

IMAGING FOR ANPR

OCR RESULTS:

 ARH 001

- NUMBER PLATE: ARH 001
- VEHICLE TYPE: MERCEDES BENZ
- NATIONALITY: EU-HUNGARY
- SPEED: 158 MPH / 254 KMH
- BLACKLIST: --- NO ---
- COLOR: BLUE METAL
- OWNER: ZSOLT VANYI
- RECOGNITION TIME: 2015-01-12T15:19:21+00:00



BRIEF GUIDE

IMAGING FOR ANPR

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INTRODUCTION

The image that is loaded into the CARMEN® engine can be provided by an image source of any kind. It could be supplied by either a digitized analog signal or by a digital camera. However, what is more important that not all images are usable for ANPR (Automatic Number Plate Recognition). In fact, the CARMEN® engine and ANPR in general require a set of specific criteria to be met when it comes to images. Thankfully, these criteria can be well defined. This guide will present what these criteria are and will also discuss them in detail.

Note

In general when discussing ANPR systems, the phrase “good quality images” refers to the fact that the images used meet the criteria detailed in this document.

1. GOOD CONTRAST

In order to be able to differentiate the character from the background, there has to be a certain contrast between the two. The criteria for this is not for high contrast, but rather, a consecutive average difference. Of course, the higher the contrast the better, but having low dispersion in contrast ratio (minimal blur on the edges) is more important.



Figure 1: An image with good contrast. The characters on the license plate are clear. ✓

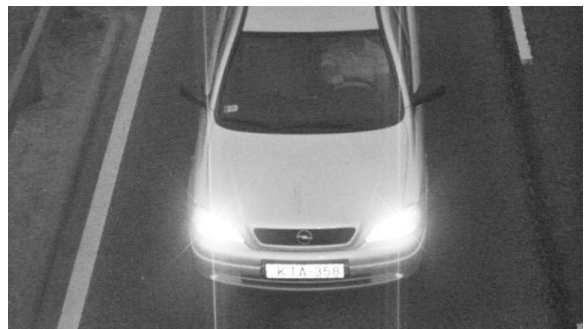


Figure 2: An overexposed image on which the license plate is barely visible. ✗

2. SHARP IMAGE

Having adequately sharp images is also crucial. One general rule that can be applied to OCR is that if the characters can be recognized by a human, then the engine will also recognize them. This rule applies the other way around as well: if one cannot read the characters properly and easily, there is a low probability that the engine will recognize the license plate. It is also worth noting that blurring can be caused by many other factors and not just small image size.

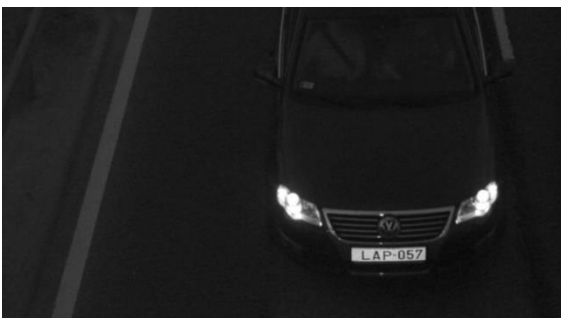


Figure 3: An adequately sharp image. ✓

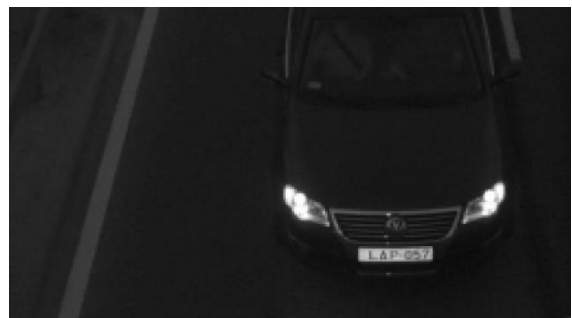


Figure 4: A blurry image with a hard to read license plate. ✗

3. CHARACTER SIZE AND RESOLUTION

Optimal size of characters on the given image is essential. In terms of character size there is one typical misconception. Many think that the higher the resolution, the better. This statement however, is not true. Neither images with too high or too low resolution will work properly.

3.1. HIGH RESOLUTION

High-resolution (macro) images contain a lot of redundant data. Characters can be easily defined based on the edges of a character. No other information is needed. So much so, that the pixels within a character are irrelevant in terms of shape/pattern recognition. These are just pixels that waste the resources of computation. Therefore, resolution is optimized for a certain character size. Although this size can be adjusted, it has to be noted that adjusting the default character size can cause problems if characters are too tall.

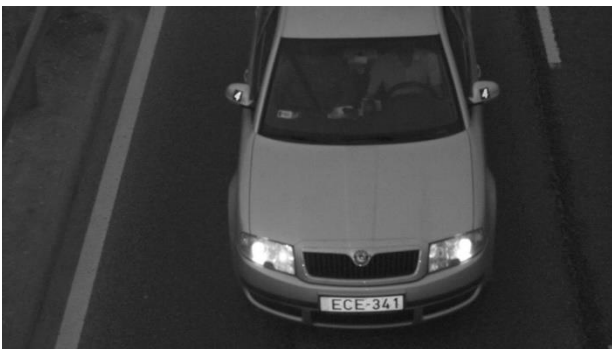


Figure 3: A good image with adequate resolution, not too high, not too low. ✓



Figure 4: Macro image with enormous amounts of redundant data. The character size is about 55 × 105 pixels. ✗

3.2. LOW RESOLUTION

Images containing less information than what the engine needs should be considered as low resolution images. Of course, it has to be noted that even if the characters are smaller in resolution than the required minimum, the engine may deliver correct results, but it will not consistently recognize these images. If one would feed the engine a few thousand low resolution images, the recognition rate would drop over time.

3.3. MINIMUM AND OPTIMAL CHARACTER SIZE

The optimal size of a character for an ANPR task is at least 16 pixels in height for Latin characters. For Arabic characters the minimum height is 20 pixels.



Figure 5: Optimal character size with optimal resolution for OCR:
HD image. ✓

A general rule of OCR is that the smallest unit that defines the recognized object has to be 2x2 pixels. In terms of ANPR, the smallest unit is the width of the line that comprises the characters on the license plate. In order to get this line width, the minimum height of the characters has to be 16 pixels.

The characters can of course be taller (and will be if higher resolution cameras are used), the 16 pixel height is just the minimum value. But do note that if the character height is less than 16 pixels, then the recognition rate will drop drastically. The same is true if the characters are too high. At around 40-50 pixels, the recognition will again drop and sooner or later will reach 0%.



Figure 8: Example of a license plate with Arabic characters.

Arabic, Chinese, Korean, etc. license plates however are an exception to the 16 pixel minimum rule. For the engine to reliably recognize these characters, a higher resolution is needed. The rule applies to all license plate types where the text contains non-Latin characters.

There are multiple reasons for this, the easiest and most simple example is the Arabic "0" (zero), which is a simple dot. The

CARMEN® engine is very robust; therefore, it has the capability of filtering noise from the image. A dot, if it is too small, can be recognized by the engine as noise in the image. However, if it is sufficiently big, CARMEN® will recognize it more effectively without making mistakes.

4. LOW DISTORTION

The camera which acts as the image source for OCR can be installed in many ways. There exist multiple installation positions that can help in providing optimal images with minimal distortion. However, there are many cases when the camera cannot be installed in these position causing the object (license plate) to become distorted on the image. This is why the OCR engine was built to tolerate a 30° angle. However, if the pan or tilt angles of the camera exceed 30°, distortion may significantly reduce recognition and performance rates.

5. EXAMPLES TO AVOID (NOT OPTIMAL FOR ANPR)



LOW SPATIAL RESOLUTION



LOW CONTRAST



HIGH DISTORTION



BLURRED IMAGE



OVEREXPOSURE



BAD LIGHTING CONDITIONS
(SHADOW AND STRONG LIGHT)

6. SUMMARY

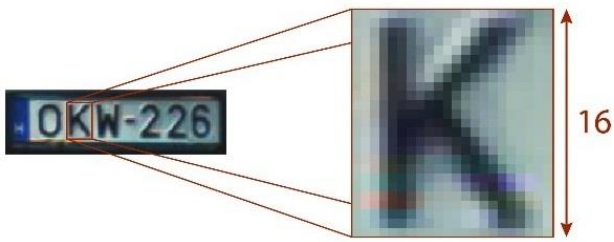


Figure 6: Minimum character height.

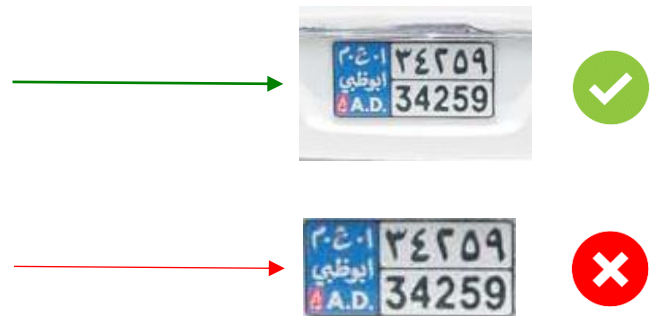
To summarize, the images provided to the engine should meet the following requirements:

- A consecutive average difference in contrast.
 - Adequate sharpness.
 - Minimal distortion.
- Is taken under good lighting conditions
 - The picture has to contain the whole license plate on which the characters are:
 - at least 16 px high in case of Latin characters
 - at least 20 px high in case of Arabic, Chinese, or any other special characters
 - not more than 50px in either case

7. USING CROPPED IMAGES FOR ANPR

In some cases there may be a need to crop the source images. While it is possible to use cropped images, these also have a set of criteria that have to be met:

- All the previously mentioned rules apply to the cropped image as well. Therefore, the image should contain a license plate:
 - with good sharpness
 - with high contrast
 - under good lighting conditions
- The characters have to be at least 16 pixels high (20 in case of non-Latin characters) and the line width of the characters has to be at least 2 pixels.
- When cropping the images, make sure that on the cropped image there is some space between the license plate and the edge of the image. The engine will not recognize characters on pictures that only contain the license plate and nothing else. In very simple terms, do not crop the images at the edge of the license plates.



EXAMPLE IMAGES:

PROPER IMAGES



IMPROPER IMAGES



The examples clearly demonstrate that a proper image is not cropped at the edges of the license plate. Some space is left between the license plate and the edge of the image. If the above mentioned criteria are met, then the engine should have no issues with recognition when cropped images are used for recognition.

CONTACT INFORMATION

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