



Wire-Cell ProtoDUNE Local Meeting

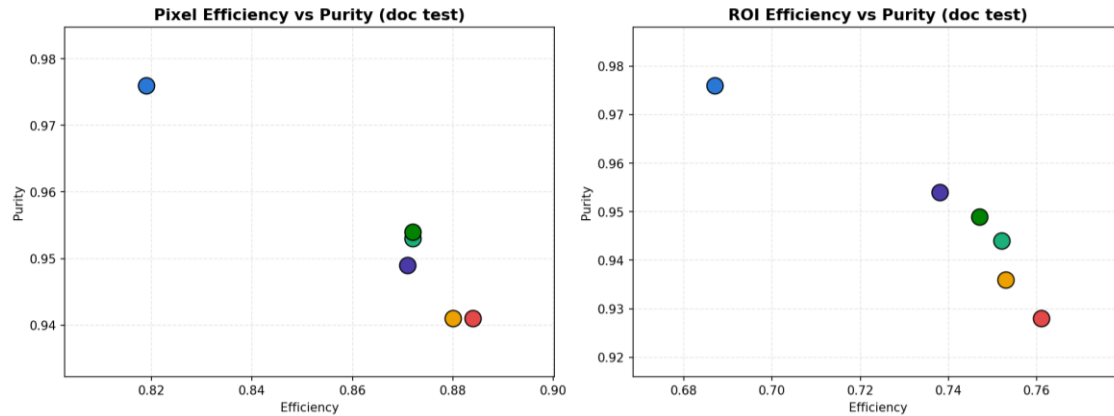
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Aug19, 2026 (Wed)

Wire-Cell DNNROI

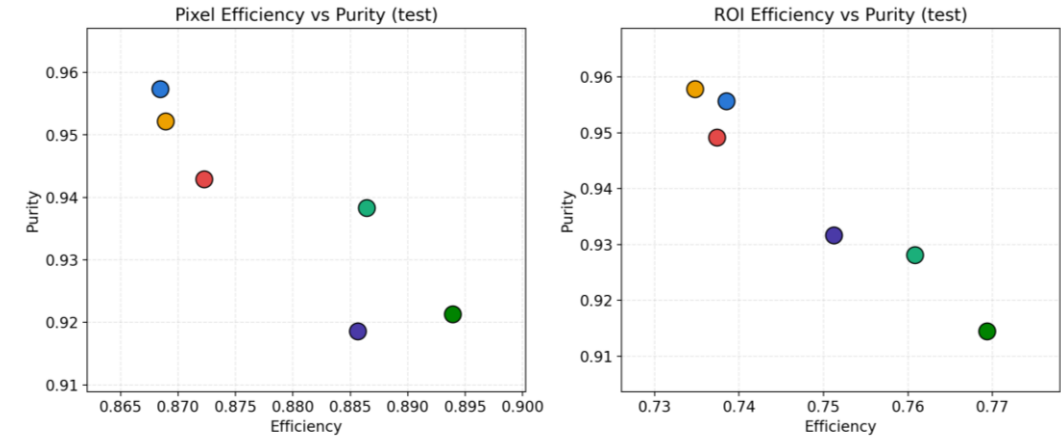
PDHD KD Validation

Baseline (no KD) UNet+A NestedUNet+A Transformer+A NestedUNet+B Transformer+C

- Original Xin's results



- Previous results
- The trend was not matched...



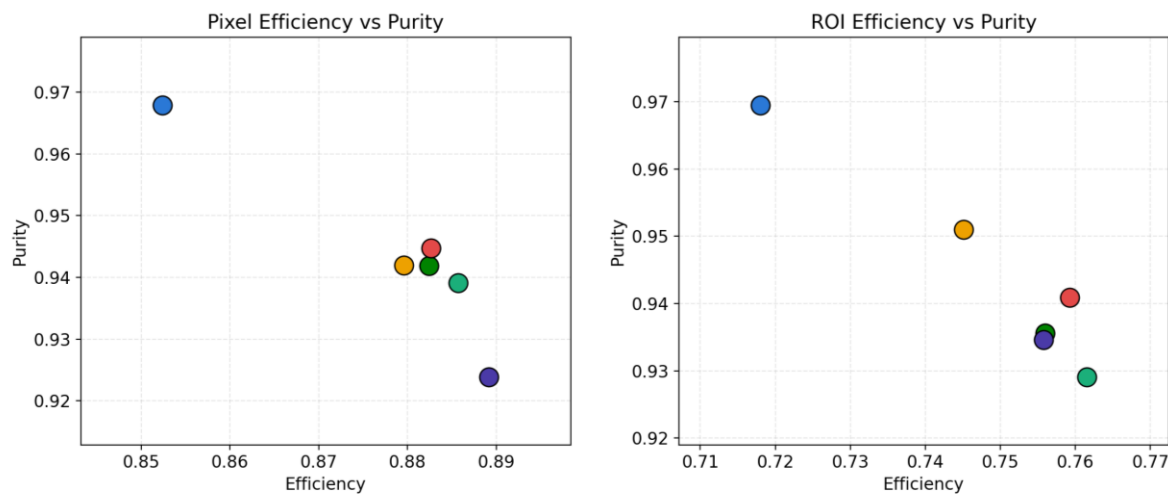
Motivation for KD

- Student model (MobileUNetV3) is more conservative than teacher models.
- Distilling teacher architectures improves model efficiency at a slight cost of purity.
- Purity loss can be compensated for in the subsequent pipeline.
- Transformer with feature distillation (Strategy C) shows the best performance with highest ROI efficiency

Wire-Cell DNNROI

PDHD KD

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- New training results on SDCC
- The trend become similar.
- The highest ROI efficiency model is changed to **U-Net+A**, while **Transformer+C** wins 3 metrics.

-> Keep these two model.

Metric	Baseline	UNet+A	NestedUNet+A	Transformer+A	NestedUNet+B	Transformer+C
ckpt epoch	53	60	89	97	86	85
loss	0.00297	0.00292	0.00296	0.00292	0.00294	0.00291
Dice	0.9069 (+1.6%)	0.9116 (+0.1%)	0.9099 (+0.1%)	0.9116 (+0.1%)	0.9068 (-0.1%)	0.9129 (+0.2%)
Pixel Efficiency	0.8535 (+3.5%)	0.8864 (+1.4%)	0.8807 (+0.1%)	0.8839 (+1.2%)	0.8898 (+1.9%)	0.8832 (-0.1%)
Pixel Purity	0.9676 (-0.8%)	0.9384 (-1.5%)	0.9413 (+0.0%)	0.9413 (-1.3%)	0.9245 (-2.5%)	0.9447 (+0.4%)
ROI Efficiency	0.7179 (+3.1%)	0.7608 (+0.9%)	0.7444 (-0.9%)	0.7562 (+0.9%)	0.7545 (+1.7%)	0.7592 (-0.2%)
ROI Purity	0.9689 (-0.7%)	0.9281 (-1.6%)	0.9503 (+1.4%)	0.9365 (-1.3%)	0.9347 (-1.9%)	0.9408 (+1.3%)

Metric	1st	2nd
loss (lower is better)	Transformer+C	UNet+A / Transformer+A
Dice	Transformer+C	UNet+A / Transformer+A
Pixel Efficiency	NestedUNet+B	UNet+A
Pixel Purity	Transformer+C	NestedUNet+A / Transformer+A
ROI Efficiency	UNet+A	Transformer+C
ROI Purity	NestedUNet+A	Transformer+C

Backup