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Benchmark dataset and classification of marine plastic waste acquired by a remote hyperspectral imaging system embedded on an aquatic drone

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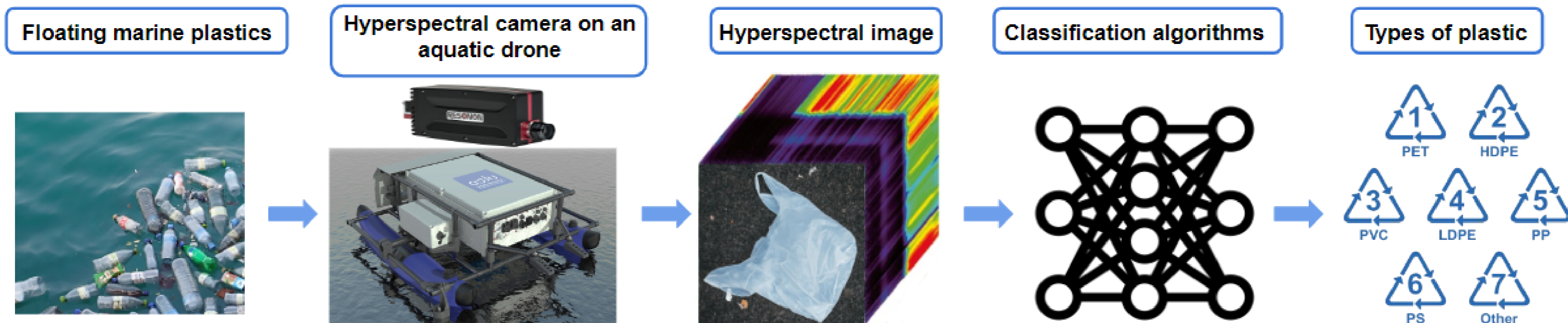
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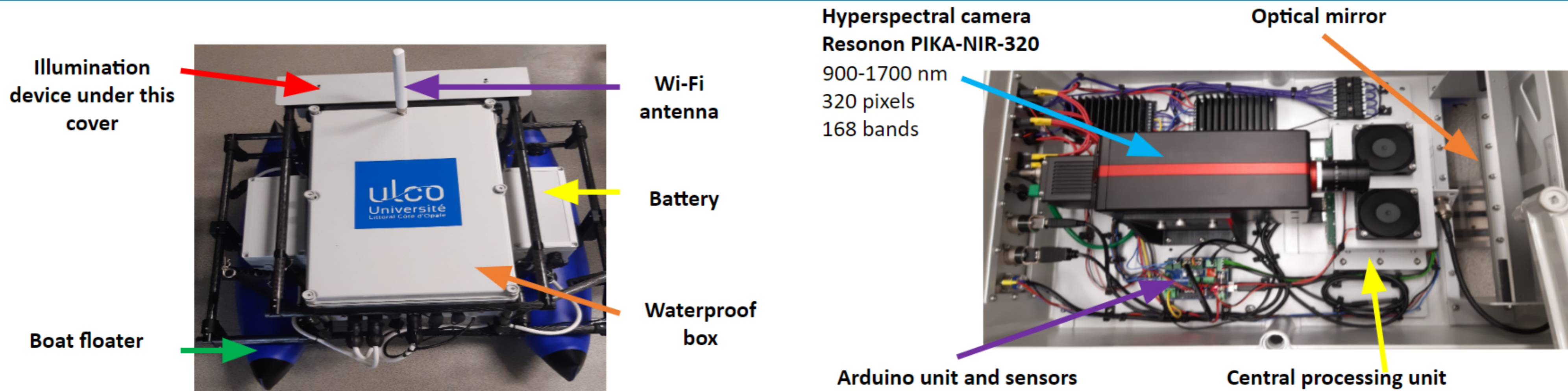
4- Laboratoire d'Hydrodynamique Marine, LHyMAR, IFREMER, 150 Quai Gambetta, F-62200 Boulogne-sur-Mer, France.

Introduction

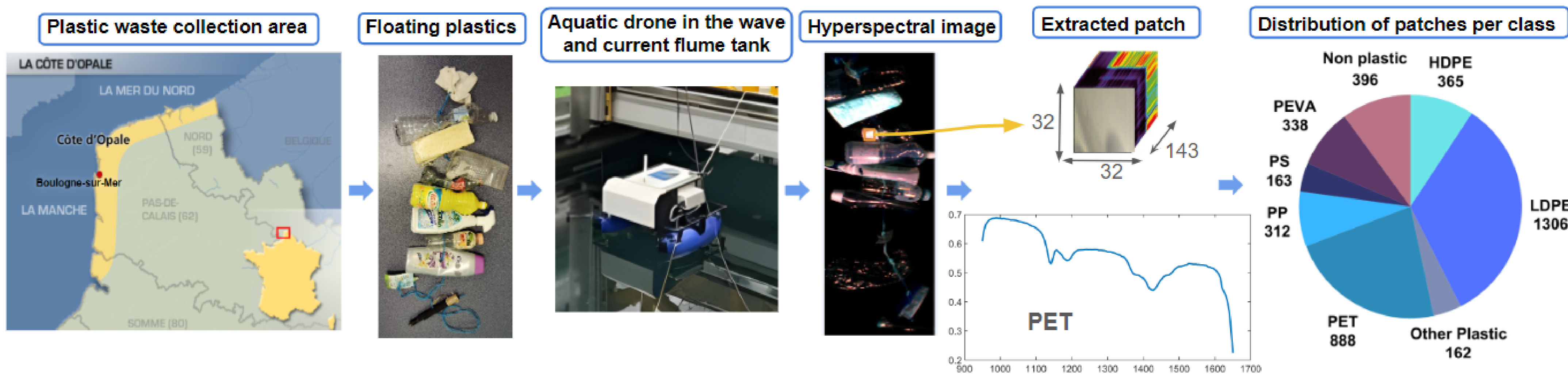
- ▶ The problem of marine debris, particularly plastic waste, presents significant challenges for environmental pollution.
- ▶ This work introduces a new benchmark dataset designed for the classification of floating plastic litter and captured by a remote hyperspectral imaging system [1].



Remote hyperspectral imaging system



Acquisition setup and dataset description



Results

- ▶ Machine learning classifiers based on the **spectral** signature of the patch and PCA:

Algorithm	NN	SVM	LR	NB	DT	RF	LDA
Accuracy	81.73%	70.93%	70.67%	66.13%	65.33%	80.67%	79.47%
Dimension	23	23	37	93	16	38	110

- ▶ **Spatial** handcrafted texture descriptors [2]:

Descriptor	LBP mar	LBP mar+opp	ILBP mar	ILBP mar+opp	RI_ULBP mar	RI_ULBP mar+opp	ODLBP
Accuracy	52.53%	75.47%	54.13%	74.80%	47.47%	78.27%	53.60%

- ▶ State-of-the-art **spectral and spatial** deep learning models:

Model	Four Layers CNN [3]	SegnetEncoder [4]	S-CNN [4]	ResNet18 [4]
Accuracy	83.64%	79.87%	77.60%	84.41%

Acknowledgments

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Conclusion

- ▶ Deep learning models, particularly ResNet18, achieved superior accuracy of **84.41%** compared to traditional machine learning at 81.73% and handcrafted texture descriptors at 78.27% in classifying marine debris, indicating their effectiveness in analyzing both spectral and texture features.
- ▶ The dataset and experimental results provide valuable resources for researchers aiming to improve marine debris detection and identification techniques using hyperspectral imaging technology.
- ▶ Future works will involve expanding this dataset to include more diverse types of marine debris, varying environmental conditions, and larger geographical coverage. This expansion could improve model generalization and robustness for detecting plastic waste in real-world scenarios.

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