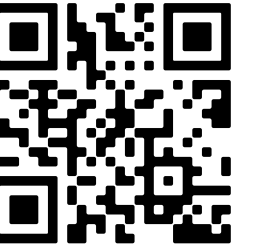


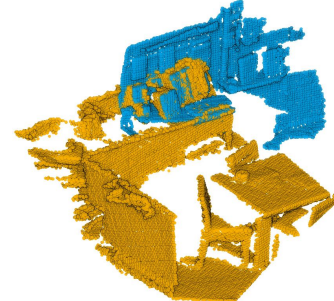


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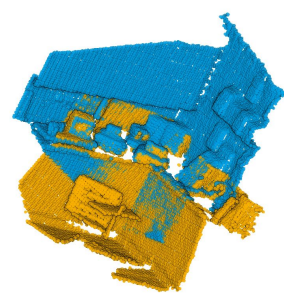


Motivation

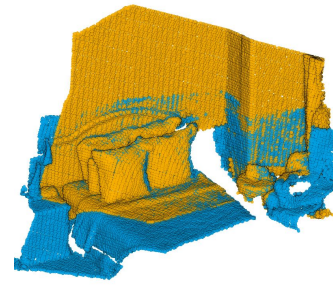
- Performance drop in low overlap regime
- Sampling interest points in overlap region recovers performance drop



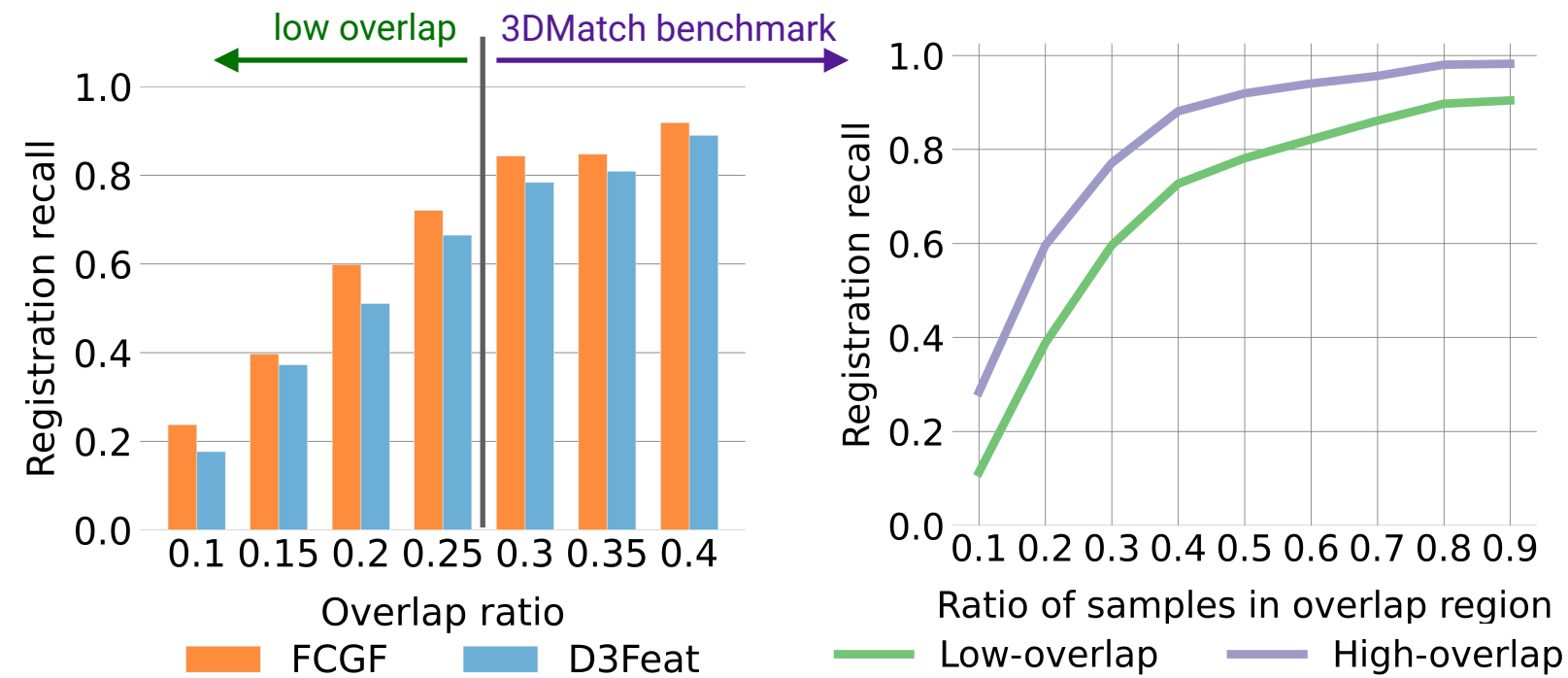
overlap ratio = 0.1



overlap ratio = 0.3

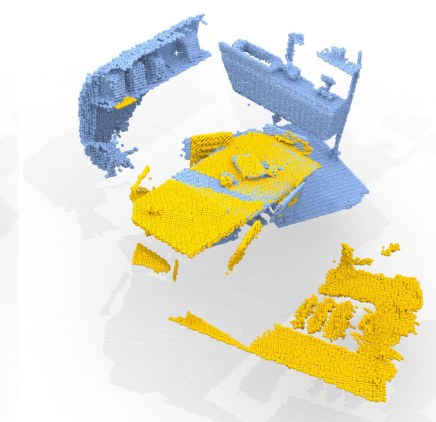
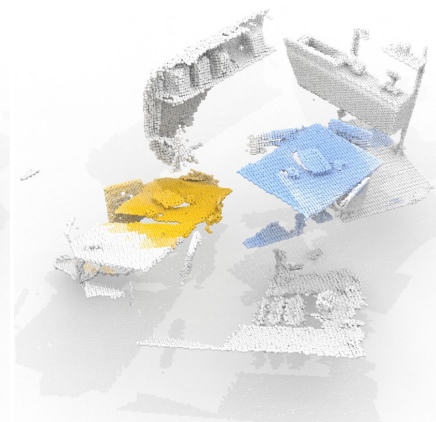
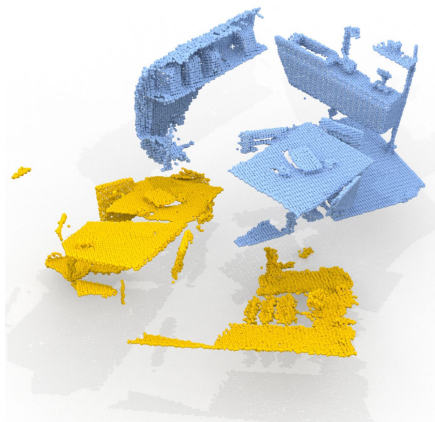


overlap ratio = 0.5

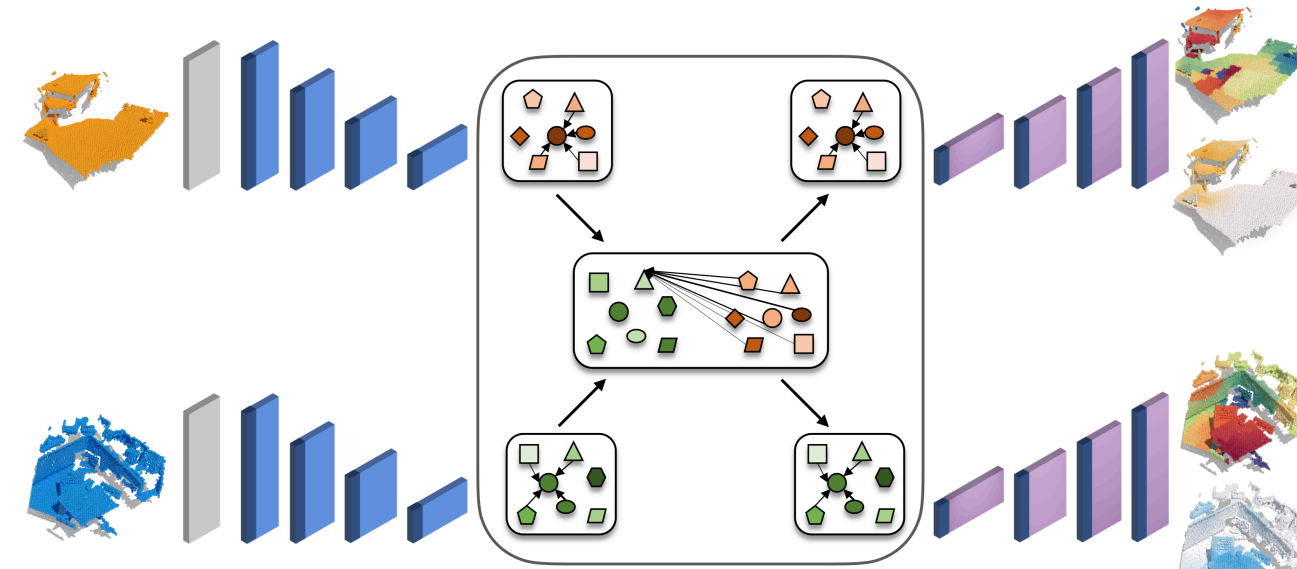


PREDATOR

- Point Cloud Registration with Deep ATtention to Overlap Region
- Predict point-wise features, overlap and matchability scores
- Probabilistic interest point sampling over the product of overlap and matchability scores



Network architecture



Overlap attention module

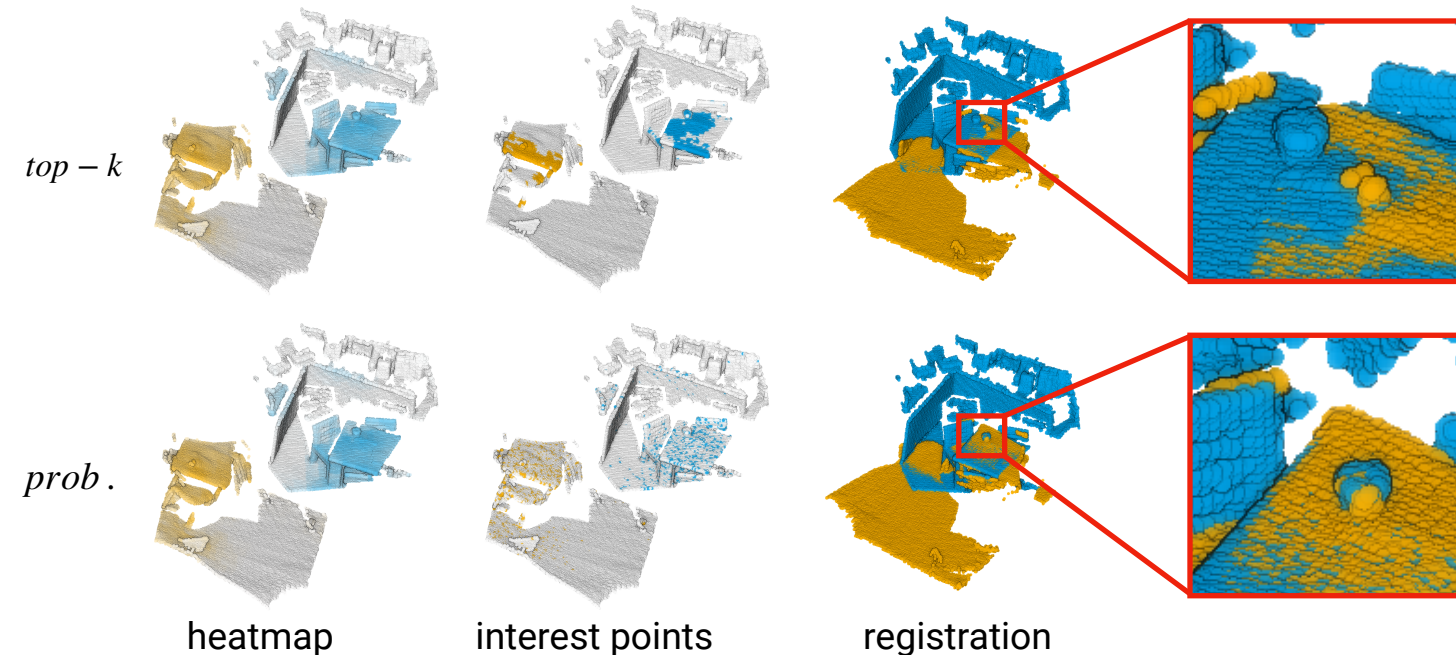
- Self-attention GNN to further aggregate local context
- Cross-attention transformer to learn co-contextual information
- Self-attention GNN to smooth out conditioned features and overlap scores

$$\text{Loss} = L_{\text{features}} + L_{\text{overlap}} + L_{\text{matchability}}$$

- Circle loss for metric learning
- Weighted BCE loss for overlap and matchability scores

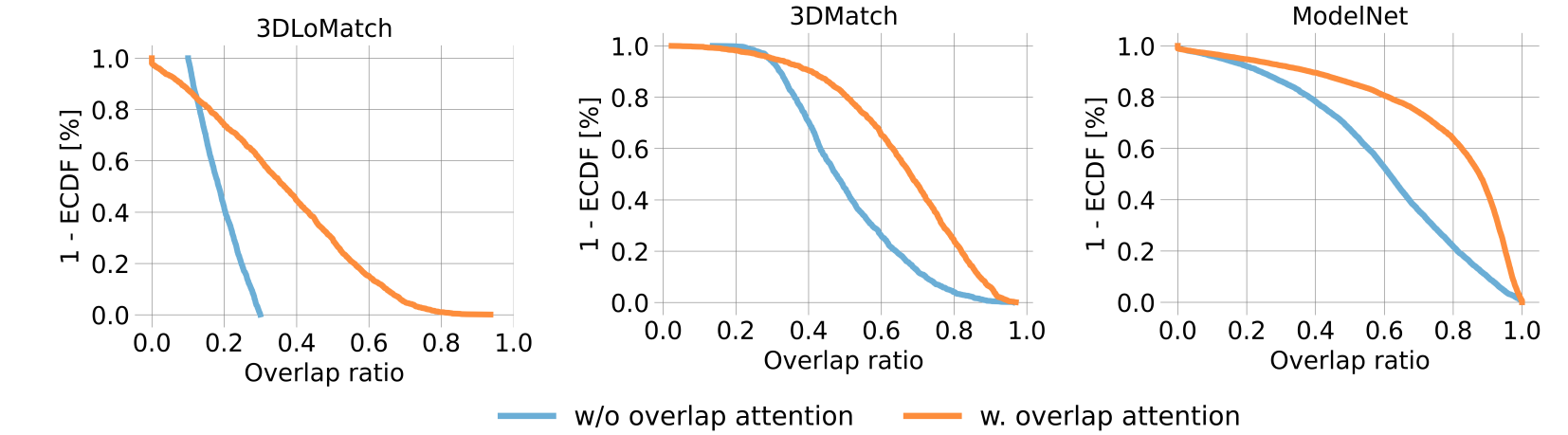
Interest point sampling

- Probabilistic sampling outperforms top-k sampling



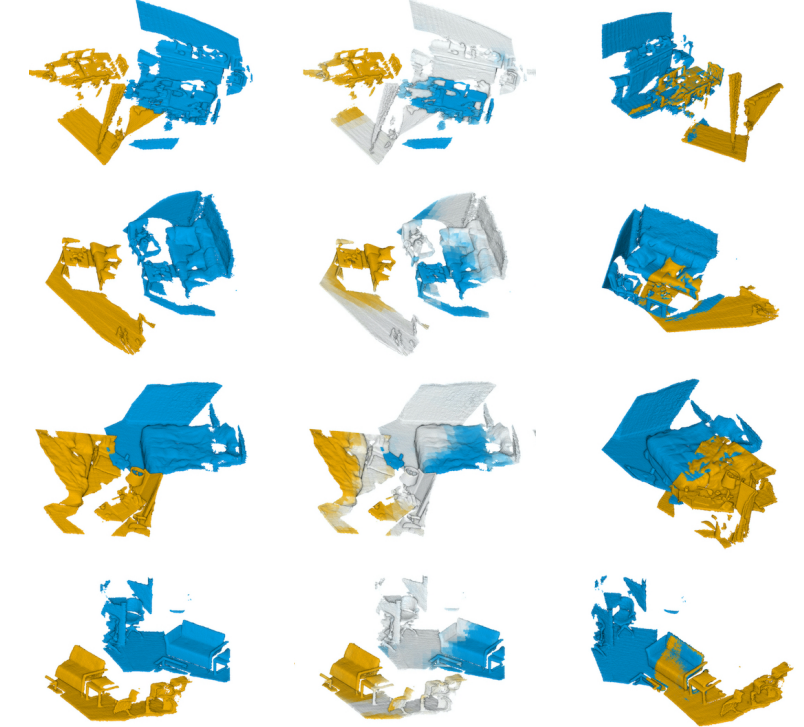
Experimental results

- Increased overlap ratio by filtering non-overlapping points



- 3DMatch: Indoor scans from RGB-D fusion

# Samples	3DMatch					3DLoMatch				
	5000	2500	1000	500	250	5000	2500	1000	500	250
Registration Recall (%)										
3DSN	78.4	76.2	71.4	67.6	50.8	33.0	29.0	23.3	17.0	11.0
FCGF	85.1	84.7	83.3	81.6	71.4	40.1	41.7	38.2	35.4	26.8
D3Feat	81.6	84.5	83.4	82.4	77.9	37.2	42.7	46.9	43.8	39.1
PREDATOR	88.3	88.3	89.0	88.4	84.7	54.2	55.8	56.7	56.1	50.7
bigPREDATOR	88.4	89.9	88.8	88.7	85.0	58.0	58.3	57.7	56.8	51.8



- Ablation study

overlap attention				3DMatch			3DLoMatch		
	ov.	× ov.	cond.	FMR	IR	RR	FMR	IR	RR
				96.4	39.6	82.6	72.2	14.5	38.9
✓				96.2	47.2	86.9	71.8	18.0	50.9
✓	✓			96.1	47.8	87.3	69.5	15.8	48.4
✓		✓		95.5	46.4	87.1	73.0	17.6	54.4
✓	✓	✓		96.6	49.9	88.3	71.7	20.0	54.2

- odometryKITTI: Outdoor scans from 64-beam Velodyne scanner

Method	RTE [cm] ↓	RRE [°] ↓	RR ↑
3DFeat-Net	25.9	0.57	96.0
FCGF	9.5	0.30	96.6
D3Feat*	7.2	0.30	99.8
PREDATOR (rand)	8.9	0.36	99.6
PREDATOR (prob. om)	6.8	0.27	99.8



- Modelnet: Object-centric synthetic dataset from CAD models

Methods	ModelNet			ModelNet		
	RRE	RTE	CD	RRE	RTE	CD
DCP-v2	11.975	0.171	0.0117	16.501	0.300	0.0268
RPM-Net	1.712	0.018	0.00085	7.342	0.124	0.0050
PREDATOR (rand)	2.923	0.034	0.00122	11.585	0.181	0.0104
PREDATOR (prob. om)	1.856	0.019	0.00088	5.462	0.133	0.0079

