New Technology for converting low resolution content into ultra high definition (4K)

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The image was sharpened using bi-cubic interpolation on the left, and a super-resolution technique on the right. The SR image shows true details not directly recorded on the original

A Research organization has developed a new technique to create super-resolution images from a single low-resolution image. They accomplished this by observing that pictures of the natural world tend to include approximate repetitions of a portion of the image, both at nearly the same size scale and at different size scales. Consider for a moment a photograph of a crocodile. The scales on its skin are all very similar in shape, but vary in size depending on where on the skin they appear, and on how distant that location is from the camera. Similarly, the teeth are similar to each other, meaning there are many image patches containing edges of the teeth having varying orientations and sizes.

This type of approximate self-similarity in natural images is the basis for understanding many multi-length scale physical processes. Applied to image sharpening, the sets of patches which are similar provide numerous example of how edges (for example) appear. The various edges will not be lined up on the pixel array in the same manner - rather there will be subpixel variations in their registration with the pixels. As a result, summing up similar areas within a single low-resolution digital image regenerates some of the high-resolution information of the original optical image in a manner quite similar to that of multi-image superposition.

This alone is not enough for high performance, as multi-image superposition is limited to doubling the resolution of the digital image. It turns out that image patches of similar objects at different size scales within the digital image allow a form of example-based super-resolution processing. The idea is that a large image patch that looks like a big version of a smaller image patch can be used to work out a mapping from the low-resolution (fewer pixels) patch to the

higher-resolution (more pixels) patch. Once worked out for all examples, these maps can be used to generate a high-resolution image in the same manner as used in example-based super resolution processing.

In practice they use an optimized mix of both techniques, using only information from within a single digital image. The two approaches to generating the high-resolution information restrict each other from making silly choices. Overall, the process attempts to recover at each pixel its best possible resolution increase based on comparison with similar subimages of similar and disparate sizes.

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