

Sometimes less means more – Subsampling, binning, or scaler

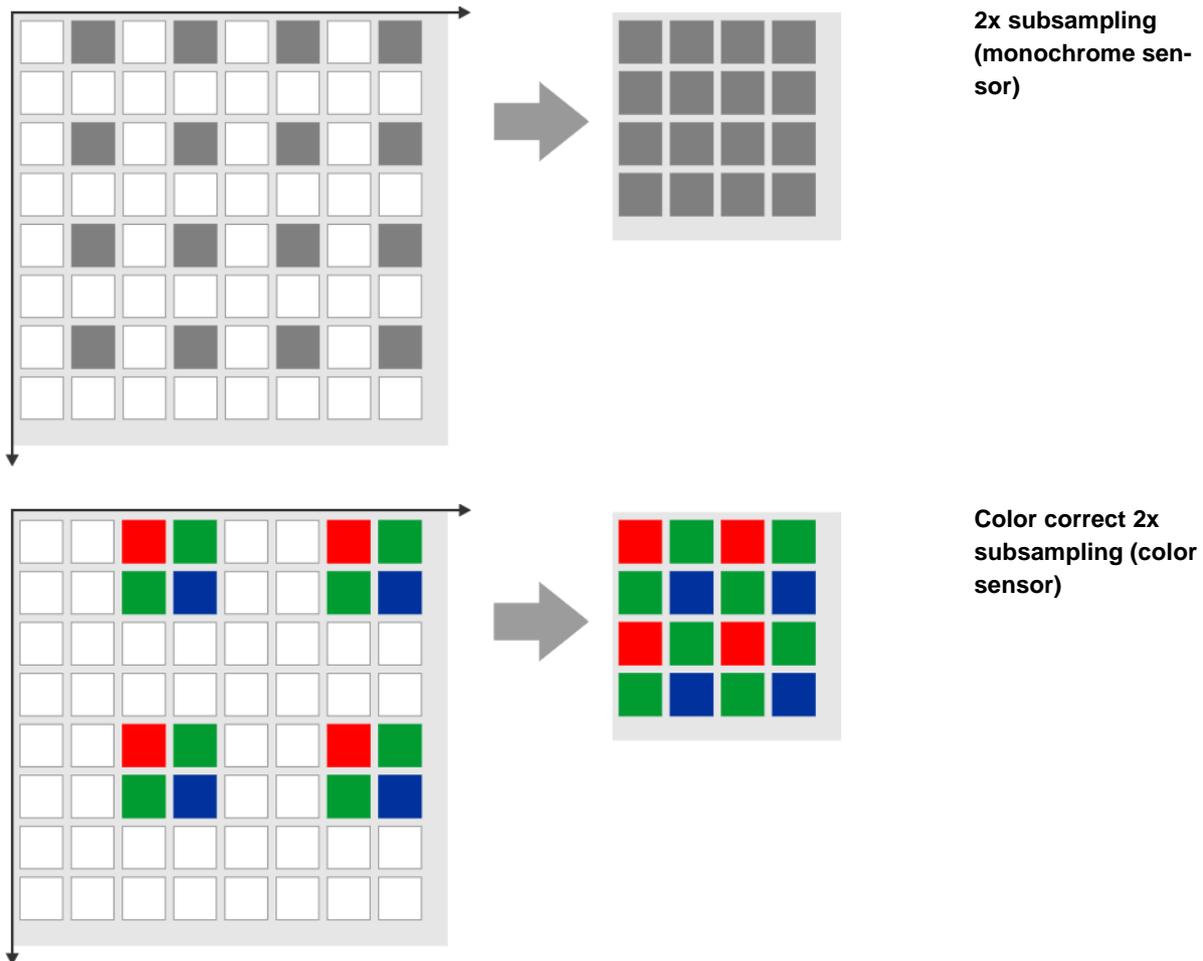
Your field of view should not change but the frame rate should be increased? You need a shorter exposure? Will a lower resolution with the same field of view do for you?

To reduce the image resolution and still having the same field of view, you have different ways depending on the sensor model: subsampling, binning, or scaler. But how do they differ?

Background

Subsampling

Subsampling skips multiple sensor pixels when reading out the image data. This reduces the amount of data to be transferred and enables higher camera frame rates. The captured image has a lower resolution but still the same field of view compared to the full-resolution image.



TechTip: Subsampling, binning, or scaler

Color subsampling – as performed by most color sensors – skips pixels while maintaining colors. For some monochrome sensors, the camera also performs color subsampling, resulting in slight artifacts.

Monochrome sensors and some color sensors ignore the Bayer pattern and the color information gets lost (mono subsampling).

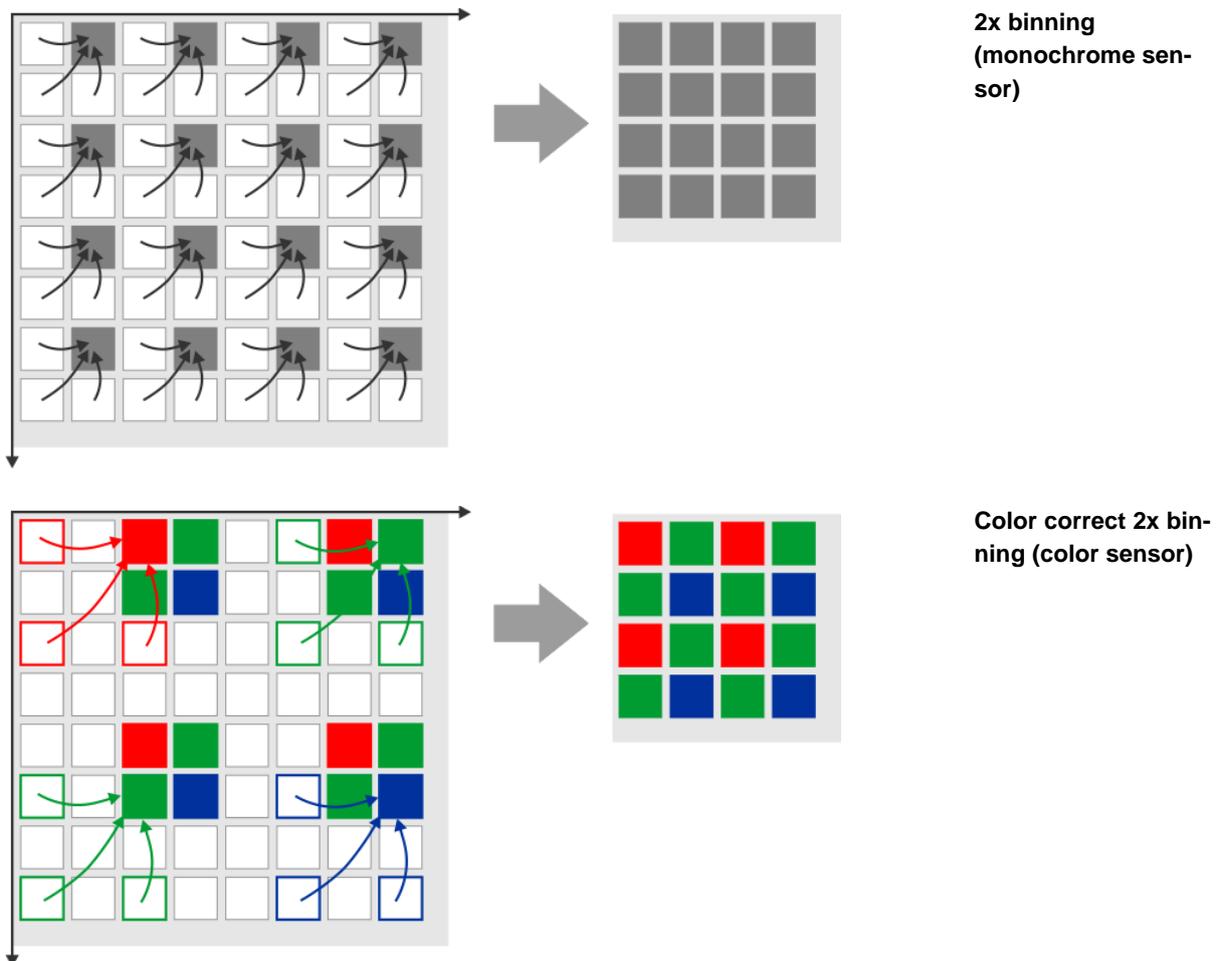
Subsampling can also be done in the pixel preprocessing on the camera. This process reduces the data volume per image, but does not increase the frame rate, but does not increase the frame rate.

Binning

Binning is a function that averages or adds multiple sensor pixels to obtain a single value:

- If the pixel values are added, the image brightness increases.
- If the pixel values are averaged, the image noise is reduced.

This also reduces the amount of data to be transferred and enables higher camera frame rates. The captured image has a lower resolution but still the same field of view compared to the full-resolution image.



TechTip: Subsampling, binning, or scaler

Color binning – as performed by most color sensors – combines only pixels of the same color. For some monochrome sensors, the camera also performs color binning, resulting in slight artifacts.

Most monochrome sensors and some color sensors combine neighboring Bayer pattern pixels; in this case, the color information gets lost (mono binning).

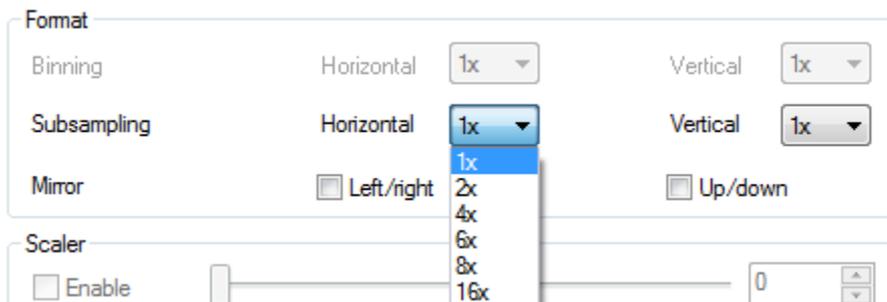
Scaler

A special case is the scaler which is only available in the models UI-124x/UI-324x/UI-524x (e2v EV76C560), UI-125x/UI-325x/UI-525x (e2v EV76C570), and UI-149x/UI-549x (ON Semiconductor MT9J003).

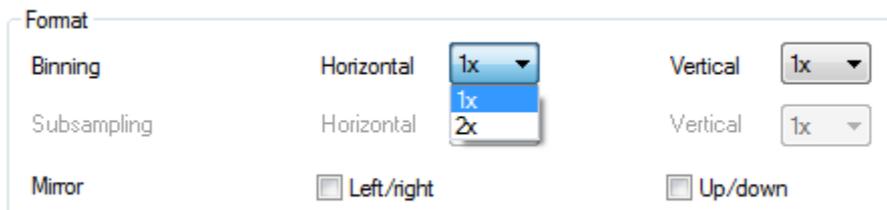
With the scaler, the image resolution can be reduced in adjustable factors. Thus, the data volume can be reduced. The captured image has a lower resolution but still the same field of view compared to the full-resolution image. Unlike subsampling or binning, the image is reduced almost continuously and the image brightness will not change.

Setting the image resolution in uEye Cockpit

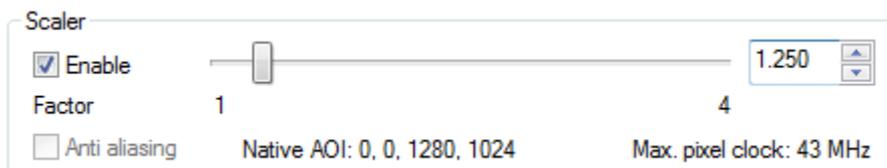
Open the camera properties in uEye Cockpit via “uEye > Properties”. Depending on the opened camera model, you can configure subsampling, binning, or scaler in the “Size” tab.



Setting the subsampling factor



Setting the binning factor



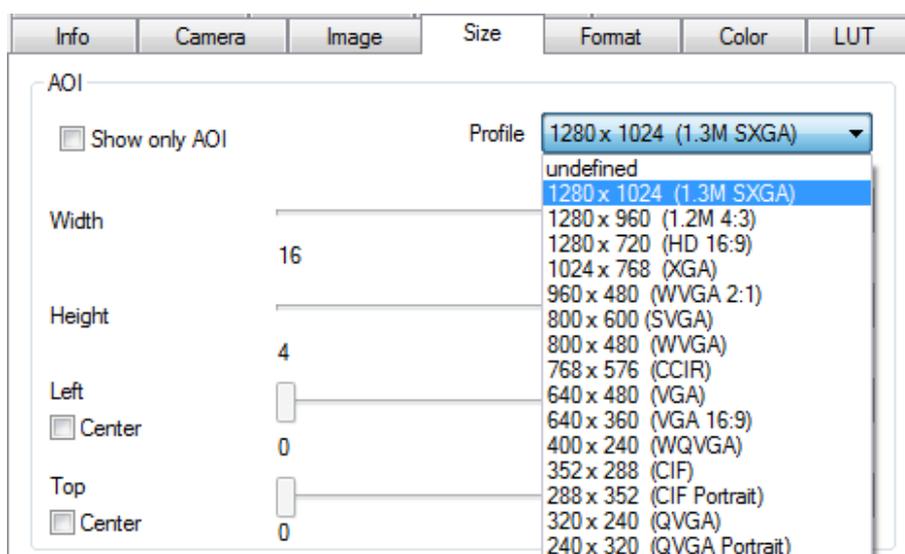
Setting the scaler factor

TechTip: Subsampling, binning, or scaler

Tip: Image profiles

If the field of view or the size of the image detail is allowed to be changed, you can use alternatively an image profile.

In the “Size” tab, you can set a predefined resolution via a profile. Depending on the profile and sensor model, the camera driver sets automatically the requested size via AOI, binning, subsampling, or scaler to receive the best image quality.



Using image profiles

Application areas

All three methods have in common that the field of view may not be changed but the image resolution may be reduced.

The advantage of subsampling is that the frame rate can be increased without changes in image brightness or contrast. The scaler allows the same as subsampling but with finer intermediate steps. However, the scaler is only supported by certain sensors.

The advantage of binning is that image brightness can be increased. This advantageous in applications in which a flash cannot be used for example for light-sensitive samples or reflective surfaces. Also you can use a shorter exposure time which is important for moving objects.

Summary

	Subsampling	Binning	Scaler
Field of view	unchanged	unchanged	unchanged
Image resolution	reduced	reduced	reduced
Frame rate	may increase	may increase	may increase
Image contrast	unchanged	may increase	unchanged
Image brightness	unchanged	may be brighter	unchanged
Image noise	unchanged	may be better	unchanged

	Subsampling	Binning	Scaler
Advantage	Data reduction Can be set independently in vertical or horizontal direction	Data reduction Can be set independently in vertical or horizontal direction In certain circumstances shorter exposure times are possible. Binning is superior to subsampling in terms of image quality.	Data reduction Reduces the image almost continuously.
Disadvantage	Pixel details get lost Fixed step widths	Fixed step widths	Only available for few sensor models

With the uEye API functions “is_SetBinning”, “is_SetSubsampling”, and “is_SetSensorScaler” or the uEye .NET classes “Binning”, “Subsampling”, and “SensorScaler”, you can get and set the configuration of binning, subsampling, and scaler.

For more information on the settings, refer to the uEye manual at <http://en.ids-imaging.com/manuals-ueye.html>.

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