

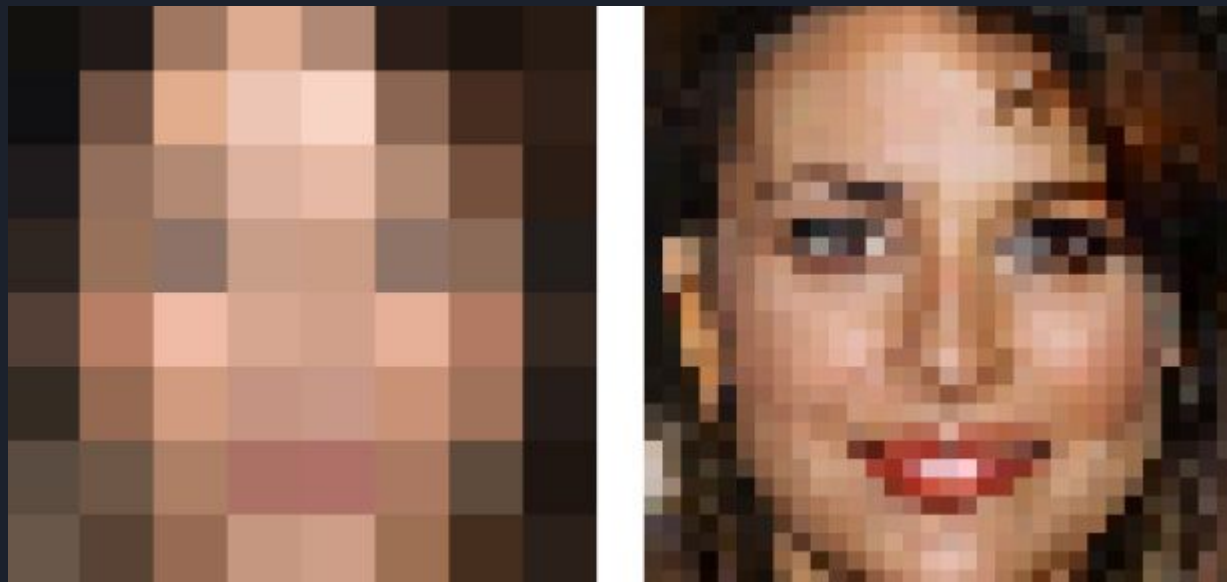


Super-resolution Cartoons

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Super-resolution

- What is super-resolution?



Cartoons



The Flintstones (1960)



The Three Bears (1939)
"Spaghetti"



Avatar: The Last Airbender (2005)

Cartoons



355x236

Approaches

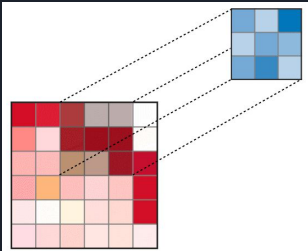
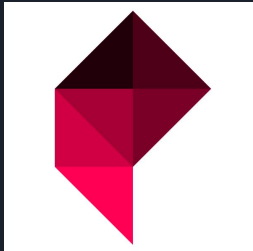
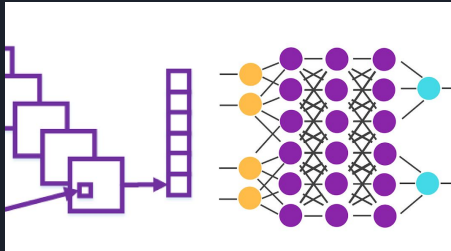
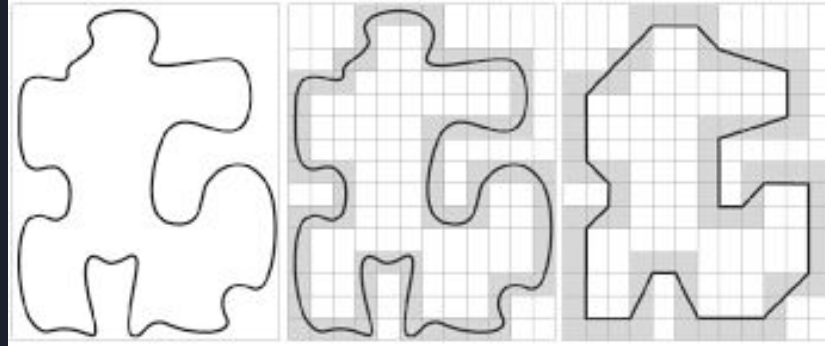
Traditional approach	Vectorization	Deep Learning
		
<ul style="list-style-type: none">• Pixel surroundings.• kernels.	<ul style="list-style-type: none">• Polygons and other shapes.• 2D points.	<ul style="list-style-type: none">• Convolutional Neural Network.

Image vectorization



- Approximating the image by a bunch of shapes (polygons).
- The color of each polygon is the median of the colors inside of it (removes noise).
- Image loses details in the process.
- Upscale the polygons.
- Polygon shapes get preserved, no matter how many times the image is resized.

Image vectorization - Segmentation



The colors in this image mean nothing!

- Separating the image into several different **regions**.
- Each region is composed of pixels of similar color.
- The algorithm used is called **Quickshift**.

Image vectorization - Segmentation



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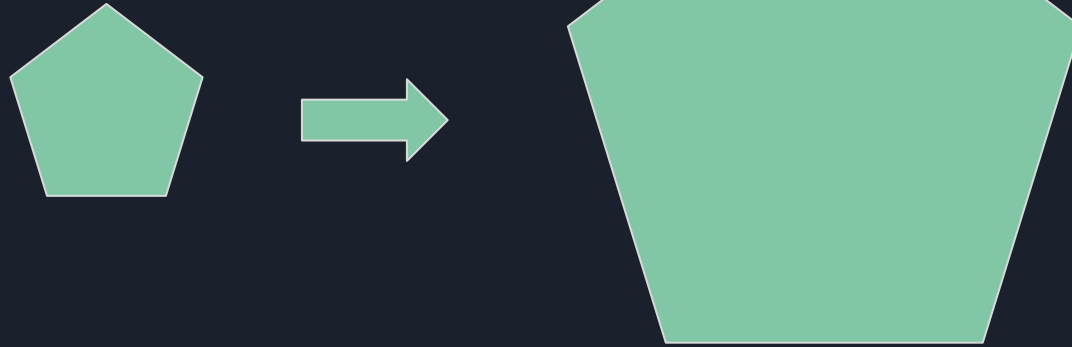
Image vectorization

Approximation by polygons





Image vectorization Upscaling the image



- Upscale each individual polygon.
- Each polygon is just a collection of coordinates (vertices).
- Multiply both the X and Y coordinate of every vertex by the same factor.

Image vectorization

Upscaling the image

- Create empty image.
- Paint each polygon separately.
- The order matters.



Image vectorization

Black dots





Image vectorization

Black dots

- Pixels that don't belong in any region.
- After upscaling, some distance between the polygons appears.
- Increasing the border sometimes is not enough.



Image vectorization

Inpainting

- Set the black dots as “mask”, then use an Inpainting algorithm.
- Predicts what is probably the correct color of those dots based on the rest of the image.

Image vectorization

Final result (after Inpainting)



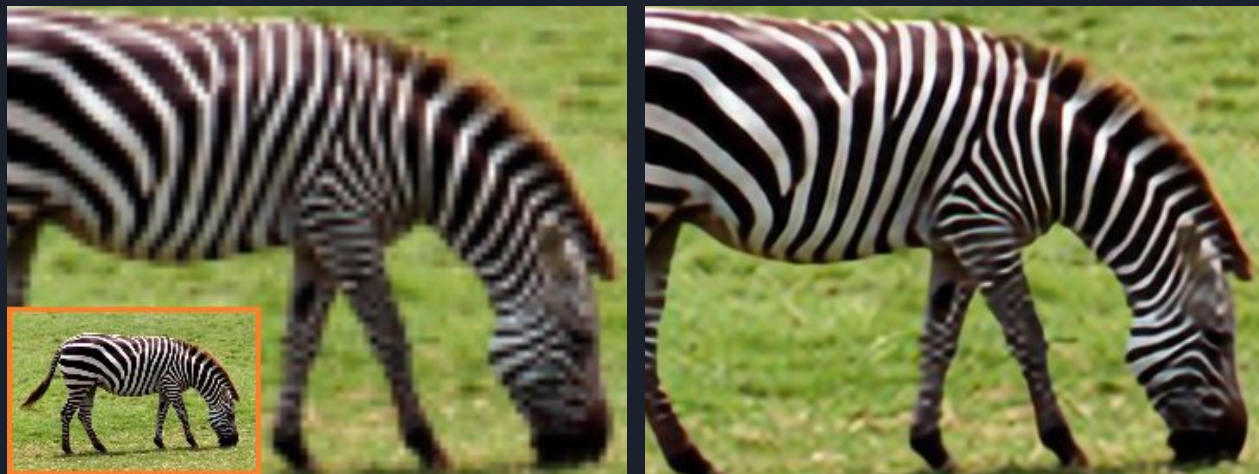
Image vectorization

Original image interpolated (for comparison)



Deep Learning - DCSCN

- Trained with 1,164 images.
- Data augmentation.



<https://github.com/jiny2001/dcscn-super-resolution>

Deep Learning - DCSCN

Final result



Deep Learning - DCSCN

Original image interpolated (for comparison)



Deep Learning - waifu2x

- Inspired by SRCNN.
- Noise Reduction.
- Trained with 6,000 high-resolution-noise-free-PNG images.



<https://github.com/nagadomi/waifu2x>

Deep Learning - waifu2x

Final result



Deep Learning - waifu2x

Original image interpolated (for comparison)





Thank You.
Now, some results