HERA IPERSPETTRALE - APPLICATION NOTE

NIREOS

Plastic sorting for recycling

Pollution from plastic debris is becoming a major problem, not only for environmental concerns but also human health.

Plastic sorting is a crucial step in the recycling process, however identifying the various plastics amongst mixed plastic waste is currently impractical. Thanks to the HERA hyperspectral camera working in the SWIR region (900–1700 nm), it is possible to achieve precise identification of different types of plastic.

Our camera works on a staring technique allowing rapid analysis of many objects at the same time. The current study analyses three commonly used plastics: high density polyethylene (HDPE), polyethylene terephthalate (PET), and polystyrene (PS). A machine learning algorithm then distinguishes the spectral differences of the samples and classifies them precisely.

ADVANTAGES OF USING HERA

- Staring technique (ideal for static objects)
- High sensitivity
- Broad spectral range (900–2300 nm)
- High spatial and spectral resolution
- Plug & Play
- Non destructive measurements

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Test measurement :

All the measurements in this work were taken with HERA SWIR (900–1700 nm). In order to develop a classification algorithm for plastics, a single hyperspectral measurement was carried out on pieces of **HDPE, PET** and **PS**.

The SWIR spectral signatures of the three types of analysed plastics are shown in **Figure 1**. It is important to notice that these plastics would be indistinguishable in the visible region (400–700 nm), while they have specific absorption windows in the near-infrared region.

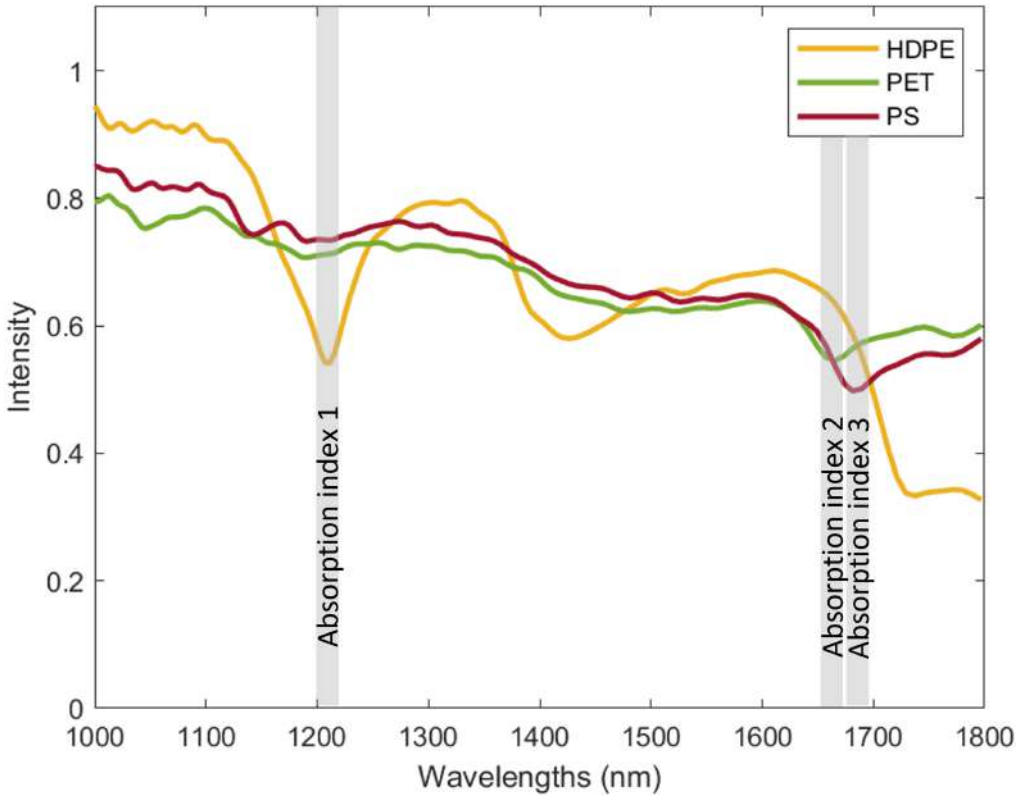

Figure 1 : Spectra of the analysed plastics

In the measured plastic samples, three indices related to different absorption peaks have been chosen as shown in **Figure 1**.

The samples are then mapped in a 3D plot according to the absorption indices. The results are shown in **Figure 2**.

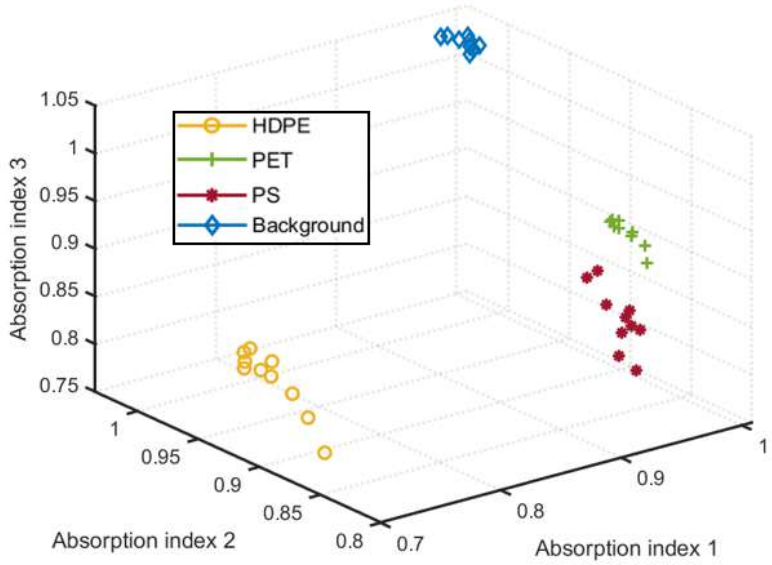

Figure 2 : Mapping of plastic samples according to the absorption indices

The indices were effective in clustering the different types of plastic. Following this, a machine learning algorithm was trained which was then used to classify a mixed sample of plastic pieces. The sample set is shown in **Figure 3**.

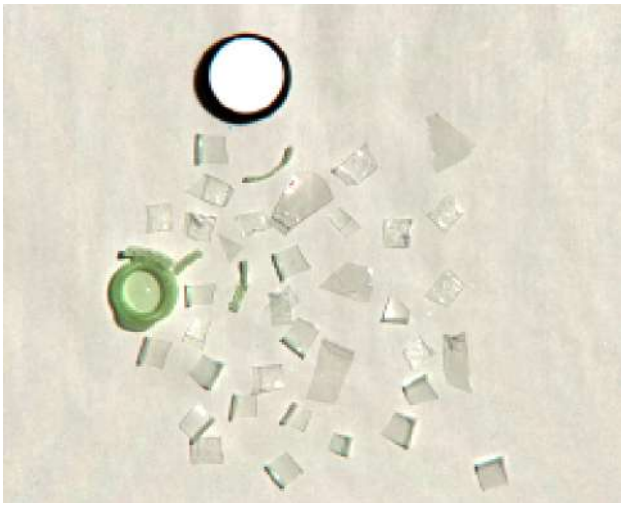

Figure 3: the plastics are indistinguishable in the visible region

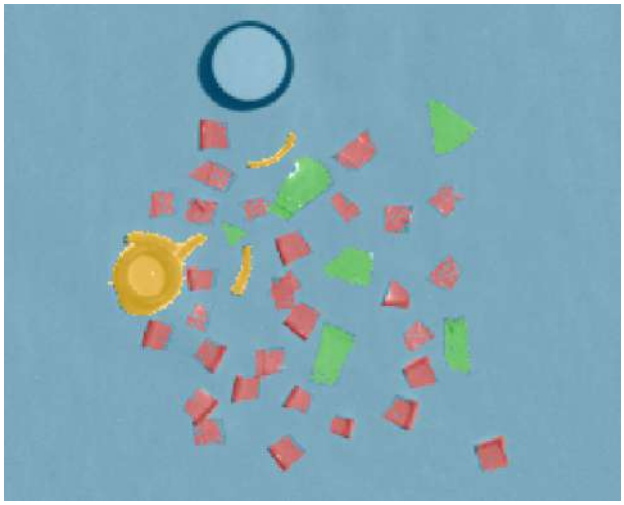

Figure 4 : Using HERA, the different plastics are easily categorised

Figure 4 shows the results of the classifying algorithm, which is effective in sorting the three types of plastic in the field of view.