

Computer Vision I

some additional material for the curious

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Master in Artificial Intelligence (MIA)

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original colored **pixel-art** with different resolutions (dots-per-inch on paper!)

the colored pixel-art image has a resolution of 128×64 pixels



72.27 dpi



150 dpi



300 dpi

the following images are shown with 300 dpi
(on L^AT_EX-beamer slide size of 12.8×9.6 cm)

enlarged by a factor of 8, hence, 1024×512 pixels



with bi-linear interpolation



with bi-cubic interpolation



with Gauss-filter interpolation



with Lanczos-like interpolation



with experimental interpolation of `ffmpeg`



with sinc interpolation



with spline interpolation



with **pixel-art** hq2x algorithm



with **pixel-art** scalar2x algorithm



with **pixel-art** scalar2xSFX algorithm



with **pixel-art** superXBR algorithm











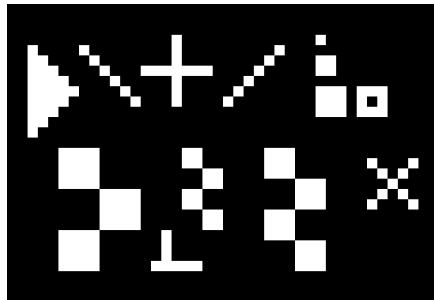
original B&W **line-art** with different resolutions (dots-per-inch)

the B&W line-art image has a resolution of 42×29 pixels



the following images are shown with 300 dpi
(on L^AT_EX-beamer slide size of 12.8×9.6 cm)

enlarged by a factor of 16, hence, 672×464 pixels



with bi-linear interpolation



with bi-cubic interpolation



with Gauss-filter interpolation



with Lanczos-like interpolation



with experimental interpolation of `ffmpeg`



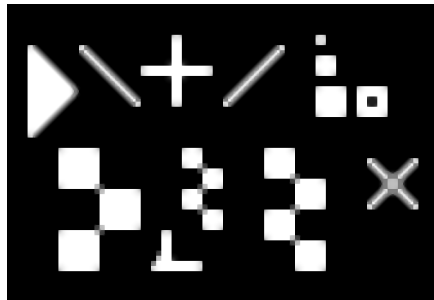
with sinc interpolation



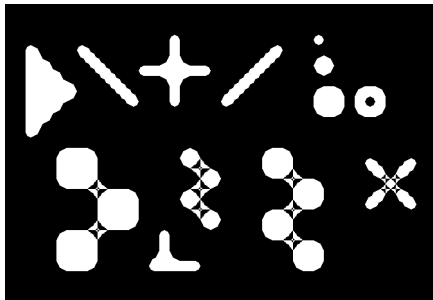
with spline interpolation



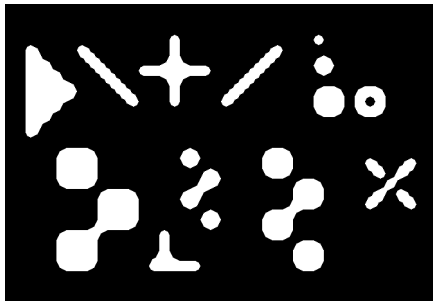
with **pixel-art** hq2x algorithm



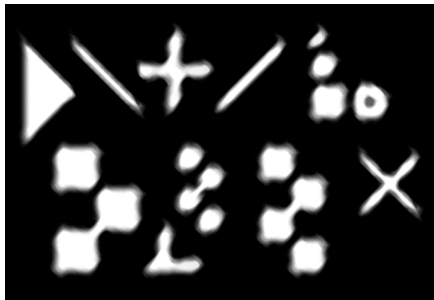
with **pixel-art** scalar2x algorithm

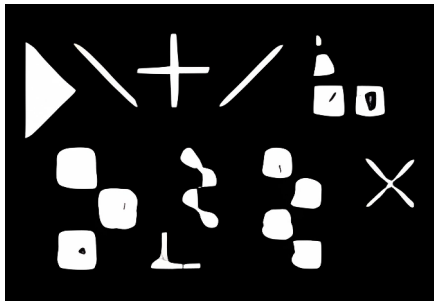


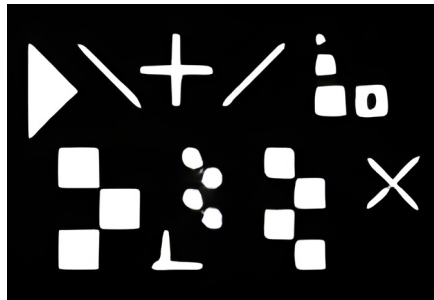
with **pixel-art** scalar2xSFX algorithm

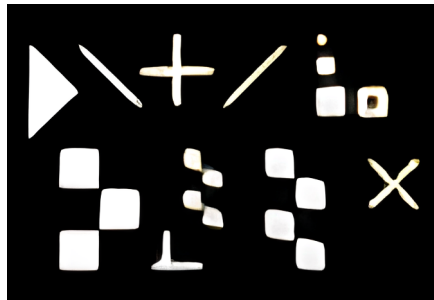


with **pixel-art** superXBR algorithm







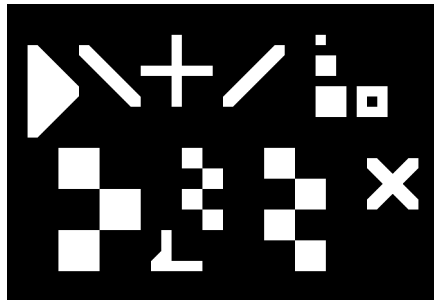




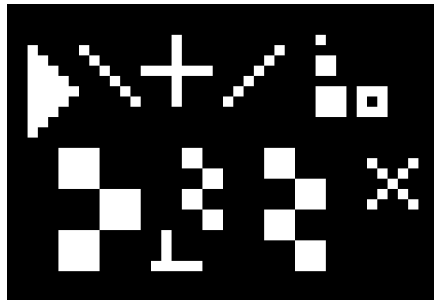
what do we really want?

- same topology of connected components?
- straight lines remain straight lines?
- angles/corners are preserved?
- no further colors (gray-scales) are introduced?
- maybe you (or your application) have some more or other requirements?

my own B&W pixel-art scale-up algorithm



once again the simple enlarged version



original B&W **line-art** with different resolutions (dots-per-inch)

the B&W line-art image has a resolution of 84×60 pixels



the following images are shown with 300 dpi
(on $\text{\LaTeX}$ -beamer slide size of 12.8×9.6 cm)

enlarged by a factor of 8, hence, 672×480 pixels



with bi-linear interpolation



with bi-cubic interpolation



with Gauss-filter interpolation



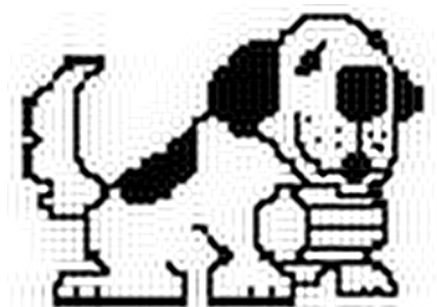
with Lanczos-like interpolation



with experimental interpolation of `ffmpeg`



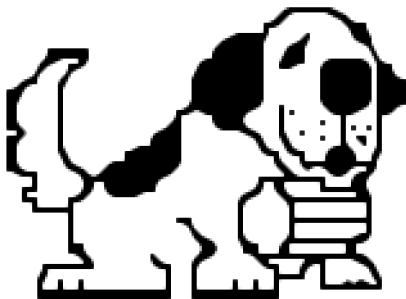
with sinc interpolation



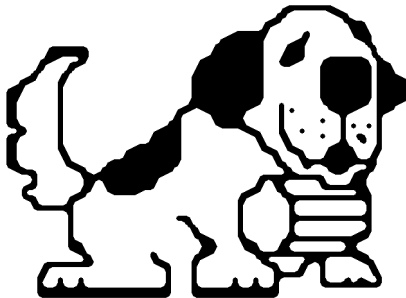
with spline interpolation



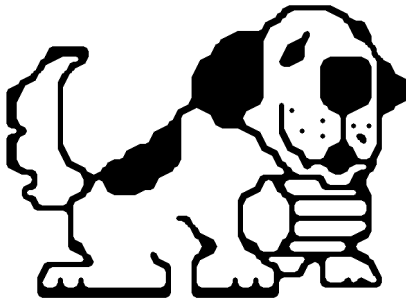
with **pixel-art** hq2x algorithm



with **pixel-art** scalar2x algorithm



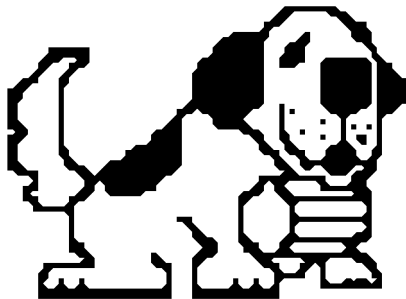
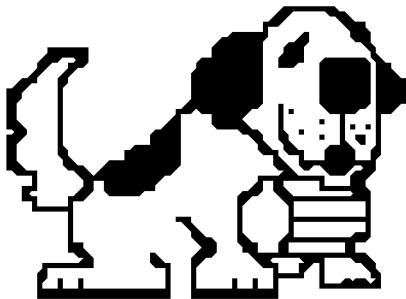
with **pixel-art** scalar2xSFX algorithm



with **pixel-art** superXBR algorithm



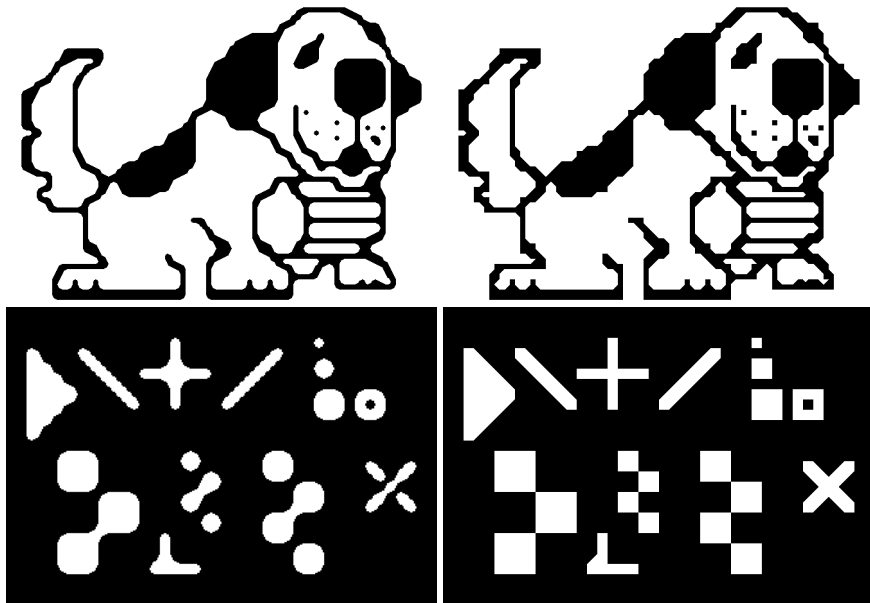
my own B&W pixel-art scale-up algorithm (2 versions)



once again the simple enlarged version



comparison on **line-art**: super2xSFX and my algorithm



some conclusions

- *classic* enlargement algorithms for *natural* images are not well suited for pixel-art and line-art images
- special algorithms designed for enlarging pixel-art and line-art have their pros and cons (depending on the requirements you have)
- enlargement tools based on artificial intelligence do something, but is it already what you might expect? (at least the on-line tools we used here)
- eventually, you have two options:
 - adapt your requirements to the tools you have at hand
 - design the tools that fulfill your requirements (that is what I've done)

- https://en.wikipedia.org/wiki/Pixel-art_scaling_algorithms
- <https://www.ffmpeg.org/>
- <https://github.com/janert/pixelscalers>
- <https://imagemagick.org/>
- the AI on-line tools given on the corresponding slides
- own software (ask me...)