

# SF300 Dataset

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## 1 Introduction

The SF300 dataset consists of 512x512 pixels images, with 308353 images in 27502 classes in the train set, and 21844 images in 2421 classes in the test set. It has been constructed using raw high-resolution images provided by the Danish Institute of Data Supply and Efficiency Improvement (SDFE) in open-access. Each class corresponds to a real-world square footprint, and is composed of a varying number of either vertical (camera pointing the nadir direction) or oblique images (camera directed with known angle) of this geographical location.

### 1.1 Dataset construction

Following a whole country aerial acquisition by planes equipped with 5-angle cameras, the source images are available at the address <https://skraafoto.kortforsyningen.dk/>. We first collected all available high-resolution ( $\sim 100$ MP) images in a set of selected urban and semi-urban areas. Using the provided footprint coordinates, we matched n-tuples of images covering approximately the same zone. To enhance precision, we manually aligned the images by picking a common point for all images in each tuple. We then computed the homography matrices linking pixel coordinates to real-world coordinates for each image, which allowed an automated cropping of tuples into a varying number of smaller images of fixed size. Available parameters for the source images were propagated to the smaller images and stored in a .csv file for each class. This process was repeated on a smaller number of other locations to create the test set. Therefore there is no common class between the train set and the test set.

In this dataset, each location is represented with different orientations, sun angles, altitudes of images (which induces variations in geographic resolutions (*i.e.* the ground coverage of each pixel), and the azimuth is known. Figure 1 shows some examples of images of the dataset. We also plot the number of images per class in Figure 2.

The 5-angle cameras induce 5 possible vertical orientations for each location (vertical + four 45 degrees on the sides).

## 2 Statistics

### 2.1 Train set

Item	Value
Number of images	308353
Number of classes	27502
Min number of images per class	2
Max number of images per class	46
Mean number of images per class	11
Median number of images per class	9
Image file format	.jpg
Image dimension (width*height)	512*512
Disk usage	13 Go



Figure 1: Examples of images from the SF300 dataset. The images of the same row belong to the same class.

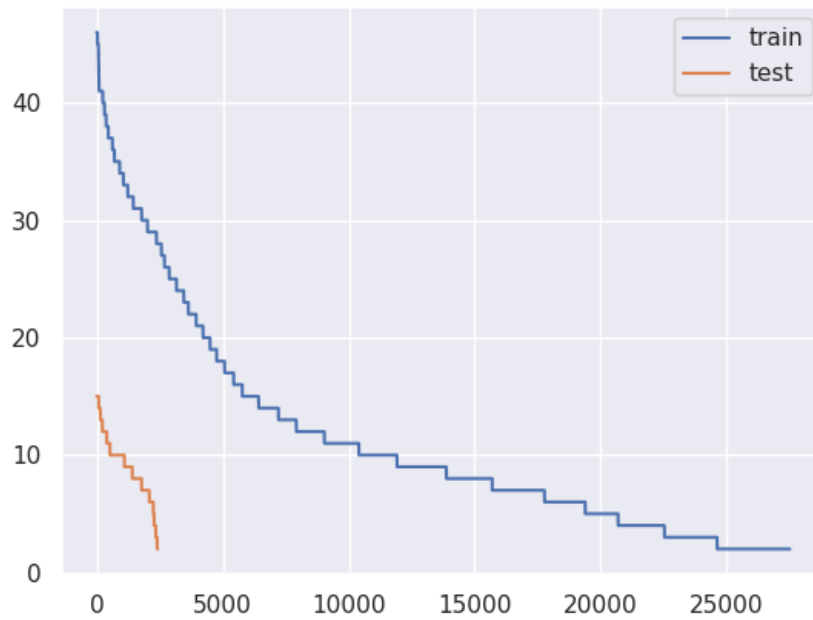


Figure 2: Distribution of the number of images per class in the SF300 dataset (x-axis denotes the class number ; y-axis denotes the number of images, with classes sorted from biggest to smallest class).

## 2.2 Test set

Item	Value
Number of images	21844
Number of classes	2421
Min number of images per class	2
Max number of images per class	15
Mean number of images per class	9
Median number of images per class	9
Image file format	.jpg
Image dimension (width*height)	512*512
Disk usage	1.2 Go

## 2.3 Attributes

The following attributes are available for each image in the dataset:

- Altitude (meters): altitude of the plane when the image was captured
- Omega (degrees): vertical orientation angle
- Phi (degrees): vertical orientation angle
- Orientation (0-5 integer): Quantized summary of Omega & Phi
- Kappa (degrees): azimuth angle
- Sun Angle (degrees): angle of the sun when the image was captured

Attributes omega & phi correspond to the two angles defining the vertical orientation of the camera. After quantization, these two parameters can be reduced to a single value stating the vertical orientation of the image, as shown on Figure 3. 0 is vertical ( $\omega=0^\circ$  and  $\phi=0^\circ$ ), and four other orientations are defined with tuples ( $\omega=0^\circ$ ,  $\phi=-45^\circ$ ), ( $\omega=0^\circ$ ,  $\phi=45^\circ$ ), ( $\omega=-45^\circ$ ,  $\phi=0^\circ$ ), ( $\omega=45^\circ$ ,  $\phi=0^\circ$ ). Value 5 is for all other orientations (rare cases of specific angle values). Table 1 shows the distribution of these values.

Image are all rotated to face north. The azimuth (kappa) is thus only an indication of how the plane was oriented when taking the picture but isn't visible on the images.

Figures 4, 5, 6, 7, 8, 9 additionally show graphical representation of attribute distributions.

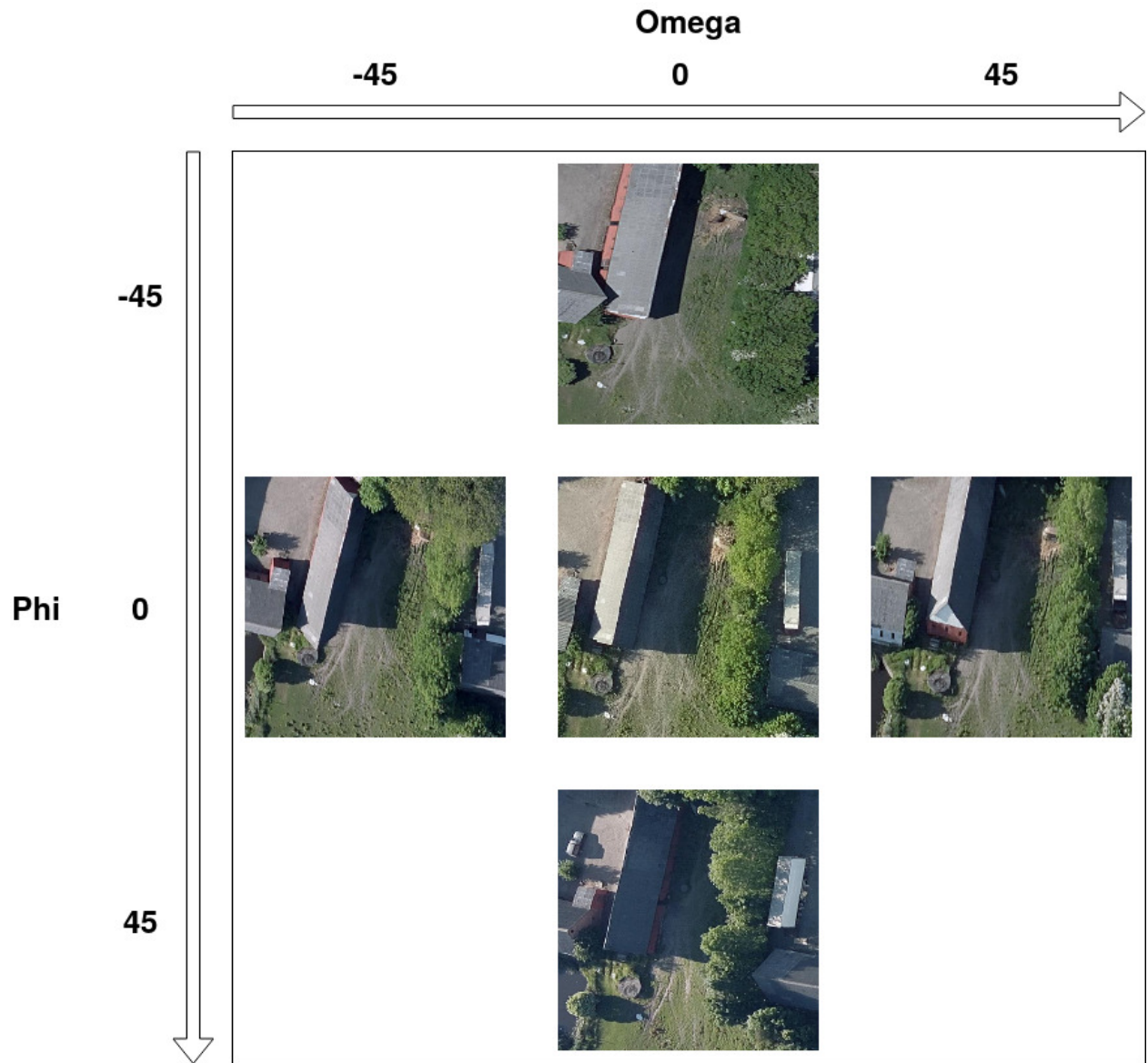


Figure 3: Vertical orientation cases. Note how the four faces of the building are (partially) visible depending on the values of omega and phi. Cases where both omega and phi  $\neq$  0 occur rarely.

Discrete attribute	Value	Train set proportion	Test set proportion
<b>omega</b>	0	19.53%	22.72%
	1	60.21%	55.65%
	2	18.36%	21.64%
	3	1.91%	0.0%
<b>phi</b>	0	66.99%	68.33%
	1	14.96%	17.52%
	2	16.18%	14.15%
	3	1.87%	0.0%
<b>Orientation</b>	0	27.20%	23.98%
	1	19.53%	22.72%
	2	14.96%	17.52%
	3	18.36%	21.64%
	4	16.18%	14.15%
	5	3.78%	0.0%

Table 1: Orientation values distributions

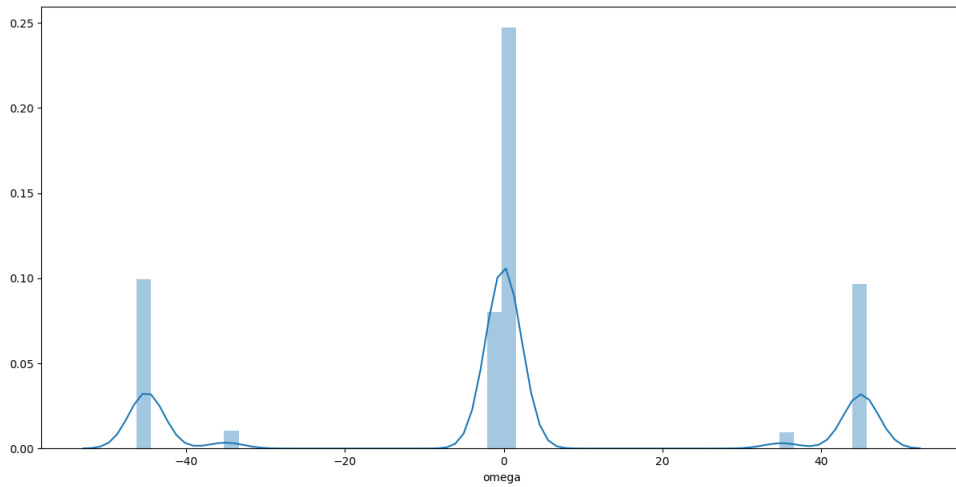


Figure 4: Distribution of omega values in the train set.

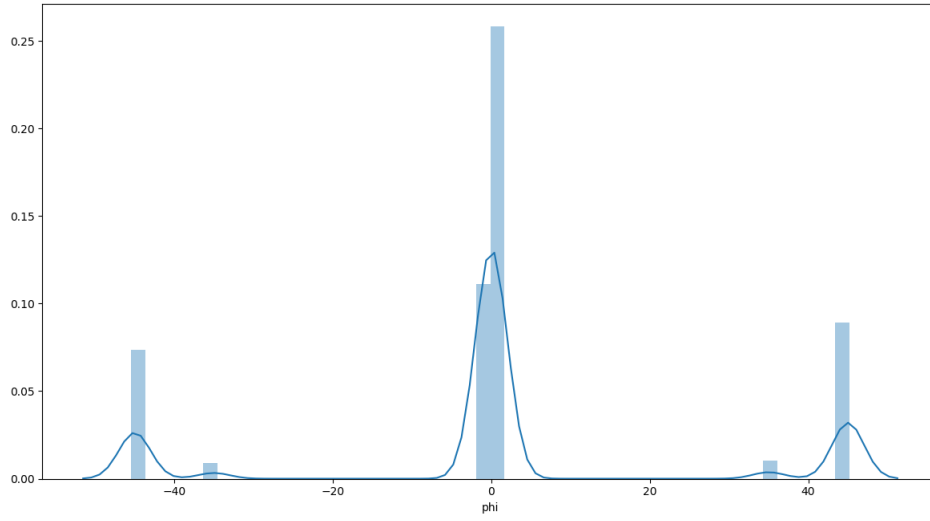


Figure 5: Distribution of phi angle values in the train set.

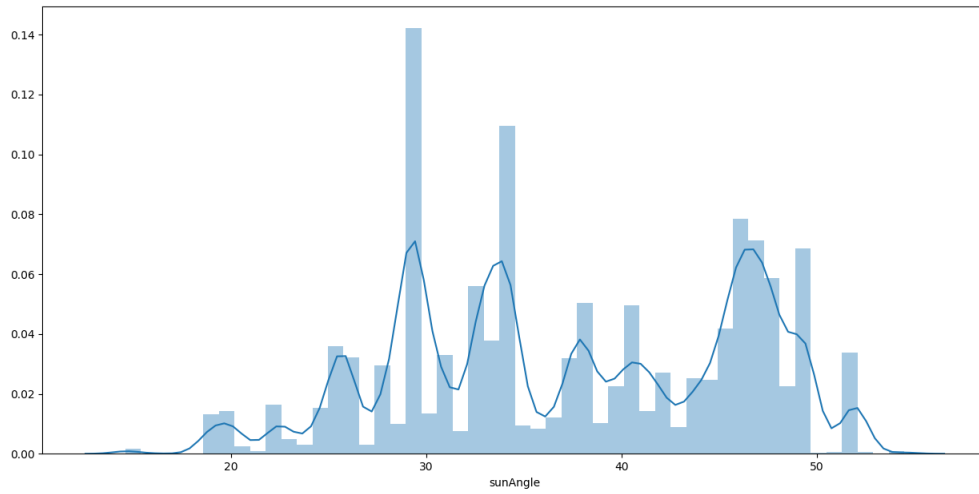


Figure 6: Distribution of sun angle values in the train set.

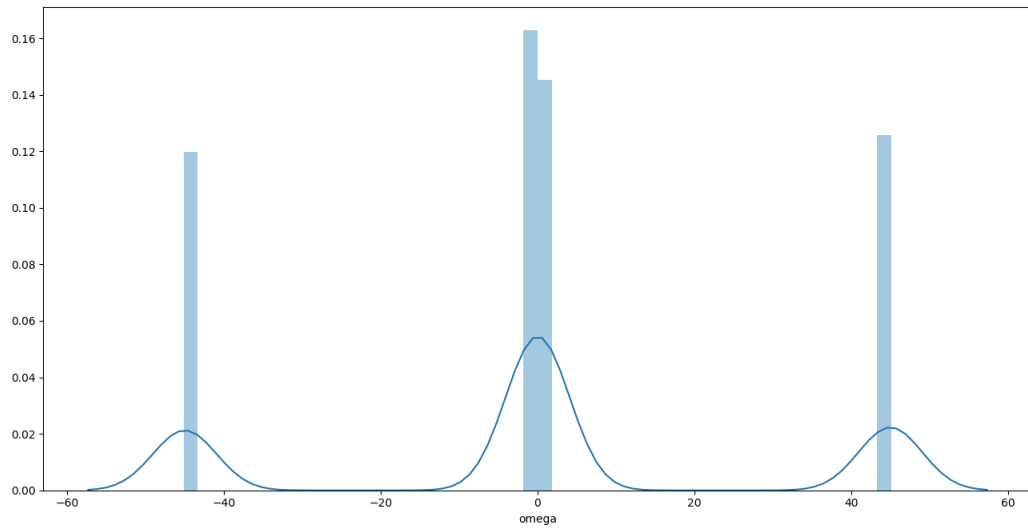


Figure 7: Distribution of omega values in the test set.

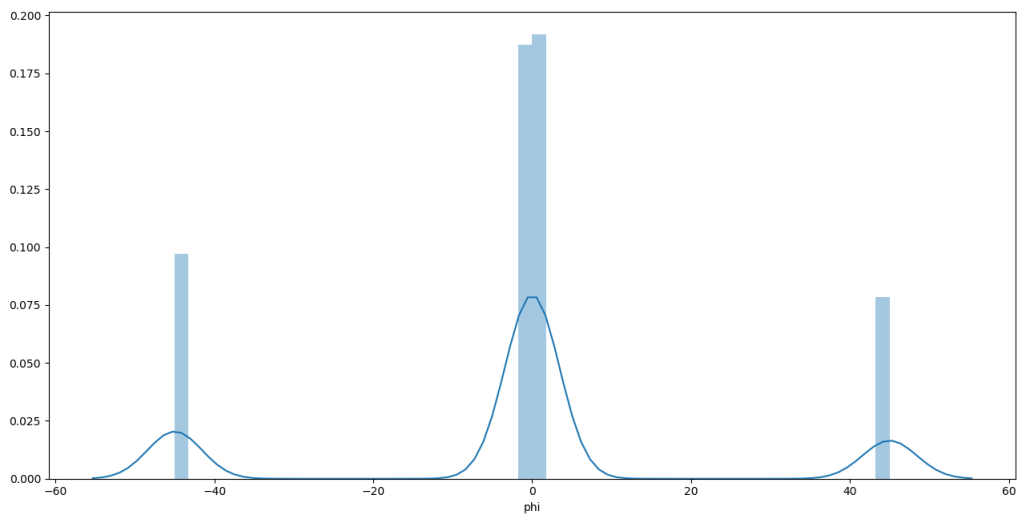


Figure 8: Distribution of phi angle values in the test set.

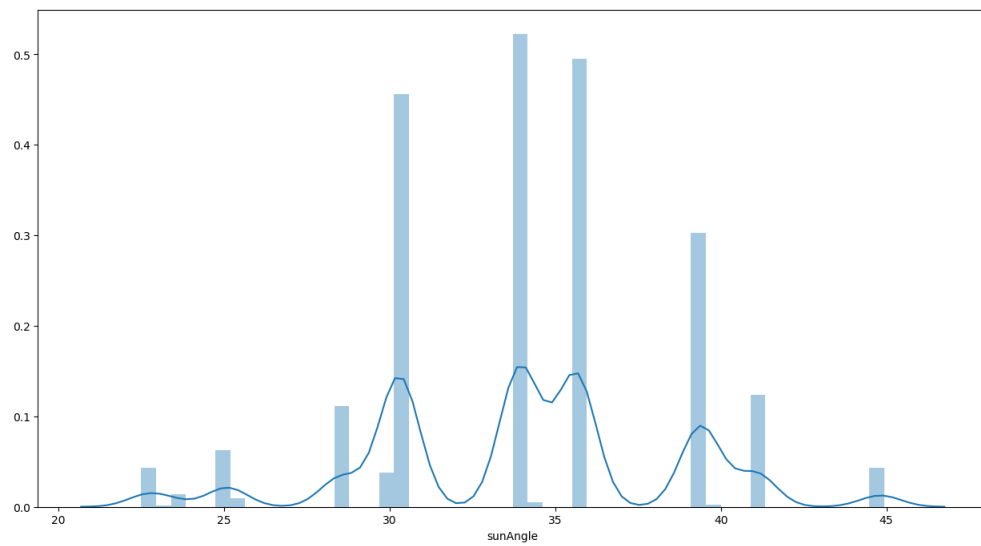


Figure 9: Distribution of sun angle values in the test set.