Upsampling

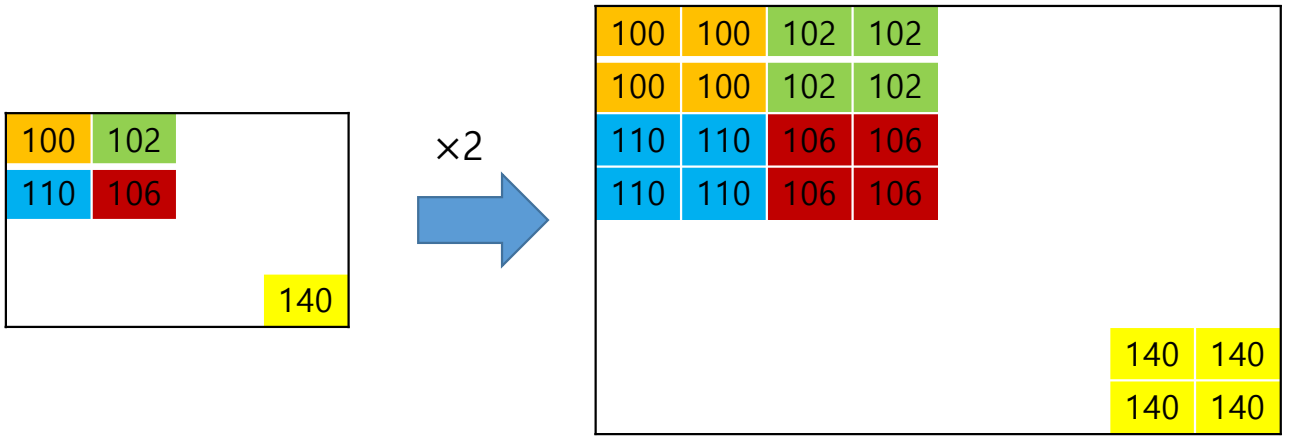
이진영

Image Upsampling

- Generally, same as image interpolation, image scaling(Upscaling), image resizing(upsizing)…
- Increasing the number of pixels
- Upscaling from a low resolution image to a high resolution image
- Generation of unknown pixels, based on known pixels

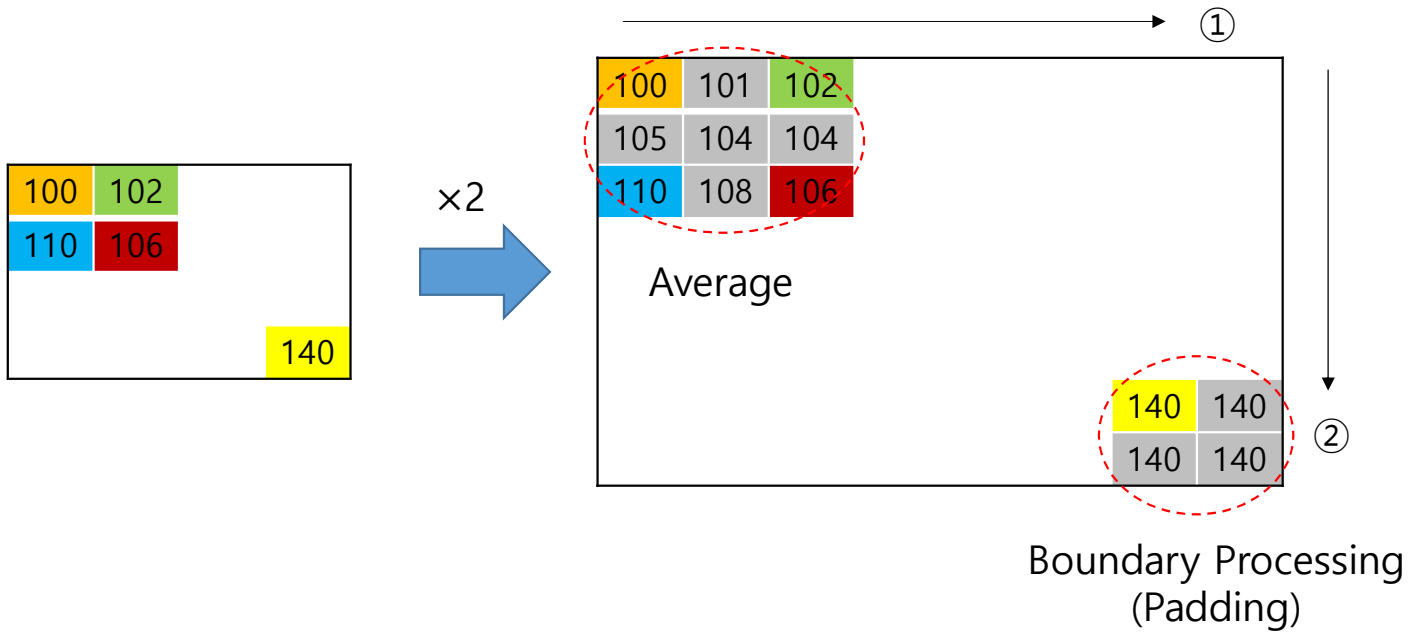
Nearest Neighbor Interpolation

- Simplest method that increases image size (Low complexity)
- Nearest neighbor pixel to interpolated positions



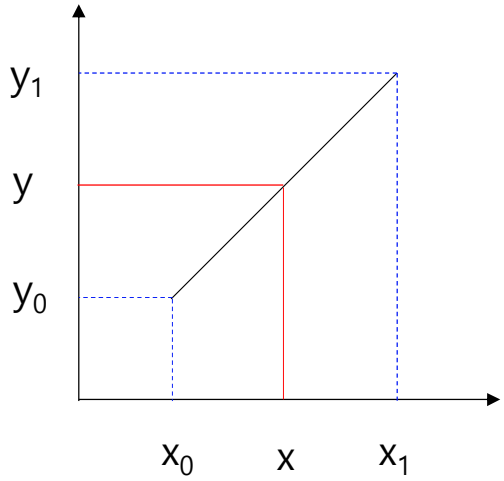
Bilinear Interpolation

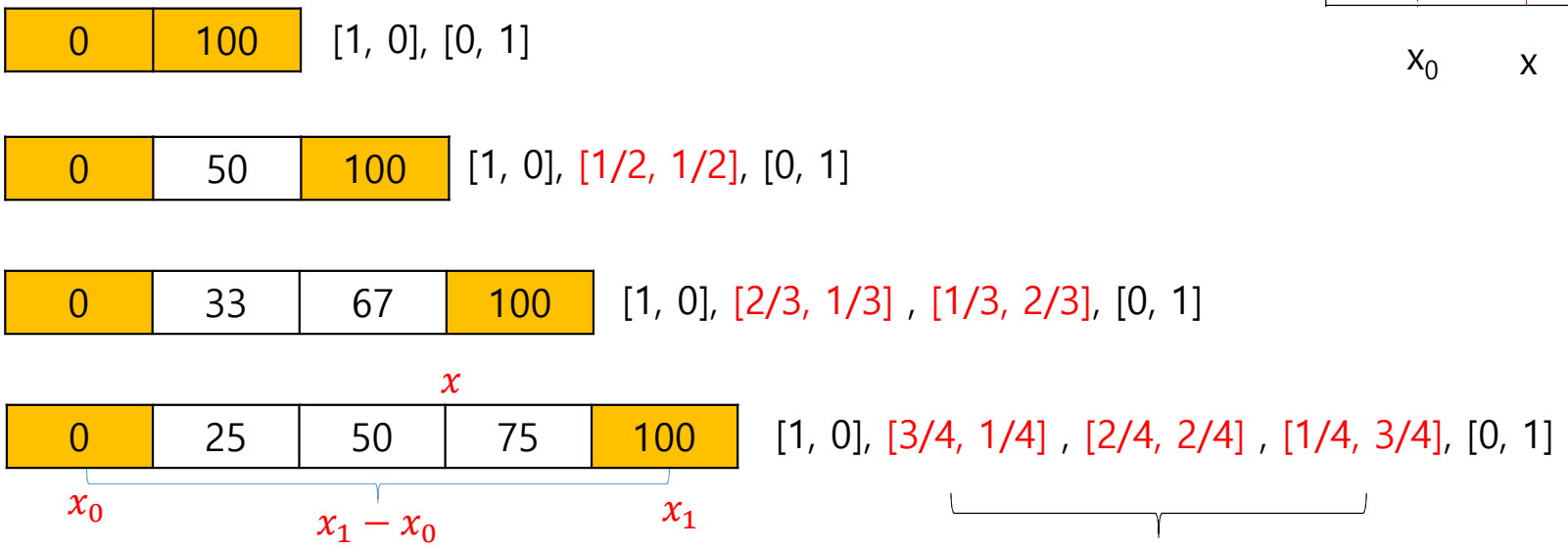
- Weighted average (Linear interpolation) with the nearest 2×2 neighboring pixels
- Generally, first in the horizontal direction and then in the vertical direction



Interpolation Coefficient

- (y, x) on a straight line between two known points (y_0, x_0) and (y_1, x_1)
- Weighting, based on the distance between known and unknown pixels



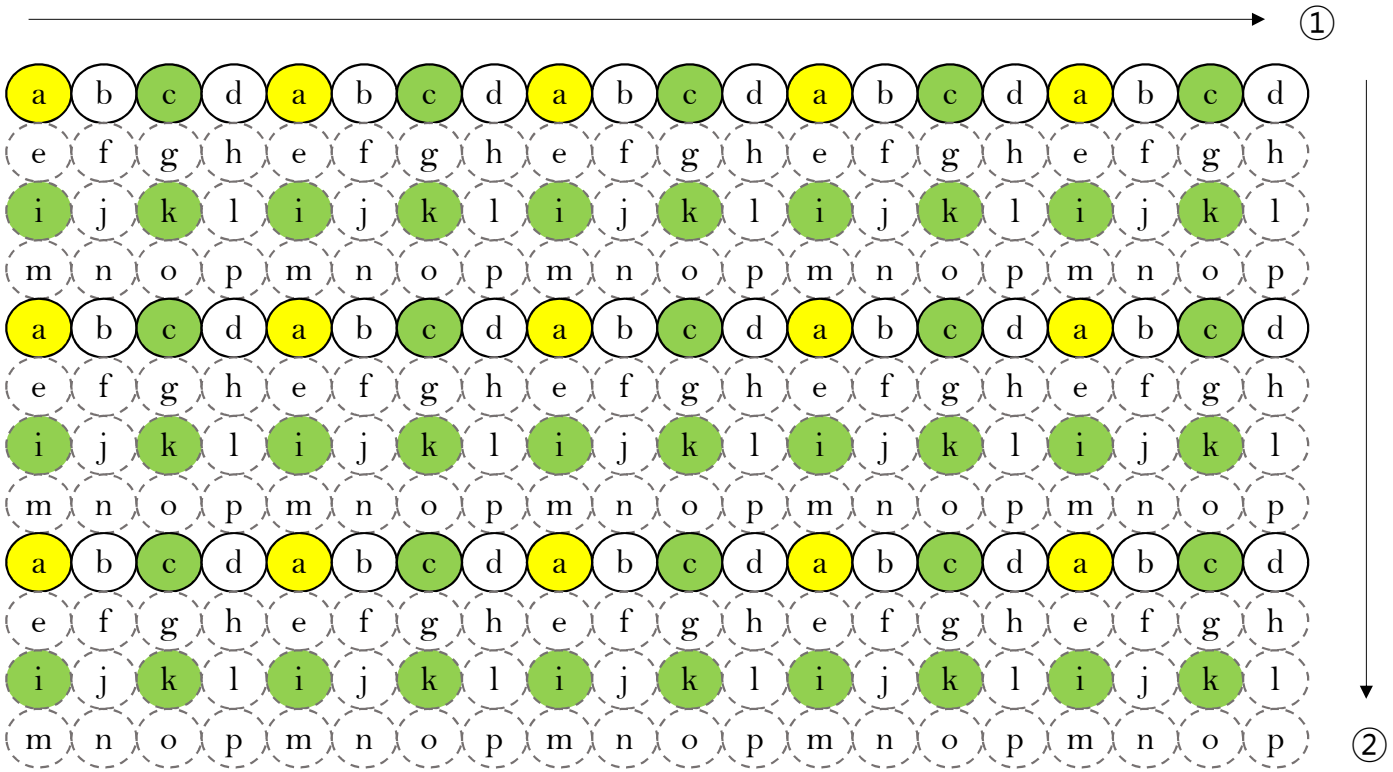


Bilinear Interpolation $\left[\frac{x_1 - x}{x_1 - x_0}, \frac{x - x_0}{x_1 - x_0}\right]$

N-Tap Interpolation Filter

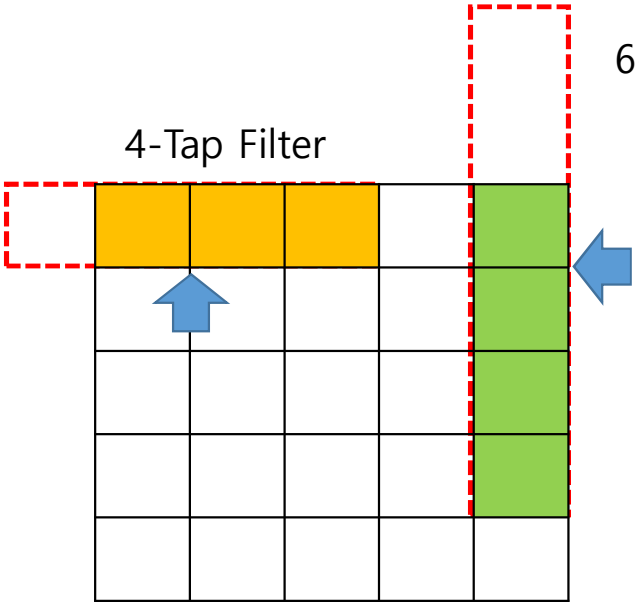
- Various filters that take more surrounding pixels into consideration
- Complexity proportional to filter size
- For example,
  - [1/2, 1/2]
  - [-1/16, 9/16, 9/16, -1/16]
  - [1/32, -5/32, 20/32, 20/32, -5/32, 1/32]
  - [-1/64, 4/64, -11/64, 40/64, 40/64, -11/64, 4/64, -1/64]
  - [a, b, …]

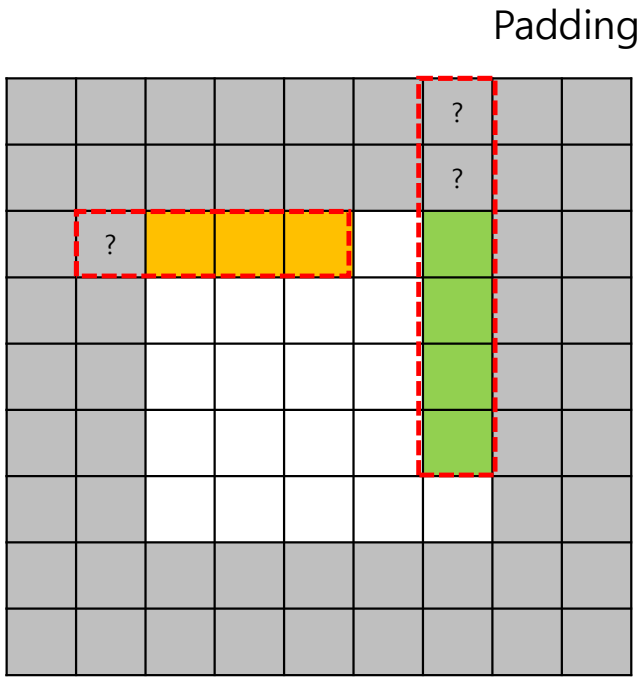
Filter Combination



Boundary Processing

- No processing or exceptional processing for image boundaries
- Various methods, depending on filter size, image characteristics…





Experiment

- Image upsamping with the nearest neighbor interpolation filter
- Generation of AICenterY_Upsampling.bmp(512X512) from AICenterY_Subsampling.bmp(256X256)
- PSNR of AICenterY_Upsampling.bmp, compared to AICenterY.bmp