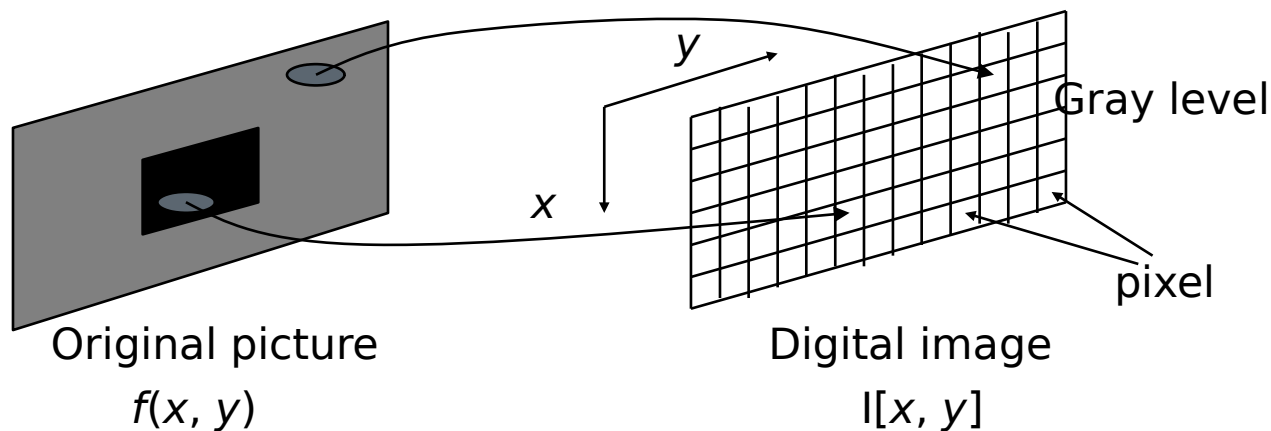


Image Read, Write and Basic Geometrical Transforms

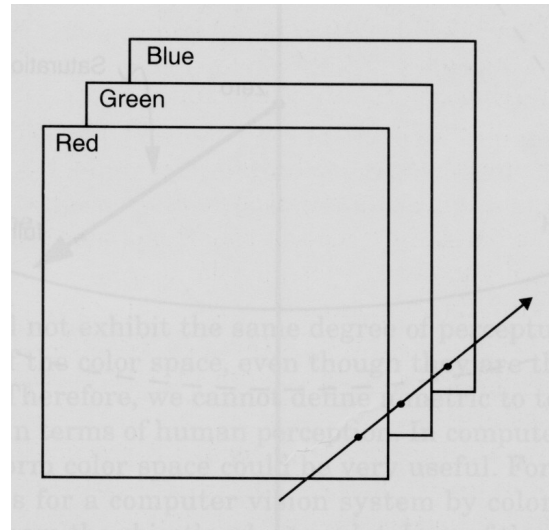
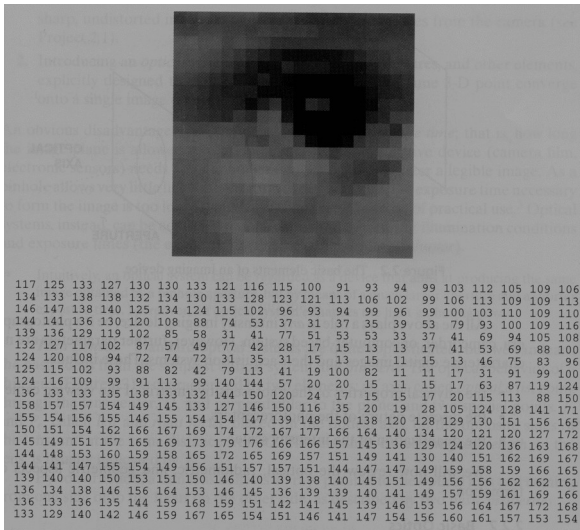
Experiment - 1

Image Processing Laboratory (EC
69502)

What is an Image



What is an Image



Color Depth

- Number of bits for a single pixel
 - 1-bit color: black and white
 - 8-bit color: gray-scale
 - 24-bit color: true color



Black-White



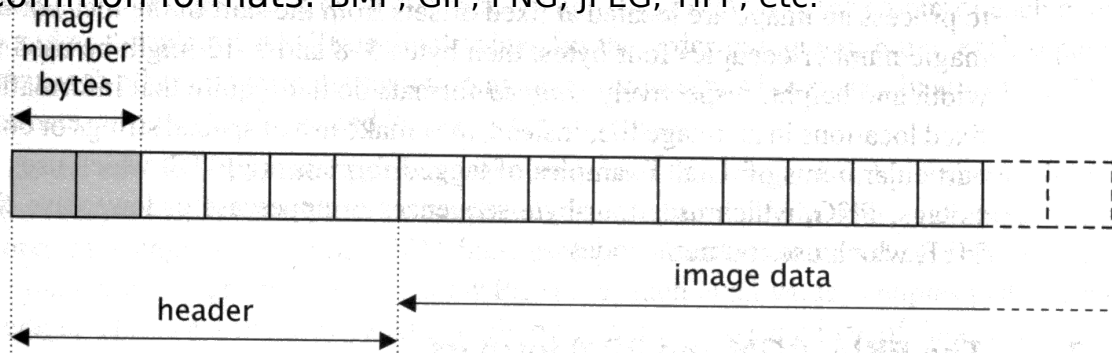
Gray-Scale



Reading and Writing an Image

Image File Format

- Most headers begin with a signature or magic number - a short sequence of bytes for identifying the file format.
- Header: characteristics of the image: Size, color map, compression method, etc.
- Data value: Pixel values, index values.
- Common formats: BMP, GIF, PNG, JPEG, TIFF, etc.



BMP File Format

- The BMP file format, also known as bitmap image file
- device independent bitmap (DIB) file format or simply a bitmap, is a image file format used to store bitmap digital images.
- independently of the display device (such as a graphics adapter), especially on Microsoft Windows and OS/2 operating systems
- BMP file is an uncompressed raster image comprised of a rectangular grid of pixels.
- It contains a
 - file header (bitmap identifier, file size, width, height, color options, and bitmap data starting point)
 - bitmap pixels, each with a different color.

BMP File Format

Structure	Corresponding Bytes	Description
Header	0x00 - 0x0D	contains information about the type, size, and layout of a device-independent bitmap file
Info Header	0x0E - 0x35	specifies the dimensions, compression type, and color format for the bitmap
Color Table	0x36 - variable	contains as many elements as there are colors in the bitmap, but is not present for bitmaps with 24 color bits because each pixel is represented by 24-bit red-green-blue (RGB) values in the actual bitmap data area
Pixel Data	variable	an array of bytes that defines the bitmap bits. These are the actual image data, represented by consecutive rows, or scan lines, of the bitmap. Each scan line consists of consecutive bytes representing the pixels in the scan line, in left-to-right order. The system maps pixels beginning with the bottom scan line of the rectangular region and ending with the top scan line.

BMP File Header

Name		Size	Description
Header		14 bytes	Windows Structure: BITMAPFILEHEADER
	Signature	2 bytes	'BM'
	File Size	4 bytes	File size in bytes
	reserved	4 bytes	Unused (=0) Application Specific
	Data Offset	4 bytes	Offset from beginning of file to the beginning of the bitmap data

BMP Info Header

Name		Size	Description
Info Header		40 bytes	Windows Structure: BITMAPINFOHEADER
	Size	4 bytes	Size of InfoHeader = 40
	Width	4 bytes	Horizontal width of bitmap in pixels
	Height	4 bytes	Vertical height of bitmap in pixels
	Planes	2 bytes	Number of Planes (=1)
	Bits Per Pixel	2 bytes	Bits per Pixel used to store palette information.
	Compression	4 bytes	Type of Compression
	ImageSize	4 bytes	(compressed) Size of Image
	XpixelsPerM	4 bytes	horizontal resolution
	YpixelsPerM	4 bytes	vertical resolution
	Colors Used	4 bytes	Number of actually used colors
	Important Colors	4 bytes	Number of important colors

Color Table and Pixel Data

ColorTable		4 * NumColors bytes	present only if Info.BitsPerPixel less than 8
	Red	1 byte	Red intensity
	Green	1 byte	Green intensity
	Blue	1 byte	Blue intensity
	reserved	1 byte	unused (=0)
Pixel Data	InfoHeader.ImageSize bytes		The image data



Geometric Transformation



What is Geometric Transformation

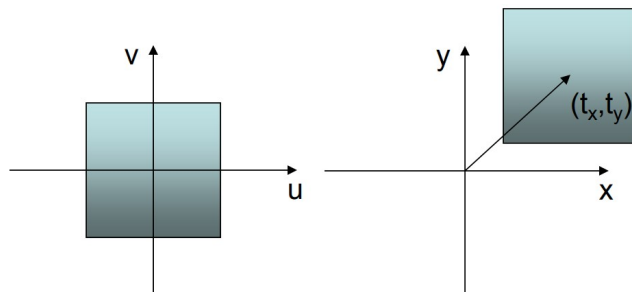
- A set of image transformations where the geometry of image is changed without altering its actual pixel values are commonly referred to as **Geometric transformation**.
- In general, multiple operations are applied on it, pixel values are not changed, the positions of pixel values are changed.
- There are two basic steps in geometric transformations:
 - Spatial transformation of the physical re-arrangement of pixels in the image
 - Interpolation, which assigns pixel intensity to the missing pixels of transformed image
- Such transformations are frequently used as pre-processing steps in different applications such as
 - document understanding, where the scanned image may be mis-aligned.
- Basic Geometric Image Transformations:
 - Translation, Scaling, Shear, Rotation

Translation

- Pixel coordinates undergo geometric translation to produce an image with coordinates
- is translation along x-axis and is translation along y-axis

Translation mapping function:

Matrix notation:



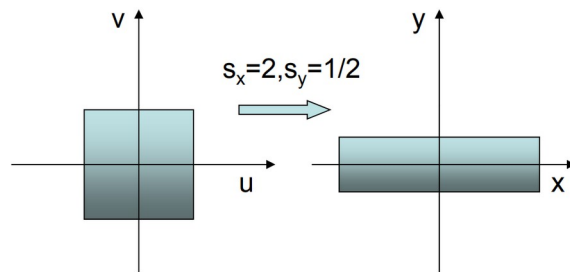
Input

Translated Image

Scaling

- Pixel coordinates undergo image scaling to produce an image with coordinates and is scale factor along x-axis and is along y-axis
- If and , this represents minification and shrinking.
- If and , this represents magnification and zoom.

Scaling function:



Input



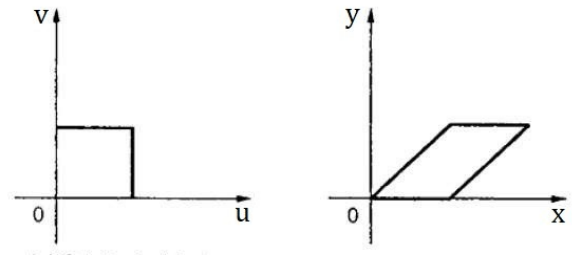
Scaled Image

Matrix notation:

Shear

- Pixel coordinates undergo shear transformation to produce an image with coordinates
- shear stress, f

Shear functional representation:



Matrix notation:

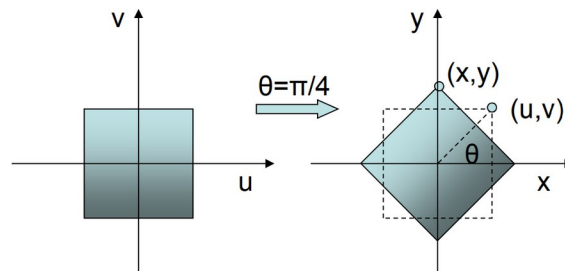


Input

Shear with different
factor

Rotation

- Pixel coordinates undergo geometric rotation to produce an image with coordinates
 - rotation angle is
- Rotation function:



Matrix notation:



Input



Rotation without
Interpolation

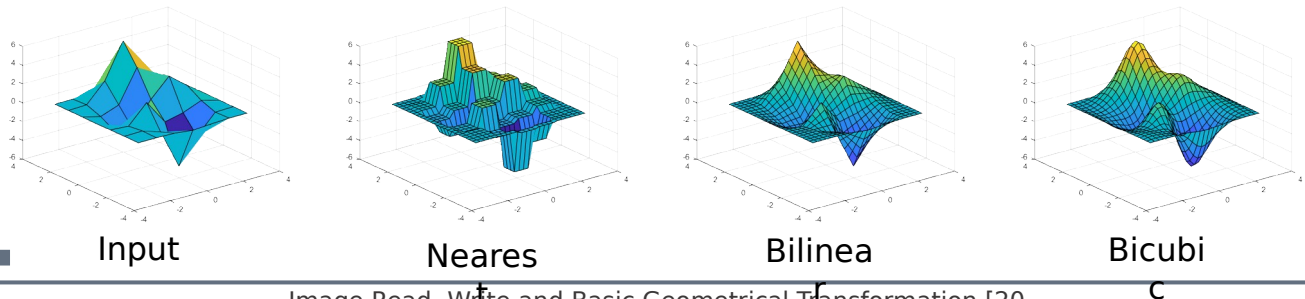
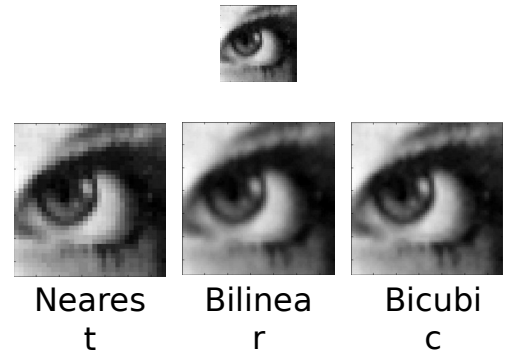
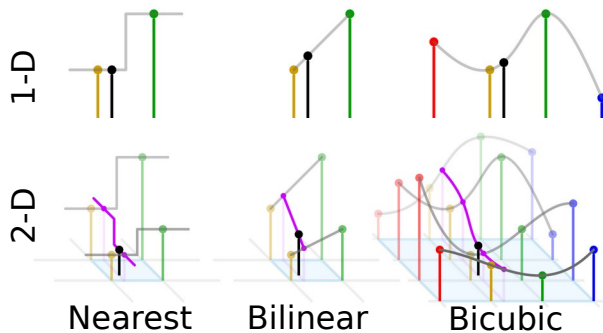


Rotation after
Interpolation

Interpolation

- Geometric transformation equations will produce values x and y that are not integers.
- A set of color intensity levels for non integer positions in the image are used to determine the color intensity levels that should be assigned to the integer pixel locations in the output image.
- Types of Interpolation:
 - Nearest Neighbor: Color intensity for to the pixel having closest integer coordinates to .
 - Bilinear Interpolation:
 - Bicubic Interpolation:
 - is the grey value at position . Grey levels of the 4 surrounding integer pixel positions are used to determine the correct grey level of the position when the output pixel came from.

Interpolation





Thank You

