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SpectralWaste Dataset: Multimodal Data for Waste Sorting Automation

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Waste classification is challenging and additional modalities can bring valuable information, but there is a lack of openly available multimodal datasets.



Data Capture and Annotation

2 synchronized line-scan cameras

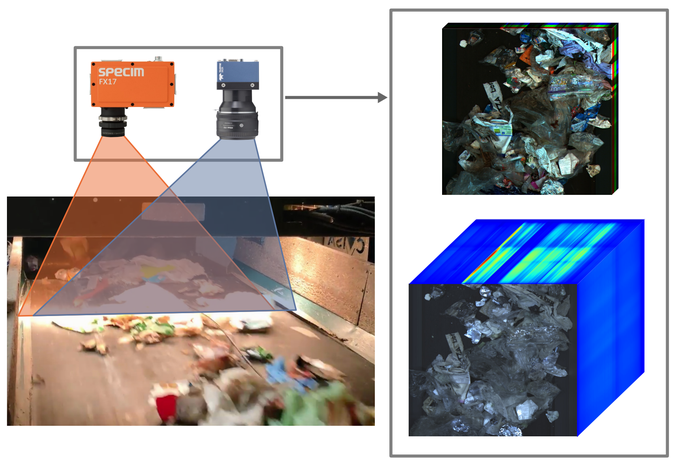
RGB (Teledyne DALSA Linea)

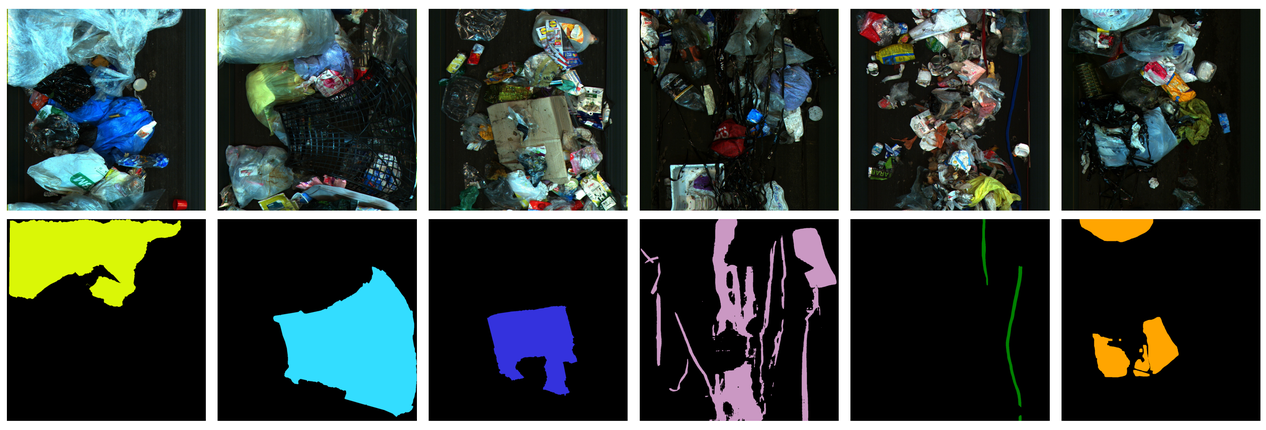
Hyperspectral (Specim FX17)
224 bands from 900 to 1700 nm

7655 non-overlapping multimodal images

2059 annotated instances

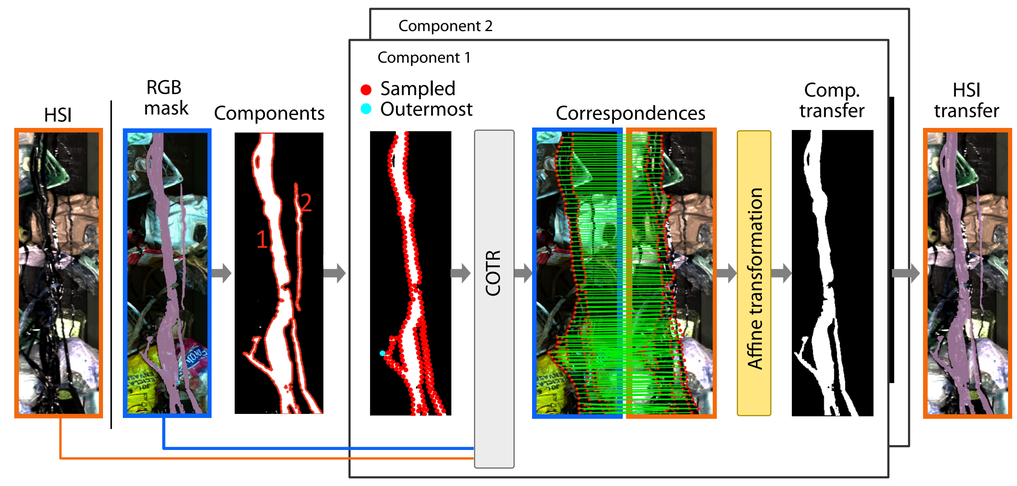
6 object classes





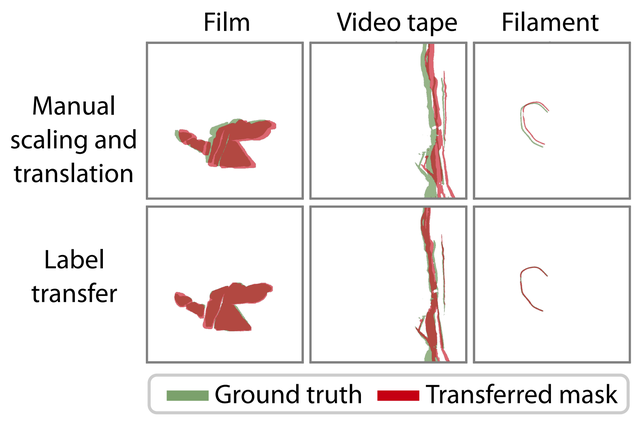
Label Transfer Between Modalities

We propose a label transfer method to facilitate multimodal data annotation with non-calibrated cameras.



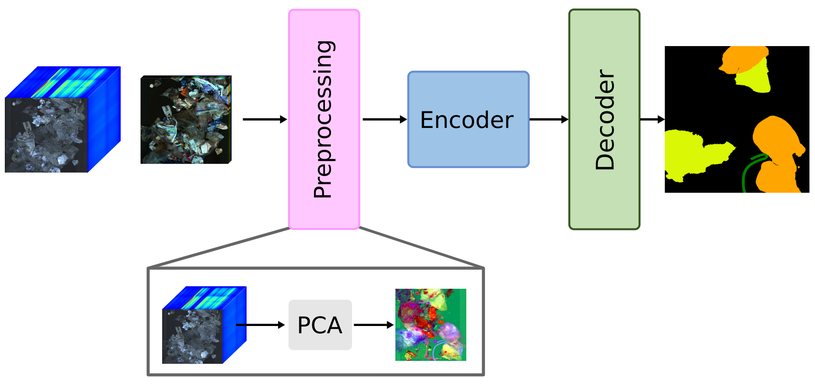
Approach

- Sample the contour of each mask annotated in one modality
- Use COTR [1] to find the corresponding points in the other modality
- Calculate an affine transformation for the mask

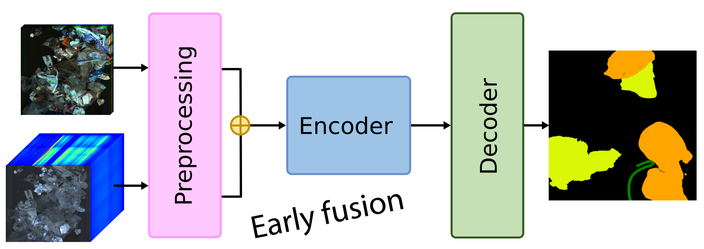


Proposed Segmentation Baselines

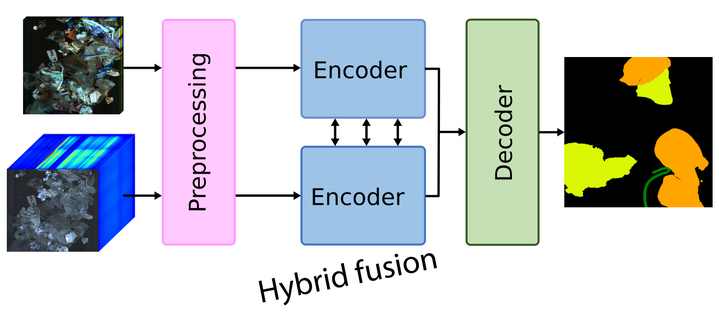
MiniNet-v2 [2] and SegFormer [3]



Multimodal MiniNet-v2 and multimodal SegFormer



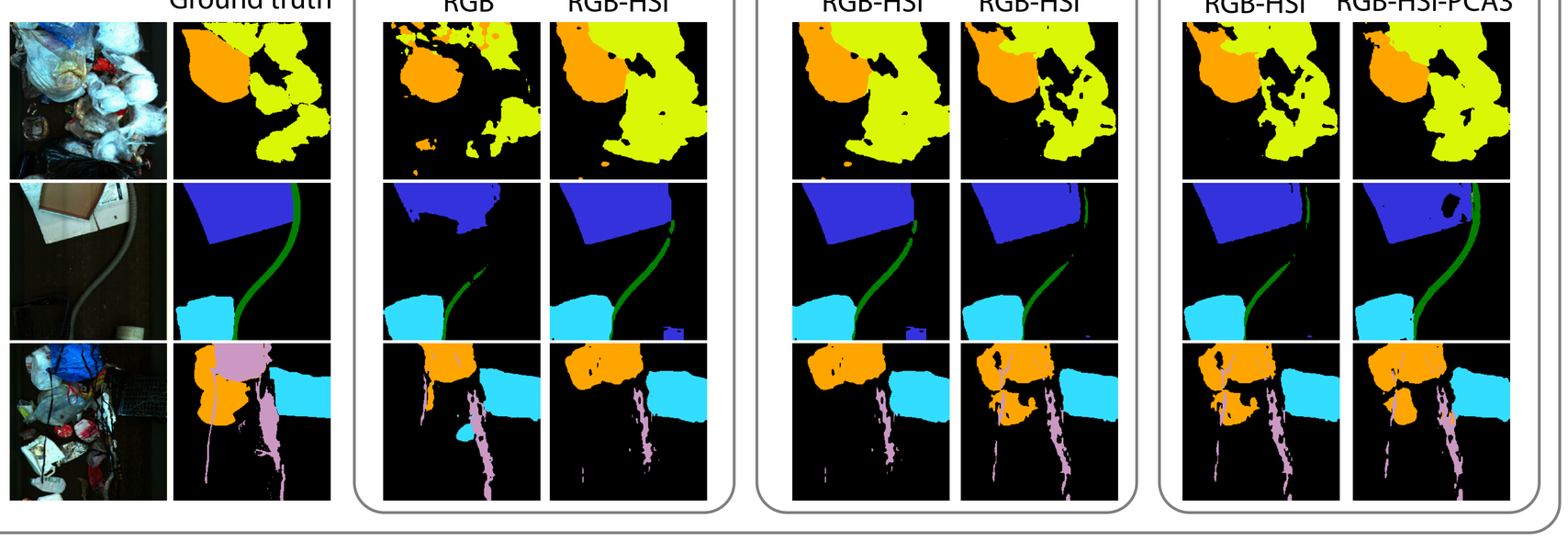
CMX [4]



Quantitative results

	Backbone	Modality	mIoU (%)
Unimodal	MiniNet-v2	RGB	44.5
	MiniNet-v2	HSI	52.8
	MiniNet-v2	HSI-PCA3	49.0
	SegFormer-B0	RGB	48.4
	SegFormer-B0	HSI	**54.3**
	SegFormer-B0	HSI-PCA3	45.5
Multimodal	MiniNet-v2	RGB-HSI	49.1
	MiniNet-v2	RGB-HSI-PCA3	41.7
	SegFormer-B0	RGB-HSI	**53.6**
	SegFormer-B0	RGB-HSI-PCA3	48.5
	CMX-B0	RGB-HSI	**58.2**
	CMX-B0	RGB-HSI-PCA3	56.6

Qualitative results



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References

[1] W. Jiang et al. COTR: Correspondence transformer for matching across images, International Conference on Computer Vision, 2021

[2] I. Alonso et al. MiniNet: An efficient semantic segmentation ConvNet for real-time robotic applications, IEEE Transactions on Robotics, 2020

[3] E. Xie et al. SegFormer: Simple and efficient design for semantic segmentation with transformers. Advances in Neural Information Processing Systems, 2021

[4] J. Zhang et al. CMX: Cross-modal fusion for RGB-X semantic segmentation with transformers, IEEE Transactions on Intelligent Transportation Systems, 2023

Project website →

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https://sites.google.com/unizar.es/spectralwaste