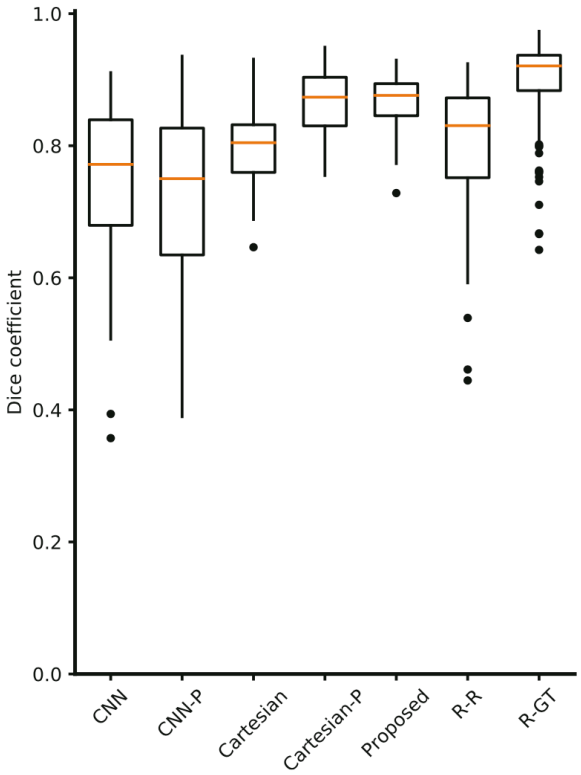
Point Cloud Segmentation

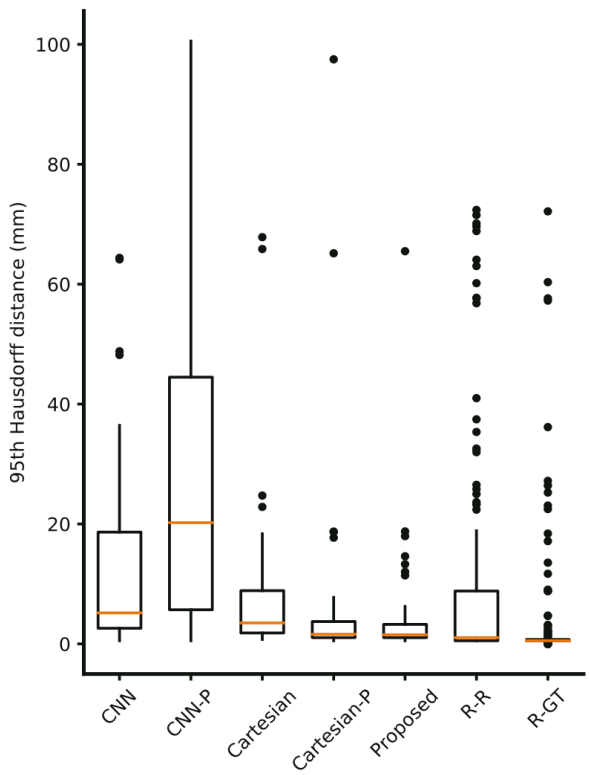
Result Visualization

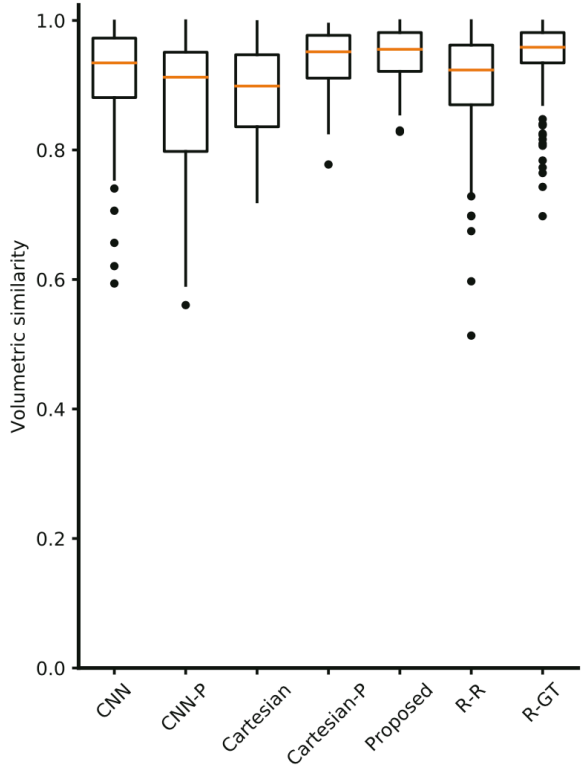


Point Cloud Segmentation

Ablation study







Point Cloud Segmentation

Conclusion

- Overcome common challenges in CNN-based segmentation
- Point cloud representation