

COMPASS-XP Dataset

Lewis D. Griffin*, Matthew Caldwell, Jerone T. A. Andrews
Computational Security Science Group, UCL

COMPASS-XP is a dataset of matched photographic and X-ray images of single objects, made available for use in Machine Learning & Computer Vision research, in particular in the context of transport security. Objects are imaged in multiple poses, and accompanied by metadata including labels for whether we consider the object to be **dangerous** in the context of aviation. Object classes overlap with those in the popular [ImageNet Large Scale Visual Recognition Challenge](#) class set and the [WordNet](#) lexical database, and identifiers for shared classes in both schemes are also provided.

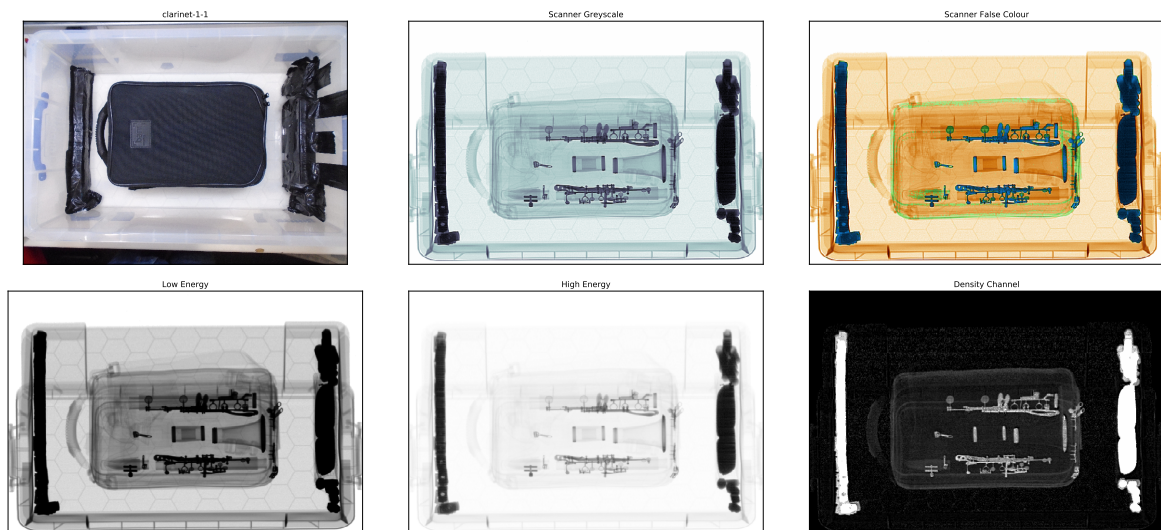


Figure 1: Example photograph and the corresponding five X-ray variants.

Hardware Configuration

Photographs were captured with a [Sony DSC-W800](#) compact digital camera. X-ray scans were obtained using a [Gilardoni FEP ME 536](#) mailroom X-ray machine, distributed in the UK by [Todd Research](#) under the name [TR50](#). The scanner is dual energy and generates several image outputs:

- **Low:** Raw 8-bit greyscale data from the scanner's low energy X-ray channel.
- **High:** Raw 8-bit greyscale data from the scanner's high energy X-ray channel.
- **Density:** 8-bit greyscale data representing inferred material density computed from the two channels.
- **Grey:** RGB PNG image representing a combination of both low and high energy channels with some appearance improvements. Although nominally greyscale, the image does include subtle

*Email: l.griffin@cs.ucl.ac.uk

duotone-style colouration.

- **Colour** RGB PNG image with false colour palette representing material density.

Examples of these different X-ray image variants are shown shown in Fig. 1, together with the corresponding photo. In practice the **grey** and **colour** versions are probably most useful, but for completeness the dataset includes all variants for each scan.

Data Files

Image files are supplied in six subdirectories, corresponding to the five X-ray image variants above plus photos. X-rays are provided in PNG format, while photos are JPEG. Each scan is identified by a numeric index, which is also used to name the file, padded with leading zeros to always be 4 digits long.

Scan metadata is provided in the accompanying tab-delimited text file, `meta.txt`. This includes the following columns:

- **basename**: The zero-padded identifier for the scan. All six image type variants for the same class-instance-pose have the same basename. X-ray files are named *basename.png* while photos are *basename.jpg*.
- **class**: The object class in the scan.
- **instance**: An integer identifying the object instance. Instances start at 1 for each class.
- **pose**: An integer identifying the object pose. Poses start at 1 for each instance.
- **scan_tray**: Either **A**, indicating that the pose was imaged in a weighted tray, or **N** indicating it was not.
- **dangerous**: Whether the object was considered dangerous (**True/False**).
- **IN_id**: Numeric index of the object class in the ILSVRC list of 1000 classes, or empty if the class isn't present there.
- **WN_id**: WordNet identifier for the object class, or empty if the class isn't present in WordNet.

License

The COMPASS-XP dataset was acquired as part of a research project funded by the UK Government [Future Aviation Security Solutions](#) programme. Both the images and their metadata are licensed under the [Creative Commons Attribution 4.0 International License](#) and may be freely used for research and commercial purpose, including derivative works, providing the source is acknowledged.