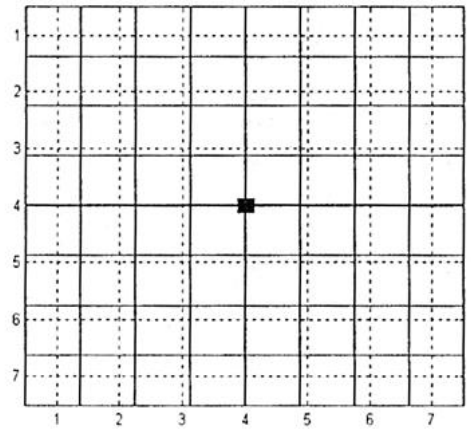
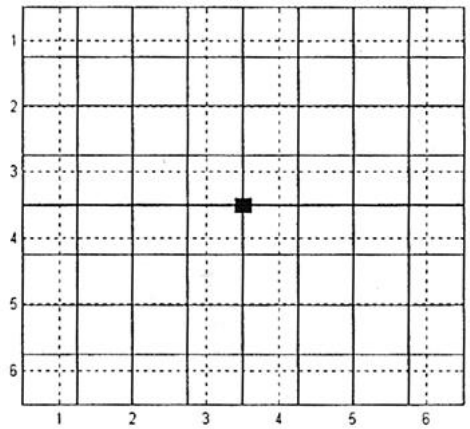
Computer Image Processing

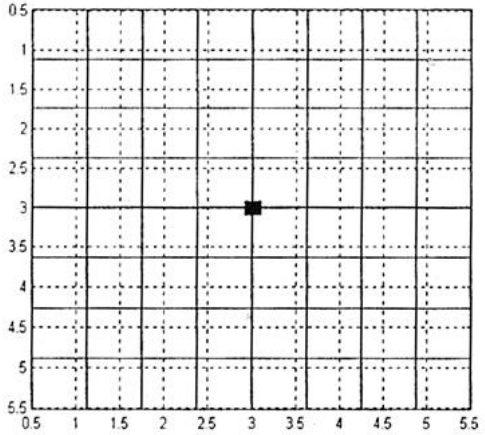
Lecture 3

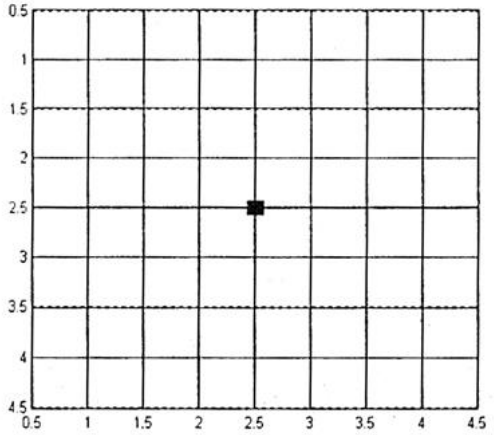
Image resizing algorithms

Change of the image size



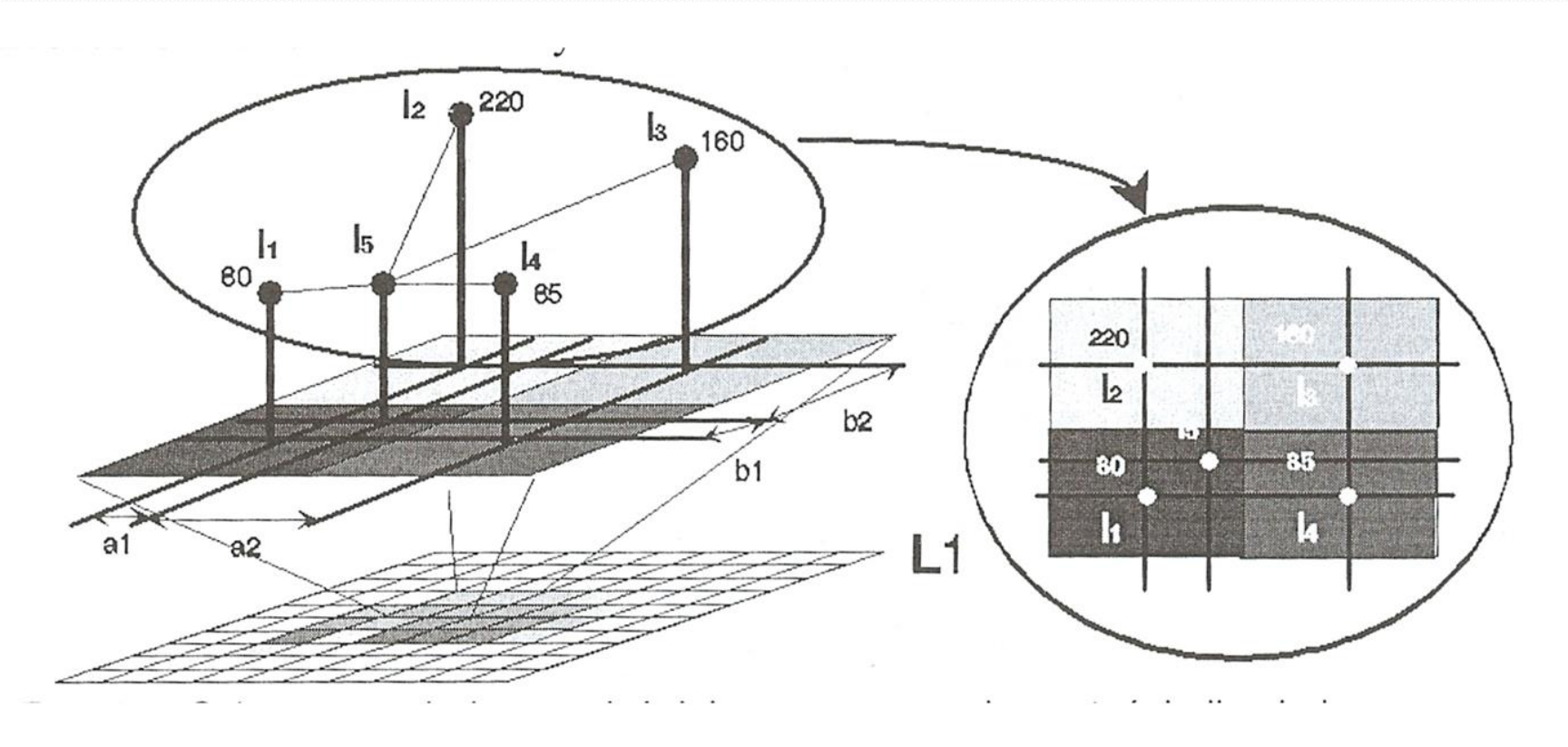






Interpolation methods

Nearest neighbour



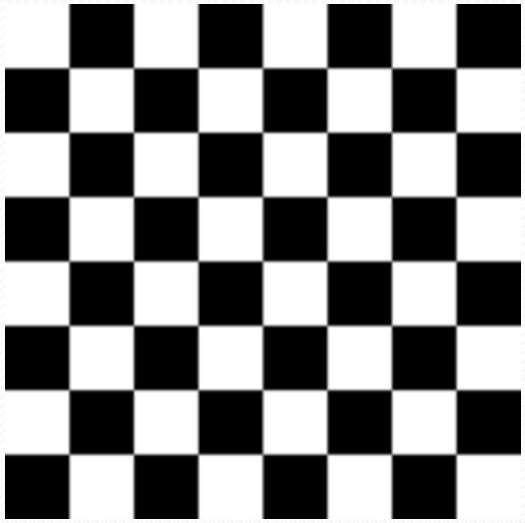
Interpolation methods

Nearest neighbour interpolation

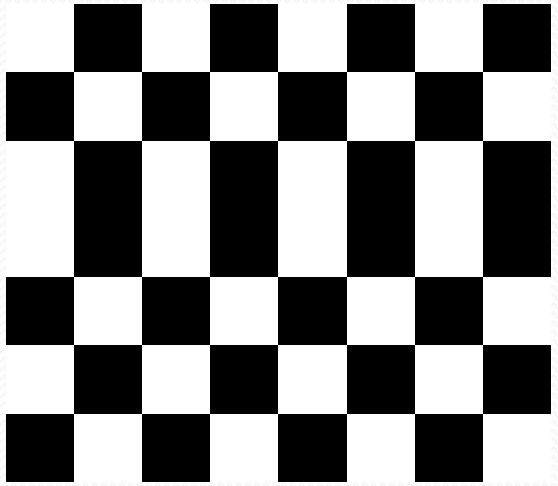
1. New pixel values are obtained by selecting a value of one of the four nearest pixels (in terms of Euclidean distance).
2. Pixels are duplicated (in upscaling) or eliminated (in downscaling).
3. No new values introduced into the picture.
4. No interpolation means that edges remain sharp.

Interpolation methods

Nearest neighbour



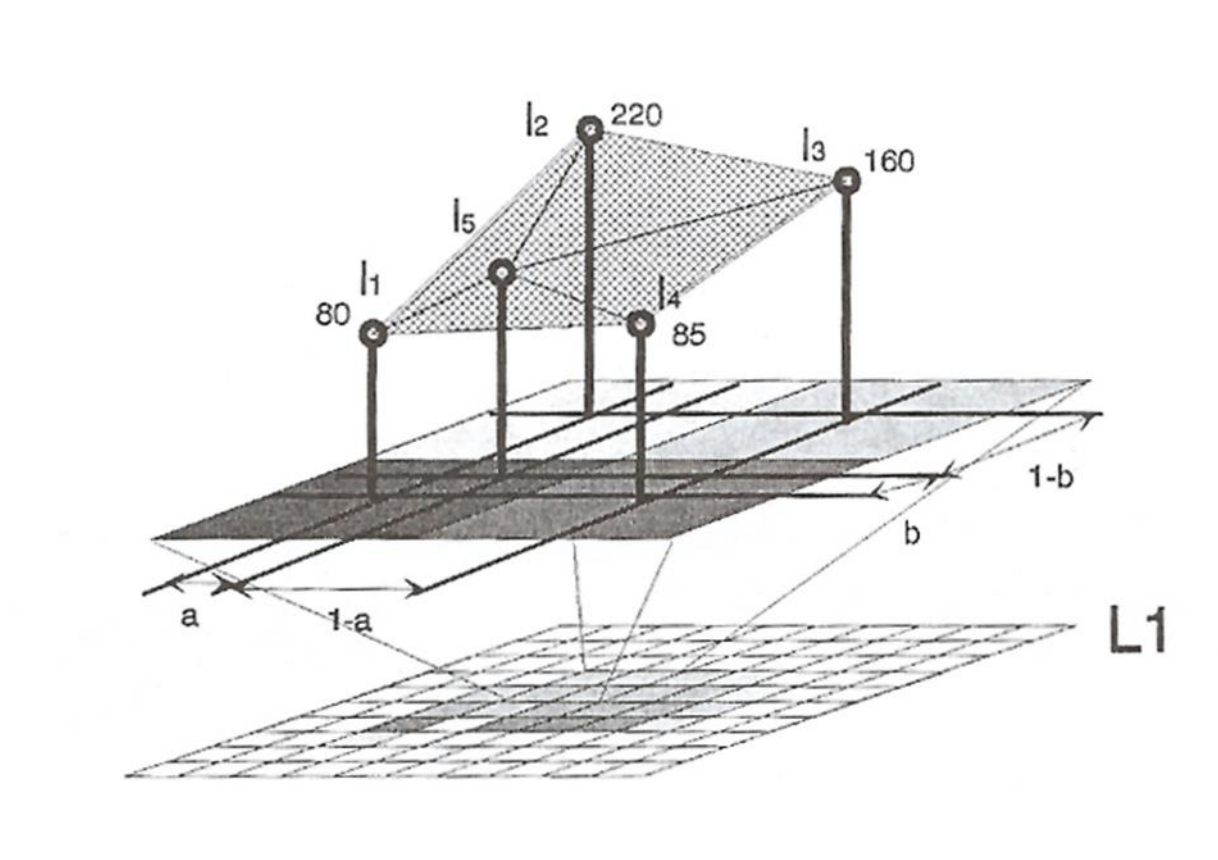
8 x 8 pixels



7 x 8 pixels

Interpolation methods

Bilinear interpolation



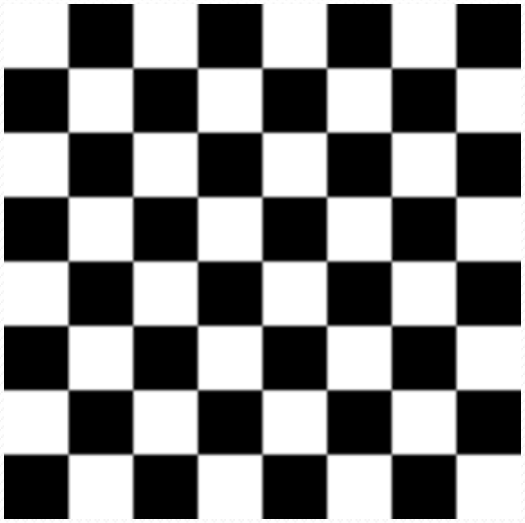
Interpolation methods

Bilinear interpolation

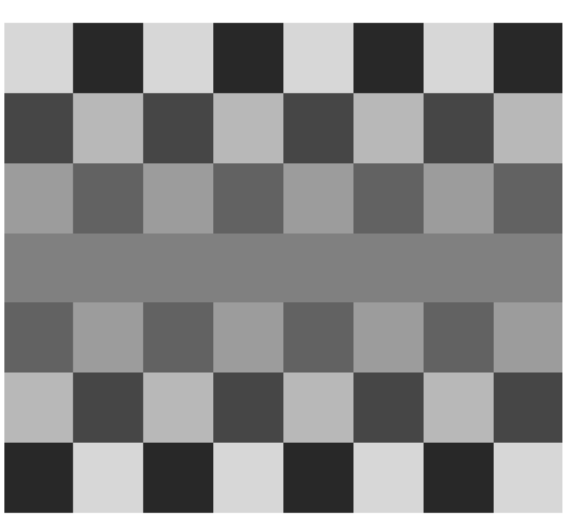
1. Four pixels of the neighbourhood are taken into consideration.
2. New pixel value is calculated with the use of linear combination of surrounding pixels.
3. The closer the pixel in neighbourhood is, the more influence on the resulting value it has.
4. New values are introduced into the image.
5. Edges are softened due to the linear interpolation.

Interpolation methods

Bilinear interpolation



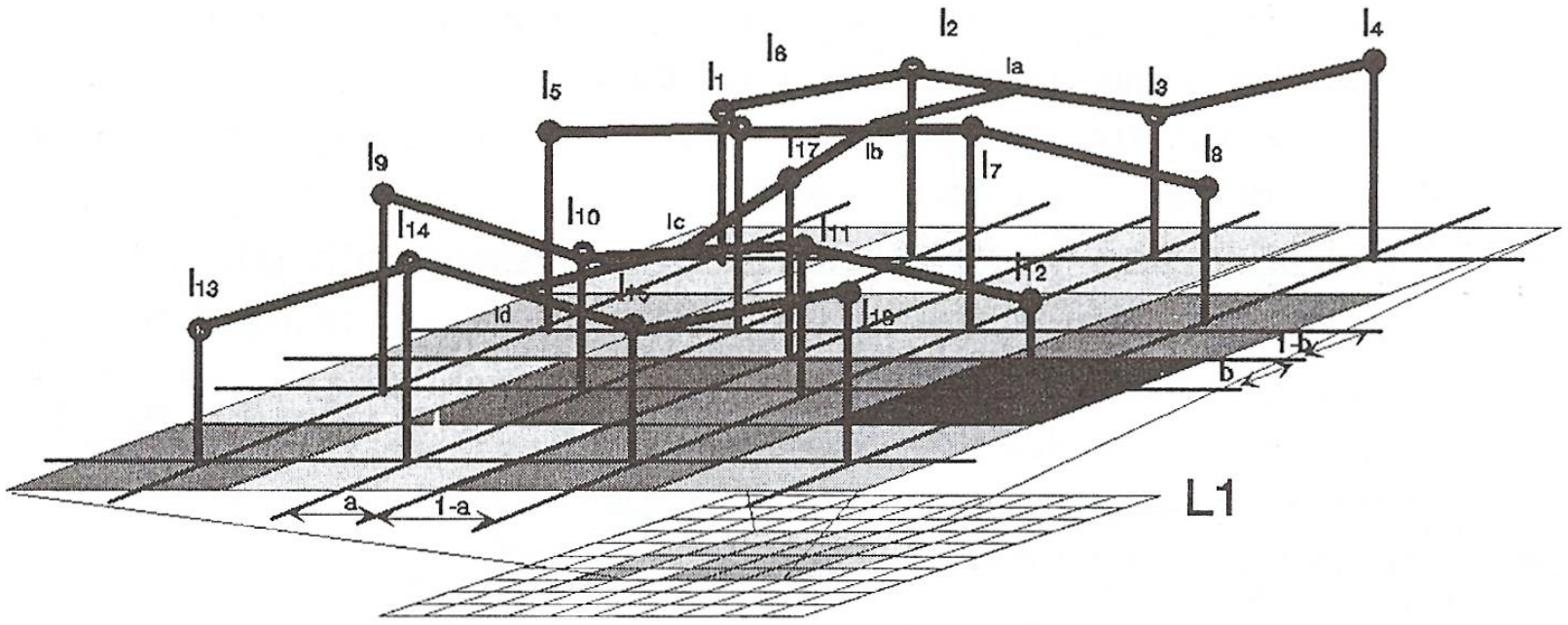
8 x 8 pixels



7 x 8 pixels

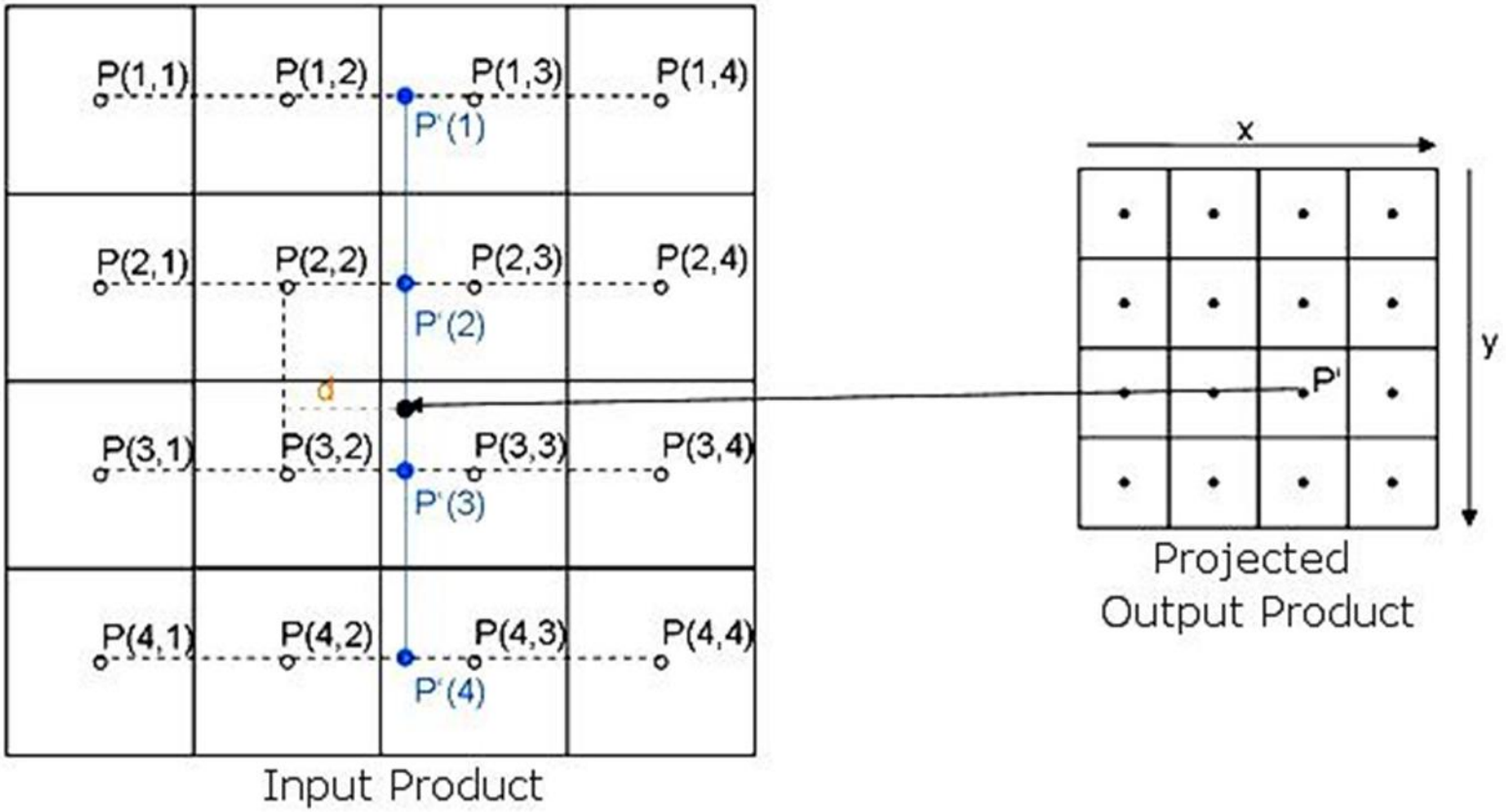
Interpolation methods

Bicubic interpolation



Interpolation methods

Bicubic interpolation



Interpolation methods

Bicubic interpolation

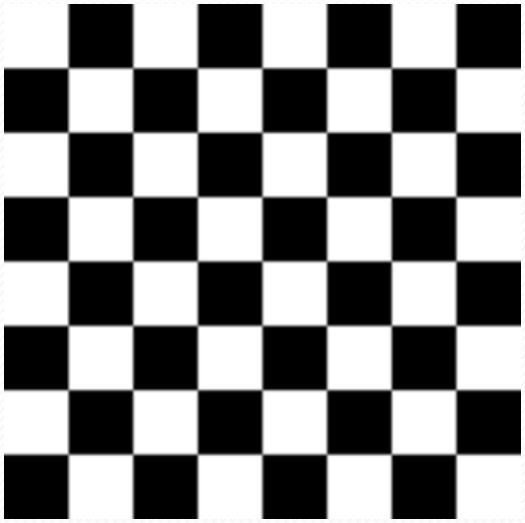
1. Sixteen pixels of the neighbourhood are taken into consideration.
2. New pixel value is calculated with the use of cubic function of surrounding pixels.

$$f(x) = a \cdot x^3 + b \cdot x^2 + c \cdot x + d$$

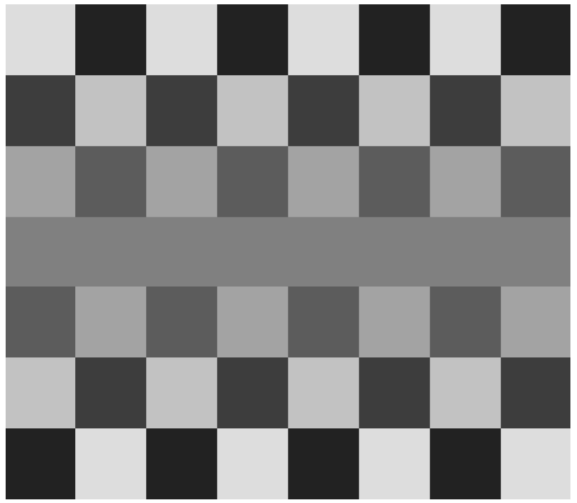
3. The closer the pixel in neighbourhood is, the more influence on the resulting value it has.
4. New values are introduced into the image.
5. Edges are softened due to the interpolation.

Interpolation methods

Bicubic interpolation



8 x 8 pixels



7 x 8 pixels

Interpolation methods

Resizing image with the use of the **nearest neighbour** method

Source image

Resulting image

Interpolation methods

Resizing image with the use of **bilinear interpolation** method

Source image

Resulting image

Interpolation methods

Resizing image with the use of **bicubic interpolation** method

Source image

Resulting image

Interpolation methods

Lanczos resampling

It uses *sinc* function

$$\operatorname{sinc} x = \begin{cases} \dfrac{\sin x}{x} & \text{for } x \neq 0 \\ 1 & \text{for } x = 0 \end{cases}$$

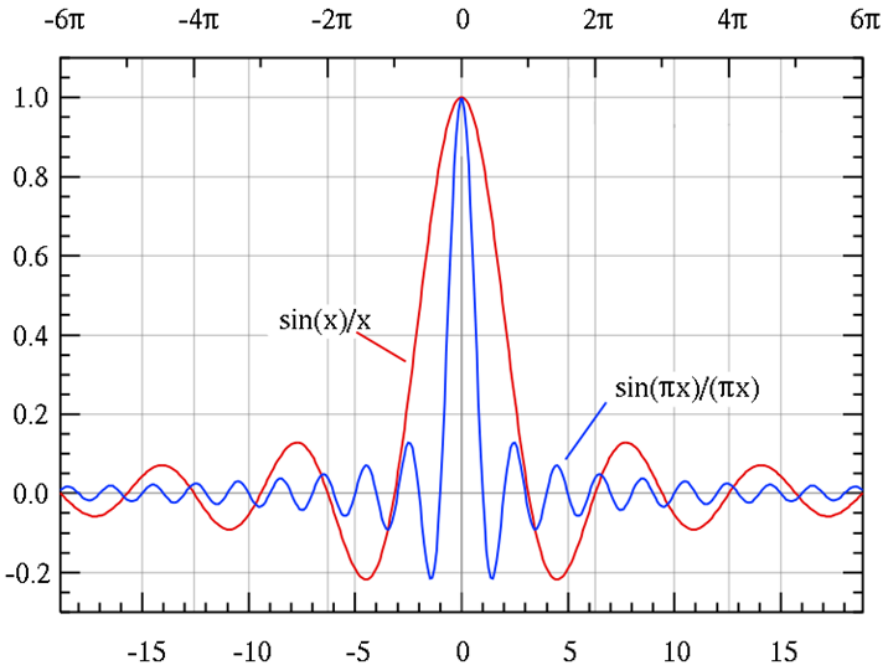


Image resizing

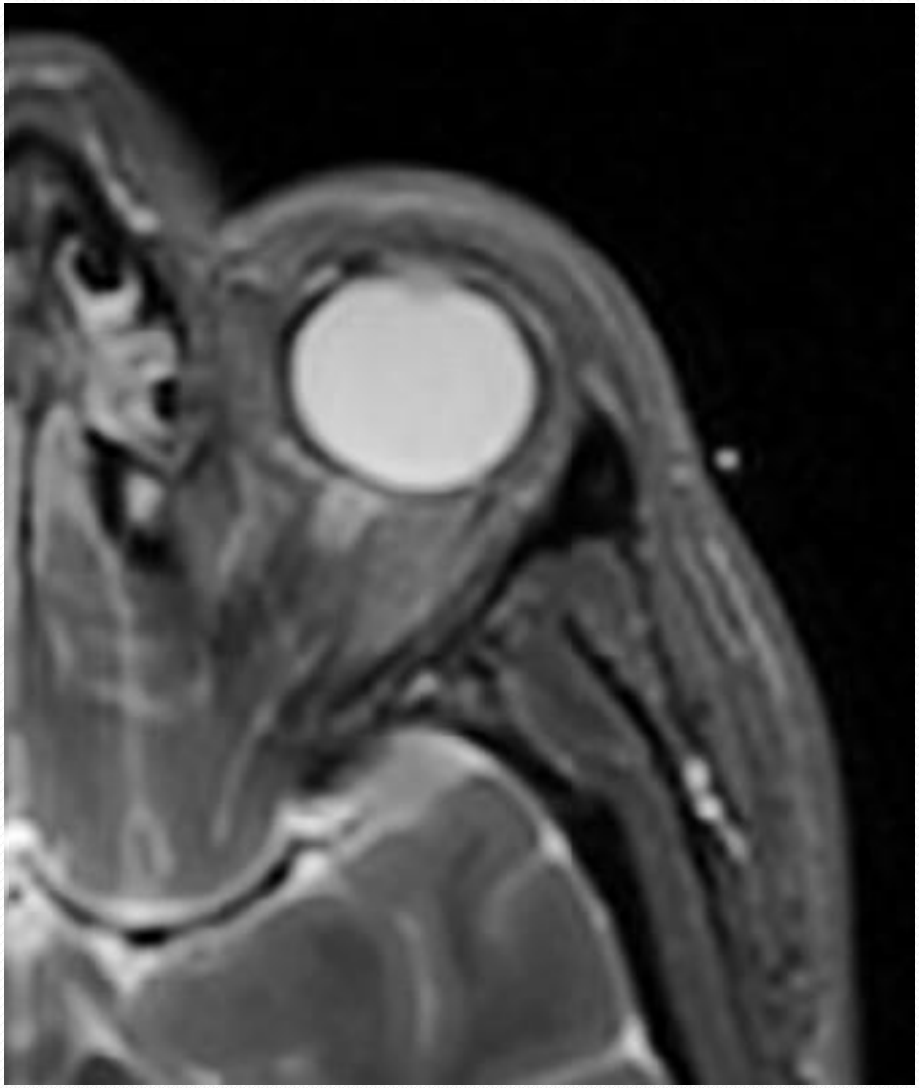
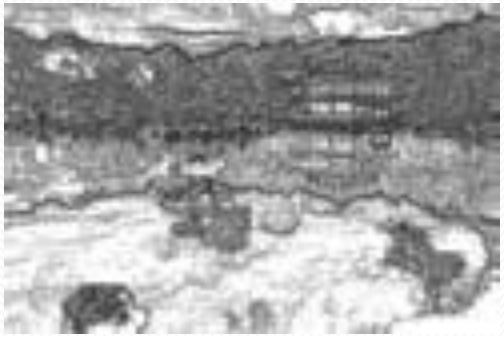


Image resizing

’ Intelligent’ resizing
(Content Aware Scale)

Image resizing

Resizing taking into account the content of the image.



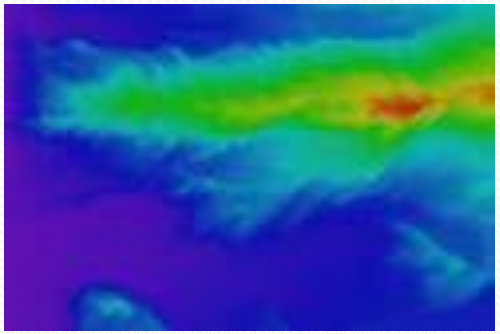


Image resizing

Comparison between Content Aware and known algorithms

Image rotation