# SortWaste: A Densely Annotated Dataset for Object Detection in Industrial Waste Sorting
## Supplementary Material

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## 1. Introduction

This supplementary document provides illustrative examples corresponding to the different clutter levels defined by the ClusterScore metric introduced in the main paper. The purpose of these images is to illustrate how ClusterScore visually reflects varying levels of scene clutter.

## 2. Images Analysis with ClutterScore

To better illustrate how scene complexity varies across the SortWaste dataset, we apply the proposed ClutterScore metric to every image in the test set. Since ClutterScore is normalized to the interval [0, 1], we partition this continuous range into five discrete clutter levels, each reflecting progressively higher visual complexity. These levels are defined as follows:

- **Very Low Clutter (0.0–0.2)**: frames contain a few objects with minimal occlusion and low entropy in both class distribution and object sizes. These images typically represent the simplest detection scenarios (Figure 1).

- **Low Clutter (0.2–0.4)**: scenes exhibit a slightly higher number of objects and mild visual variability. Although some overlap may occur, the overall structure of the scene remains clean and easily interpretable (Figure 2).

- **Medium Clutter (0.4–0.6)**: this category corresponds to the most representative portion of the dataset. Images display increased object density, greater class diversity, and noticeable size variability. Moderate occlusions begin to emerge, making detection more challenging (Figure 3).

- **High Clutter (0.6–0.8)**: frames present visual complexity, with dense object arrangements, frequent occlusions, heterogeneous object sizes, and a wider mix of waste materials. These scenes highlight the limitations of current detectors under realistic industrial conditions (Figure 4).



**Very Low Clutter**

Figure 1. **Examples of very low clutter scenes from the test set.** Both frames contain few objects, representing the simplest visual configurations in the dataset.

- **Very High Clutter (0.8–1.0)**: this level represents extremely congested scenes with heavy overlap, high entropy across size and class distributions, and large numbers of objects. Although this range is theoretically defined, no test images in SortWaste fall within this interval.

After assigning each test frame to one of these clutter categories, we compile representative examples from the resulting groups.

### 2.1. Discussion of Clutter-Based Stratification

The visual examples across the different clutter levels illustrate how object density, occlusions, class diversity, and size variability progressively. These qualitative observations reinforce the importance of the metric: frames with higher clutter present more complex visual conditions, which directly affect the performance of object detectors. By stratifying the dataset according to ClutterScore, we provide an interpretable way to analyze how detection difficulty evolves with scene complexity, emphasizing the relevance of clutter-aware evaluation in real industrial environments.

**Low Clutter**

Figure 2. **Examples of low clutter scenes from the test set.** Frames in this group contain a higher number of objects, while the overall layout of the scene remains relatively clean and easy to interpret.



**Medium Clutter**

Figure 3. **Examples of medium clutter scenes from the test set.** These frames exhibit higher object density, class diversity, and noticeable variability in object sizes, making detection more challenging.



**High Clutter**

Figure 4. **Examples of high clutter scenes from the test set.** Frames in this group exhibit dense object arrangements, frequent occlusions, and heterogeneous object sizes, representing some of the most challenging detection conditions in the dataset.

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