Identity-aware Language Gaussian Splatting for Open-vocabulary 3D Semantic Segmentation

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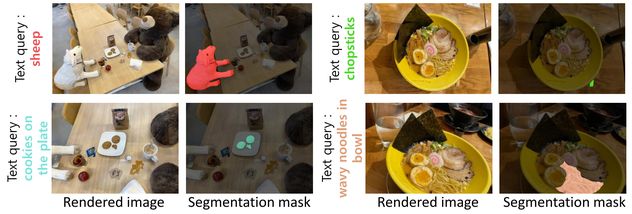
ICCV OCT 19-23, 2025 HONOLULU HAWAII

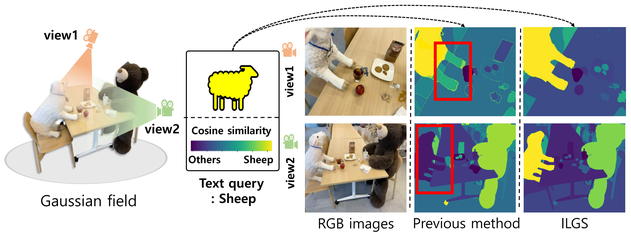
Task

- **Open-vocabulary Semantic Segmentation**
  - OVSS in Gaussian Splatting generates semantic segmentation masks from text queries

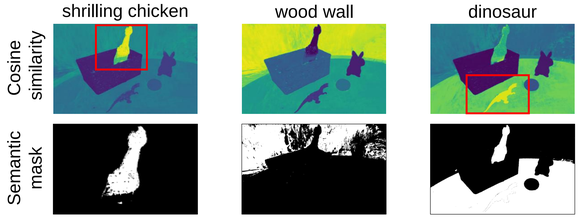


Motivation

- **Challenge in Open-vocabulary Segmentation**
  - CLIP features across different views lack multi-view consistency : inaccurate semantic masks

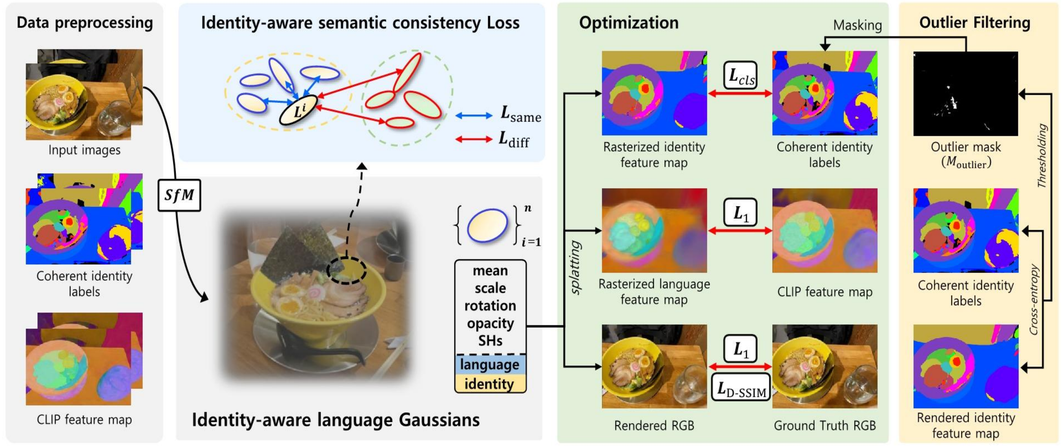


  - Fixed-threshold mask generation : inaccurate and imprecise boundaries



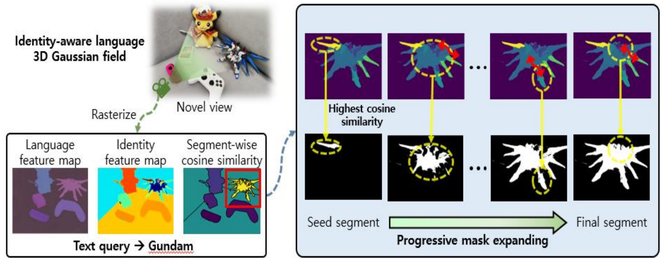
Proposed Method

- **Key Idea : Identity-aware Language Gaussian Splatting**
  - Enforce multi-view consistency of language embeddings through identity

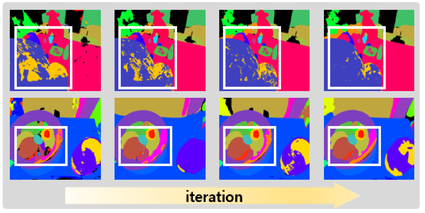


Overall Architecture

- **Progressive Mask Expanding Scheme**
  - Start from the seed segment and iteratively add neighbors for accurate boundaries



- **Outlier Filtering**
  - Excludes unreliable identity regions during training



The outlier filtering process

Results

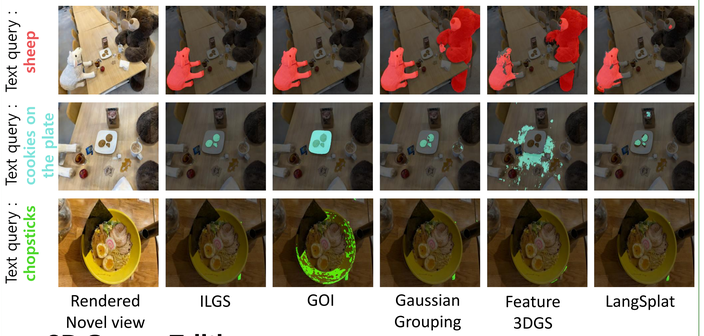
- **Quantitative Results on Benchmark Datasets**
  - Comparison on LERF-mask dataset

Methods	Figurines		teatime		ramen		Avg.	
	mIoU	mBIoU	mIoU	mBIoU	mIoU	mBIoU	mIoU	mBIoU
LangSplat	52.8	50.5	69.5	65.6	50.4	44.7	57.6	53.6
Feature-3DGS	58.8	52.5	40.5	36.8	43.7	38.3	47.7	45.7
Gaussian Grouping	69.7	67.9	71.7	66.1	77.0	68.7	72.8	67.6
GOI	63.7	-	44.5	-	52.6	-	53.6	-
Ours	**75.9**	**73.8**	**81.2**	**78.8**	**84.3**	**75.5**	**80.5**	**76.0**

  - Comparison on 3D-OVS dataset

Methods	bed	bench	room	sofa	lawn	Avg.
LangSplat	92.5	94.2	**94.1**	90.0	**96.1**	93.4
Feature-3DGS	83.5	90.7	84.7	86.9	93.4	87.8
Gaussian Grouping	83.0	91.5	85.9	87.3	90.6	87.7
GOI	89.4	92.8	91.3	85.6	94.1	90.6
Ours	**96.4**	**95.5**	93.6	**92.2**	94.2	**94.4**

- **Qualitative Results on Benchmark Datasets**



- **3D Scene Editing**