

Watermeter – Extracting settings for image processing

Step by Step Description

This Step-by-Step description describes, how to extract the needed image processing parameters for the config.ini

The image processing consists of 4 steps:

1. Prealignment
the image can be rotated by any arbitrary fixed angle about the center
2. Fine Alignment
with the help of 3 Reference structures the image is transformed to a defined position
3. Cutting out the ROI (digital meter, analogue meter
with respect tot he references, the ROIs are cut out and internally stored for further processing
4. Translate the ROIs to digital numbers
5. Writing the config.ini

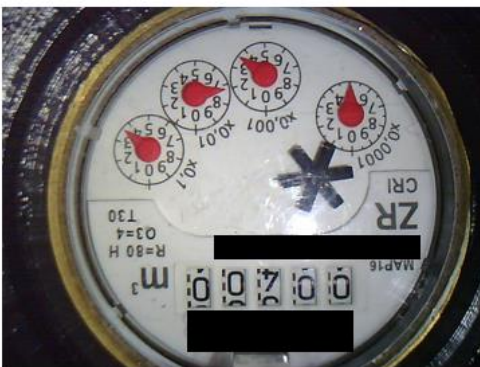
Creating Reference Image

First of all, a reference images needs to be taken, on which all coordinates and reference structures are extracted. Therefore, take this reference image with final camera setup (camera position, image size, illumination, ...)

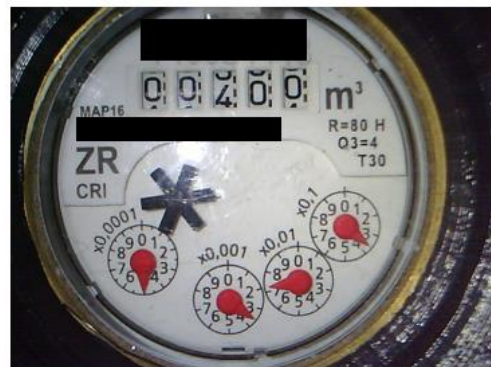
Avoid reflections on: refence structures, digits, meters

Therefore, you can rotate the camera. The image processing server has the parameter prealignment angle for initial rotation before any detection and fine alignment is done.

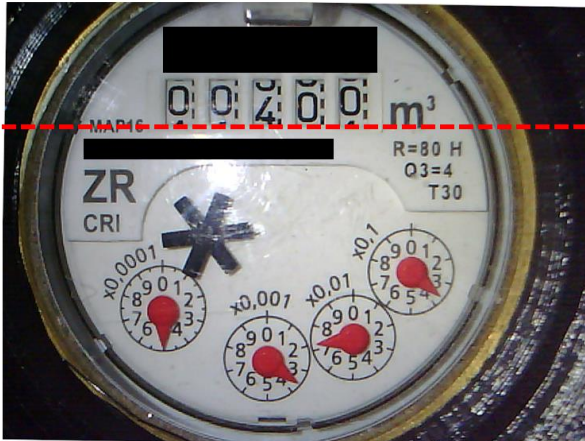
Original Image



Prealigned



To extract the coordinates the targeted fine alignment needs to be done by with a image program, one time by hand. Rotate the image, in order to have the digital numbers exactly in horizontal:



Alignment Structures

Identify 3 structures, which are unchanged and ideally positions in the corners more or less like a triangle. Cut out the three images and store them as separate files with unique names with the size of the cutout. Note the upper left coordinate of each reference.

To increase the pattern recognition in my system it seems to be beneficial to increase the contrast of the reference images – further test for best settings are to be carried out.

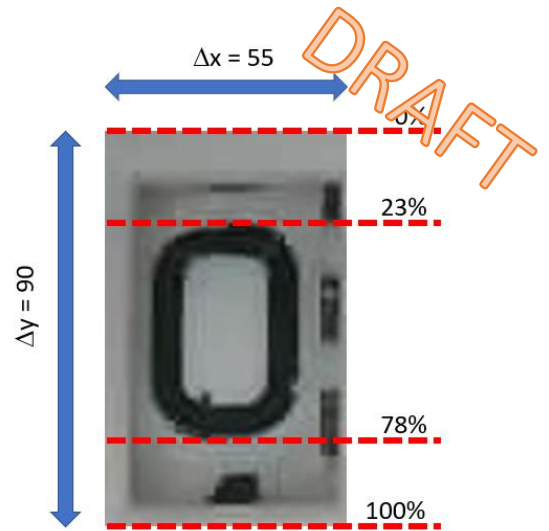
		X: 99 Y: 219
		X: 521 Y: 117
		X: 301 Y: 386

Position of Region Of Interest (ROI)

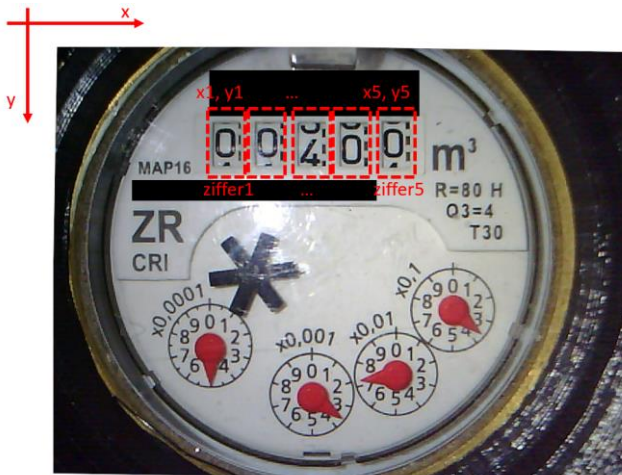
Digital Digits

The image size of the ROI for the digital digits should be as close as possible to the original trained image proportions. The absolute image size is not important, as it will be rescaled to the needed size later on. Only the relative positions is important:

- Ratio width/height: 50/90
- Upper position of letter: 23% (from above)
- Lower Ending of letter: 78% (from above)



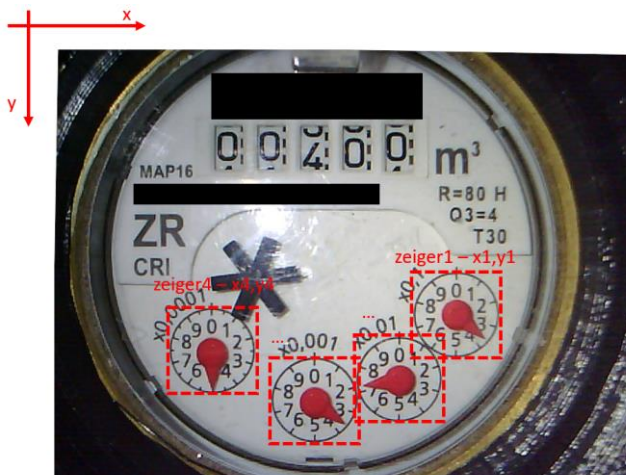
Give each digit ROI a name and note the upper left position (x, y) and the dimension (dx, dy). The y-position should be equal for all and the dimension as well:



Name	X	Y	Δx	Δy
ziffer1	215	97	42	75
ziffer2	273	97	42	75
ziffer3	332	97	42	75
ziffer4	390	97	42	75
ziffer5	446	97	42	75

Analog Meters

The same procedure applies for the analogue meters. The cut out is the outer border of the circle:



Name	X	Y	Δx	Δy
zeiger1	490	305	120	120
zeiger2	412	395	120	120
zeiger3	301	424	120	120
zeiger4	160	356	120	120

Writing the config.ini

The config.ini consists of different sections, in which the parameters are stored. To comment lines or to comment parameters out use “#” at the beginning of the line

Section “alignment”

Here the initial prealignment rotation angle is noted, here 180°.

```
[alignment]
initial_rotation_angle=180
```

Section “alignment.ref0”, ... “alignment.ref2”

Here the information about the 3 reference structures is stored

“image” contains the name for the filename it is stored in the /config folder.

pos_x / pos_y stores the upper left position

This must be repeated for each reference

```
[alignment.ref0]
image=./config/ Ref_m3_x512_y117.jpg
pos_x=512
pos_y=117
```

Section “Digital_Digit” / “Analog_Counter”

In these two sections the general informations for the ROIs is stored. Each consists of:

names: names of the ROIs. They must be ordered the same as the digits are in the final number

Modelfile: file of the neural network for conversion (leave unchanged)

LogImageLocation: if is set, the images of the cut out ROIs will be stored for review

LogNames: if only selected ROIs should be stored, name them here – if this is commented out (like here) all images are stored

```
[Digital_Digit]
names=ziffer1, ziffer2, ziffer3, ziffer4, ziffer5
Modelfile=./config/neuralnets/Train_CNN_Digital-Readout_Version2.h5
LogImageLocation=./log/digital_digit
#LogNames=zeiger3, zeiger4
```

```
[Analog_Counter]
names=zeiger1, zeiger2, zeiger3,
zeiger4Modelfile=./config/neuralnets/Train_CN
N_Analog-Readout_Version2.h5
LogImageLocation=./log/analog_counter
#LogNames=zeiger3, zeiger4
```

Section “Analog_Counter.zeiger1” / “Digital_Digit.ziffer1”

For each ROI defined in the above “name” section, you must specify the details in a dedicated section. The naming is: “Analog_counter.name” and “Digital_Digit.name”

The content consists of the positions and dimensions of the ROI

```
[Analog_Counter.zeiger1]
pos_x=495
pos_y=305
dx=120
dy=120
```

```
[Digital_Digit.ziffer1]
pos_x=212
pos_y=97
dx=42
dy=75
```