Computer Animation

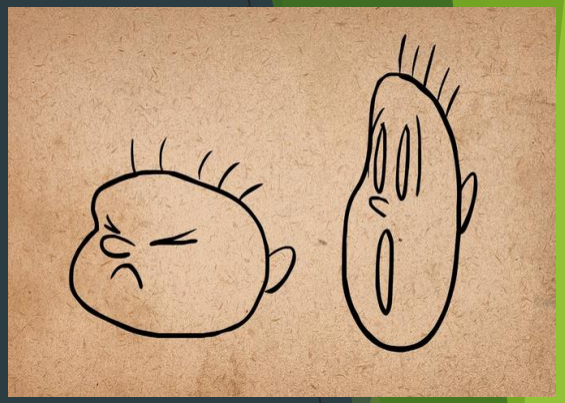
Unit 5

What is Animation?

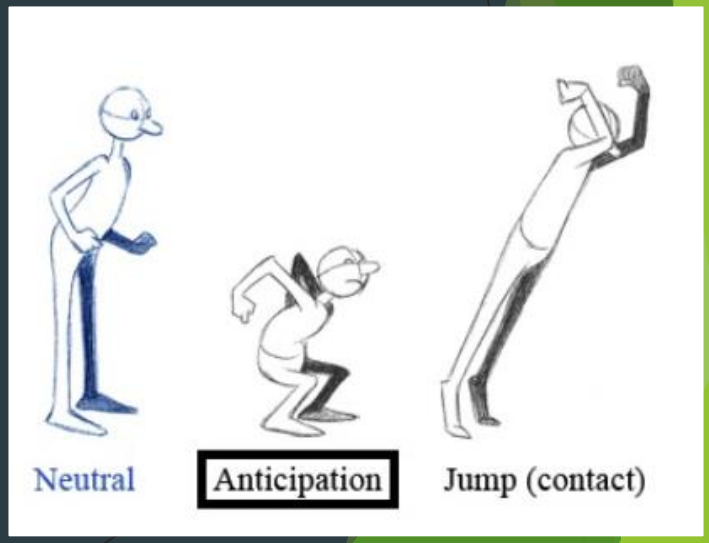
- Art of creating a moving images by using computers.
- Applications of computer animations are games cartoon motion pictures.
- Animation creates the illusion of movement.
- An image is displayed on the computer screen which then quickly replaced by a new image that is similar to the previous image but slightly shifted.

Principles of Animation

- Squash & Stretch:
  - This action gives the illusion of weight and volume to a character as it moves.

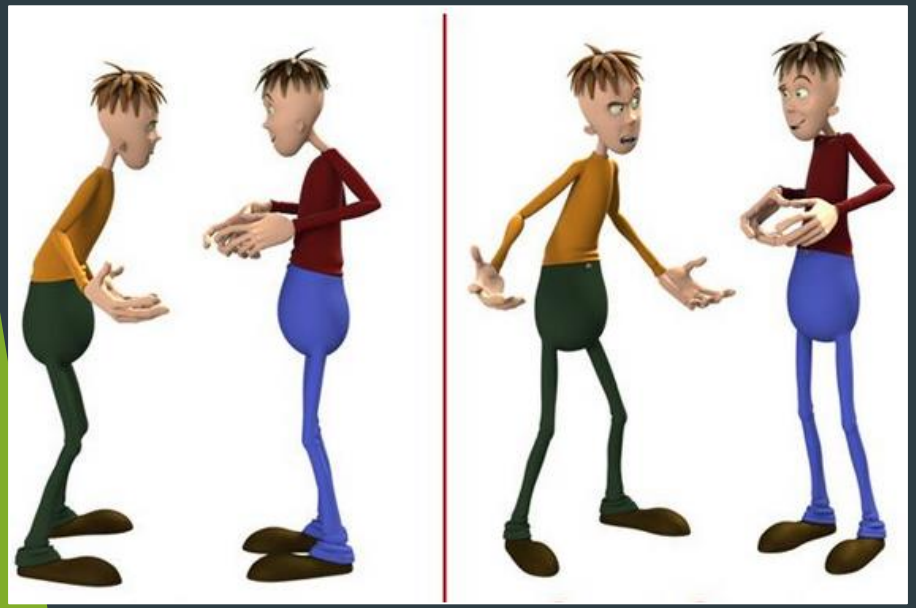


- Anticipation:
  - This movement prepares the audience for a major action the character is about to perform, such as, starting to run, jump or change expression.

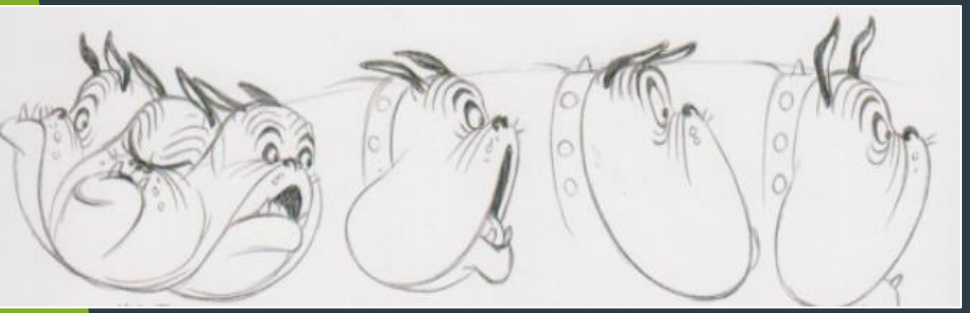


- Staging:
  - A pose or action should clearly communicate to the audience the attitude, mood, reaction or idea of the character as it relates to the story and continuity of the story line

- Straight ahead & pose to pose animation:
  - It starts at the first drawing and works drawing to drawing to the end of a scene.



- Follow through & overlapping action:
  - When the main body of the character stops all other parts continue to catch up to the main mass of the character, such as arms, long hair, clothing, coat tails or a dress, floppy ears or a long tail (these follow the path of action).



- Slow-out & slow-in:
  - As action starts, we have more drawings near the starting pose, one or two in the middle, and more drawings near the next pose.

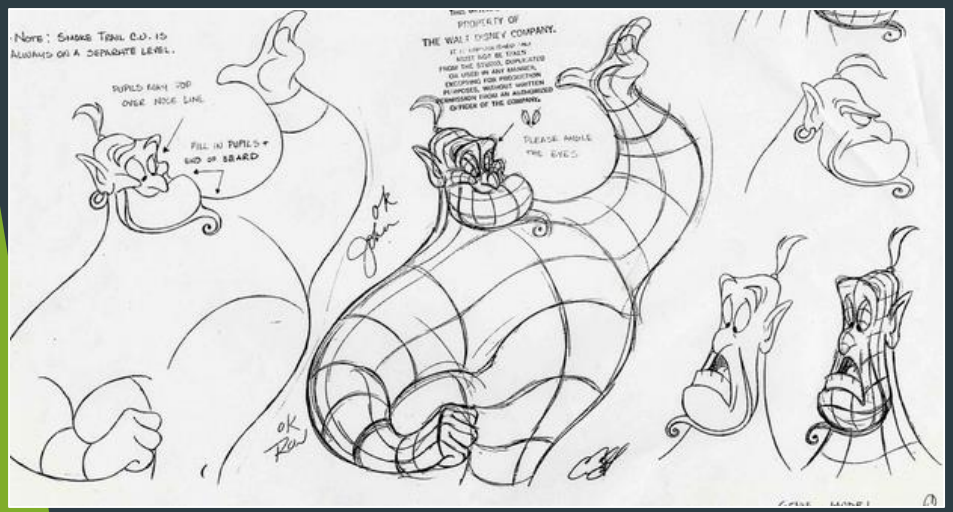
- Arcs:
  - All actions, with few exceptions (such as the animation of a mechanical device), follow an arc or slightly circular path.

- Secondary Action:
  - This action adds to and enriches the main action and adds more dimension to the character animation, supplementing and/or re-enforcing the main action.

- Timing:
  - Expertise in timing comes best with experience and personal experimentation, using the trial and error method in refining technique.

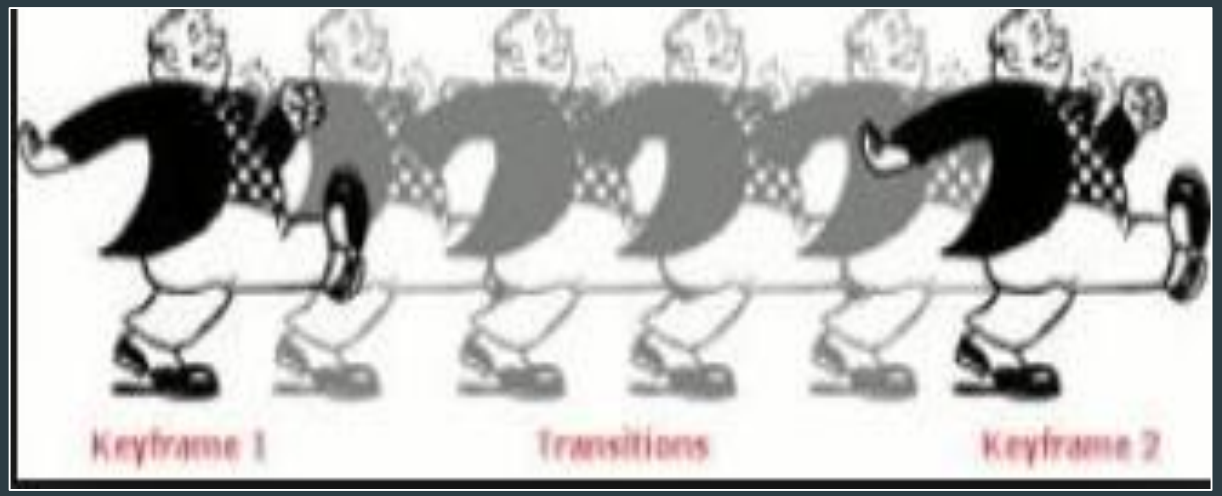
- Exaggeration:
  - Exaggeration is not extreme distortion of a drawing or extremely broad, violent action all the time.

- Solid Drawing:
  - The basic principles of drawing form, weight, volume solidity and the illusion of three dimension apply to animation as it does to academic drawing.
- Appeal:
  - A live performer has charisma. An animated character has appeal. Appealing animation does not mean just being cute and cuddly.



Key Framing

- A **key frame** in animation and filmmaking is a drawing that defines the starting and ending points of any smooth transition.
- The drawings are called "frames" because their position in time is measured in frames on a strip of film.
- To produce a key frame animation, the animator creates the behavior of a model manually by using an intuitive “put that there” methodology.
- The animator has direct control over the positions, shapes, and motions of models at any moment in the animation.

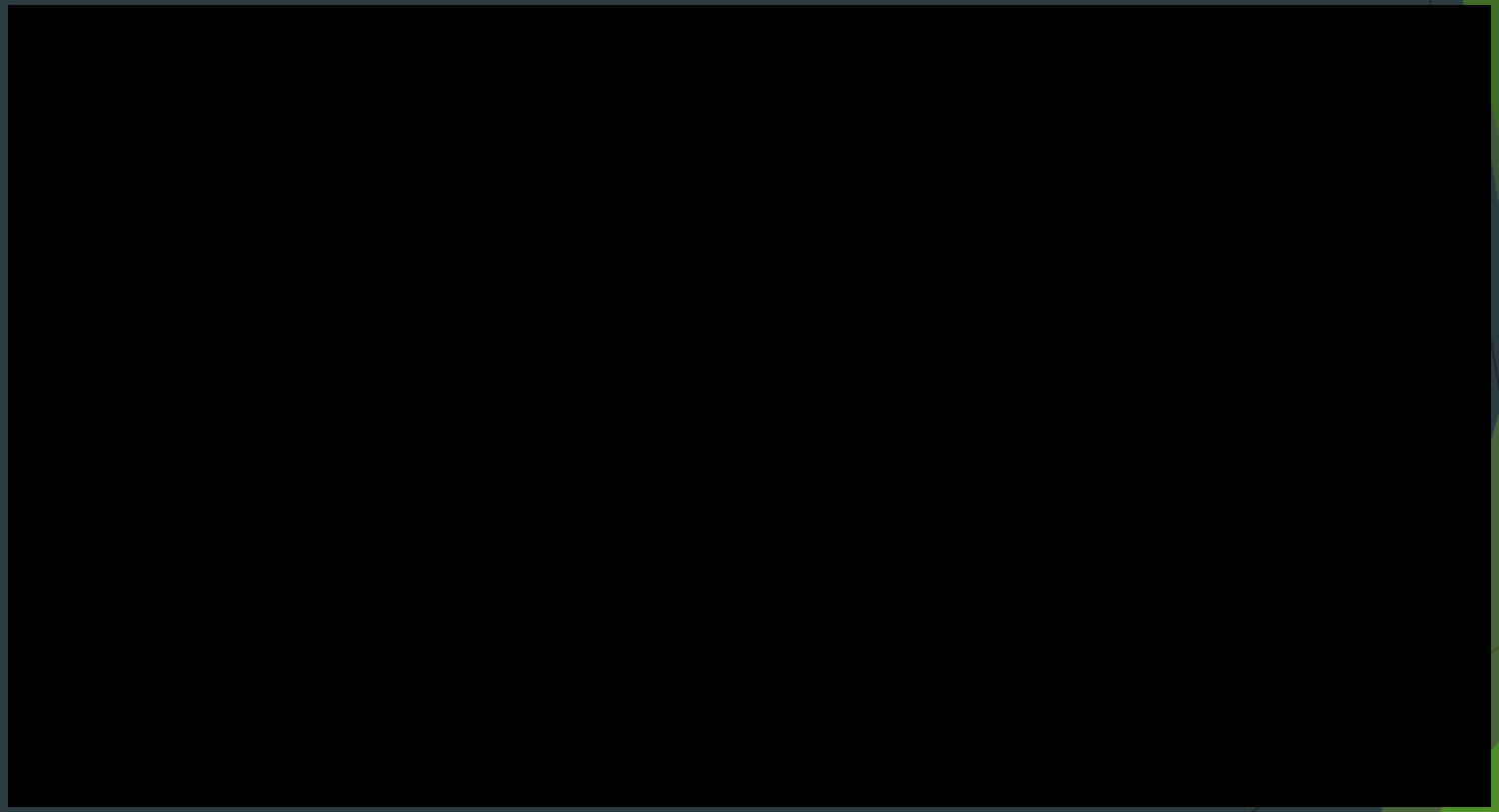

Keyframe 1
Transitions
Keyframe 2

Key Framing

Procedural Techniques

- To produce a procedural animation the animator provides initial conditions and adjust rather abstract physical parameters, such as forces, in order to control positions, shapes, and motions of models.
- The effect of changing a parameter value is often unpredictable in procedural animation. The animator has to run a simulation to see the result.
- A **Procedural Animation** is a type of computer **animation**, used to automatically generate **animation** in real-time to allow for a more diverse series of actions than could otherwise be created using predefined **animations.**

Procedural Techniques

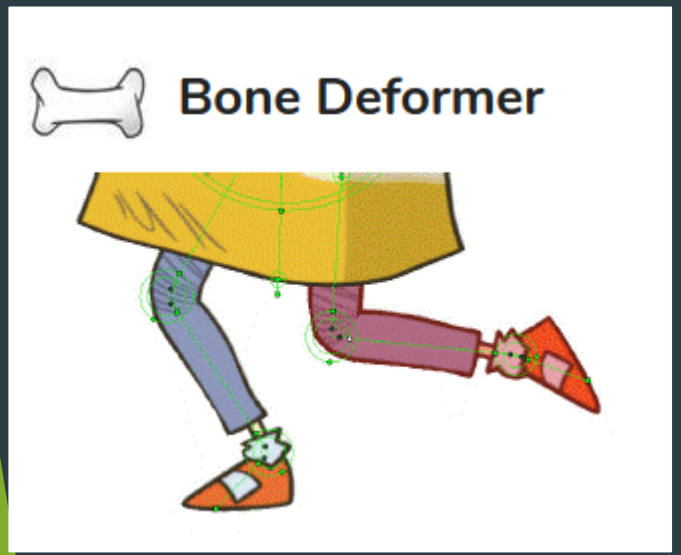


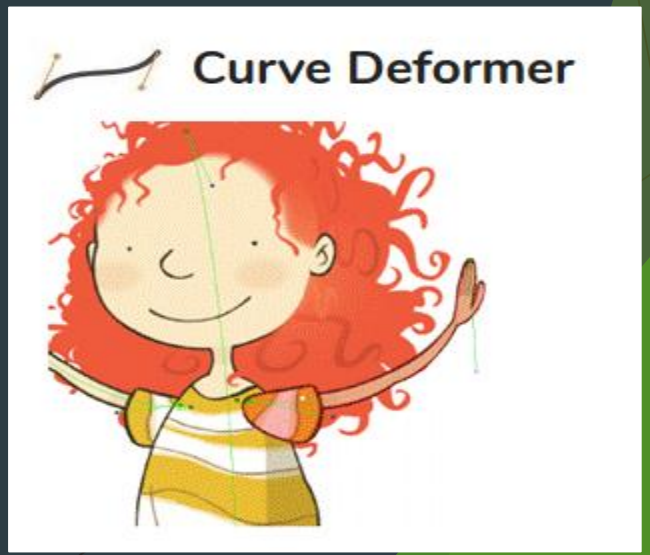
Deformations

- Harmony Stage provides you with the deformation technology to deform bitmap and vector drawings over a period of time.
- These deformers can be linked to create a hierarchy of deformation.
- This technology allows you to deform a character made out of one, or many, drawing or image layers and make it move as if it were a cut-out puppet.
- It also allows you to take an area in a single bitmap image and create animation by distortion.

About the Deformation Process

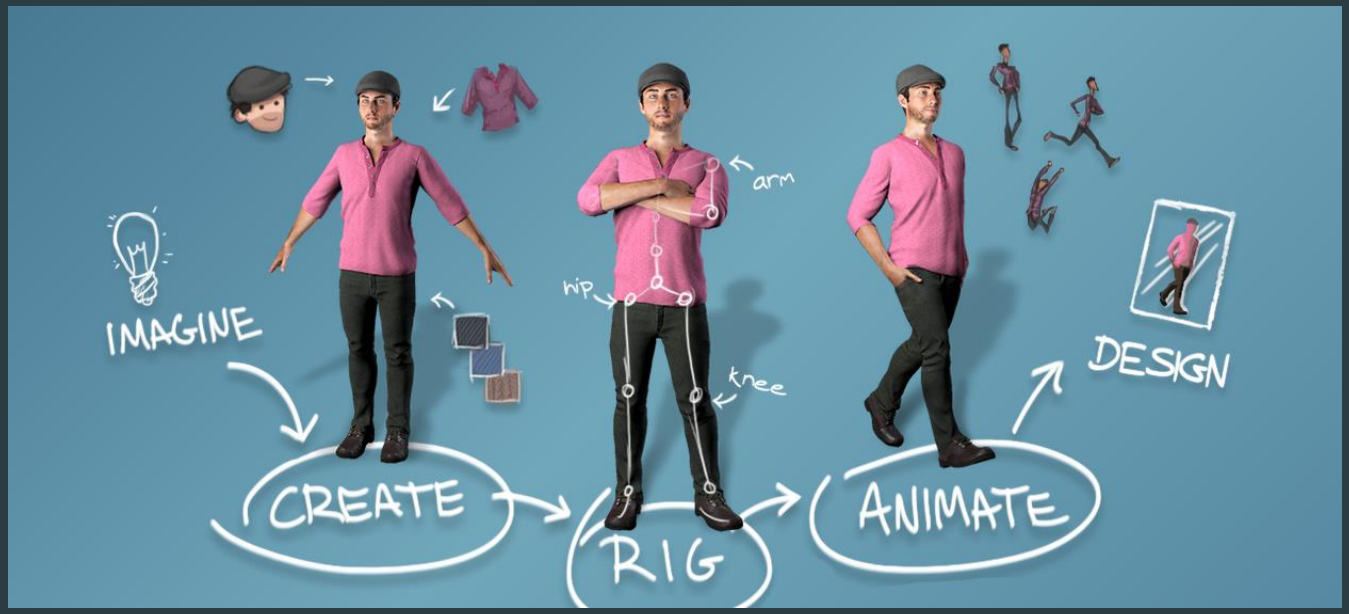
- The Deformation Effect can be used to animate either bitmap or vector based graphics, it even works on gradients and textures.
- There are 2 main types of deformer:
  - Bone Deformer
  - Curve Deformer





Character Animation

- Character animation is generally defined as the art of making a particular character move in a two- or three-dimensional context. It is a process central to the concept of animation


IMAGINE
CREATE
arm
hip
knee
RIG
ANIMATE
DESIGN

Physics-Based Animation

- Physics-based animation relies on the laws of physics to manifest a high degree of realism in animation.
- In our day-to-day life, when a change occurs, it comes with a physical transition that is natural for us to recognize.
- Similarly, animations that are more natural-looking, uninterrupted, and the ones that maintain momentum, are easily perceived by us.
- Physics-based animation uses the fundamentals of physics to build animations. An animation is driven by force. The animation comes to rest when the force reaches equilibrium.

Benefits of Physics Based Animation

- **Natural-looking**
  - Animations are more flexible and mimic real time movements. Drawing influence from physics creates motion that is easy to understand and works holistically.
- **Course Correction**
  - Animations keep momentum when their target changes, and end with a smoother motion.
- **Reduced visual defects**
  - Animations appear more responsive and smooth, and reduce overall visual disruptions.

Groups of Objects/Assets

- Grouping assets together can keep large scenes well-organized, letting you easily select and view the related assets you need. Once stored in a group, you can manipulate the assets collectively, instead of manipulating each individual item.
- For example, if you add all the nodes from a skeleton's arm to a group, you can then scale, rotate, or translate the entire arm at the same time.
- Groups are very similar to sets. However, groups are different in that you can have a single object appear in multiple groups. Sets are exclusive, meaning any object can occur in only one set.

Image Manipulation & Storage

- What is an Image?
- An image is a visual representation of something.
- An image is a picture that has been created or copied and stored in electronic form.
- An image can be described in terms of vector graphics or raster graphics.
- An image stored in raster form is sometimes called a bitmap.
- An image map is a file containing information that associates different locations on a specified image with hypertext links.

Digital Image file formats

- JPEG (Joint Photographic Experts Group):
  - an ISO/IEC group of experts that develops & maintains standards for a suite of compression algorithms for computer image files.
  - JPEGs usually have a .jpg file extension.
- GIF (Graphics Interchange Format)
  - The GIF uses the 2D raster data type and is encoded in binary.
  - GIF files ordinarily have the .gif extension.
- GIF89 (animated GIF image), formatted according to GIF Version 89a.
  - advantage - format is the ability to create an animated image that can be played after transmitting to a viewer page that moves - for example, a twirling icon or a banner with a hand that waves or letters that magically get larger.
  - A GIF89a can also be specified for interlaced GIF presentation.

- PNG (Portable Network Graphics)
  - is a file format for image compression that was designed to provide a number of improvements over the GIF format.
  - Like a GIF, a PNG file is compressed in lossless fashion (meaning all image information is restored when the file is decompressed during viewing).
  - Files typically have a ‘.png’ extension.
- SVG (Scalable Vector Graphics)
  - The description of an image as an application of XML. Any program such as a browser that recognizes XML can display the image using the information provided in the SVG format. Scalability means that the file can be viewed on a computer display of any size and resolution, whether the small screen of a smartphone or a large widescreen display in a PC. Files usually have ‘.svg’ extension.
- TIFF (Tag Image File Format)
  - Is a common format for exchanging raster graphics (bitmap) images between application programs, including those used for scanner images. A TIFF file can be identified as a file with a .tiff or ".tif" file name suffix.

Image Compression

- The objective is to reduce redundancy of the image data to be able to store or transmit data in an efficient form.

1. Lossless Technique:
   - A text file or program can be compressed without the introduction of errors, but only up to a certain extent.
2. Lossy:
   - suitable for natural images such as photos in applications where minor loss of fidelity is acceptable to achieve a substantial reduction in bit rate.

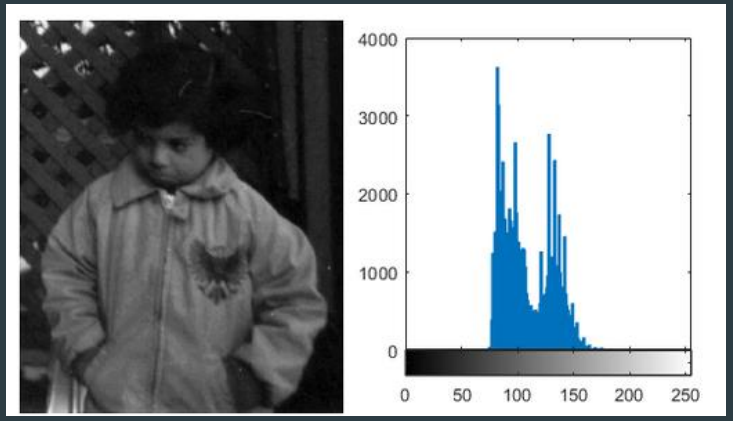

Lossless
Lossy

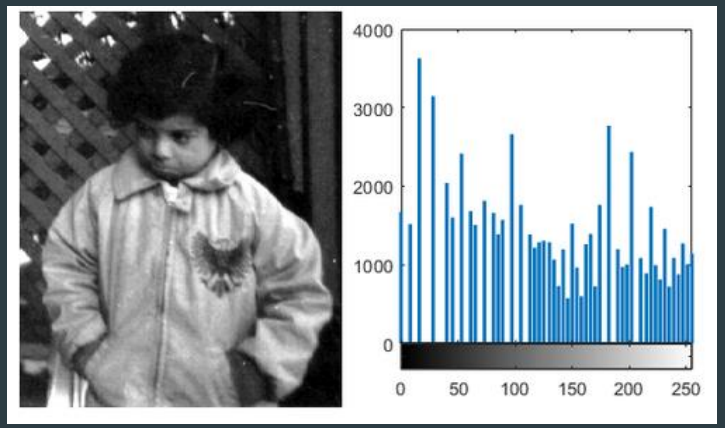
Digital Image Enhancement

- These techniques have been widely used in many applications of image processing where the subjective quality of images is important for human interpretation.
- Contrast is an important factor in any subjective evaluation of image quality.
- Contrast is created by the difference in luminance reflected from two adjacent surfaces.
- In other words, contrast is the difference in visual properties that makes an object distinguishable from other objects and the background.
- Histogram Equalization, smoothing and median Filtering.

Contrast Stretching

- Contrast adjustment remaps image intensity values to the full display range of the data type. An image with good contrast has sharp differences between black and white.
- To illustrate, the image on the left has poor contrast, with intensity values limited to the middle portion of the range.
- The image on the right has higher contrast, with intensity values that fill the entire intensity range [0,255].
- In the high contrast image, highlights look brighter and shadows look darker.

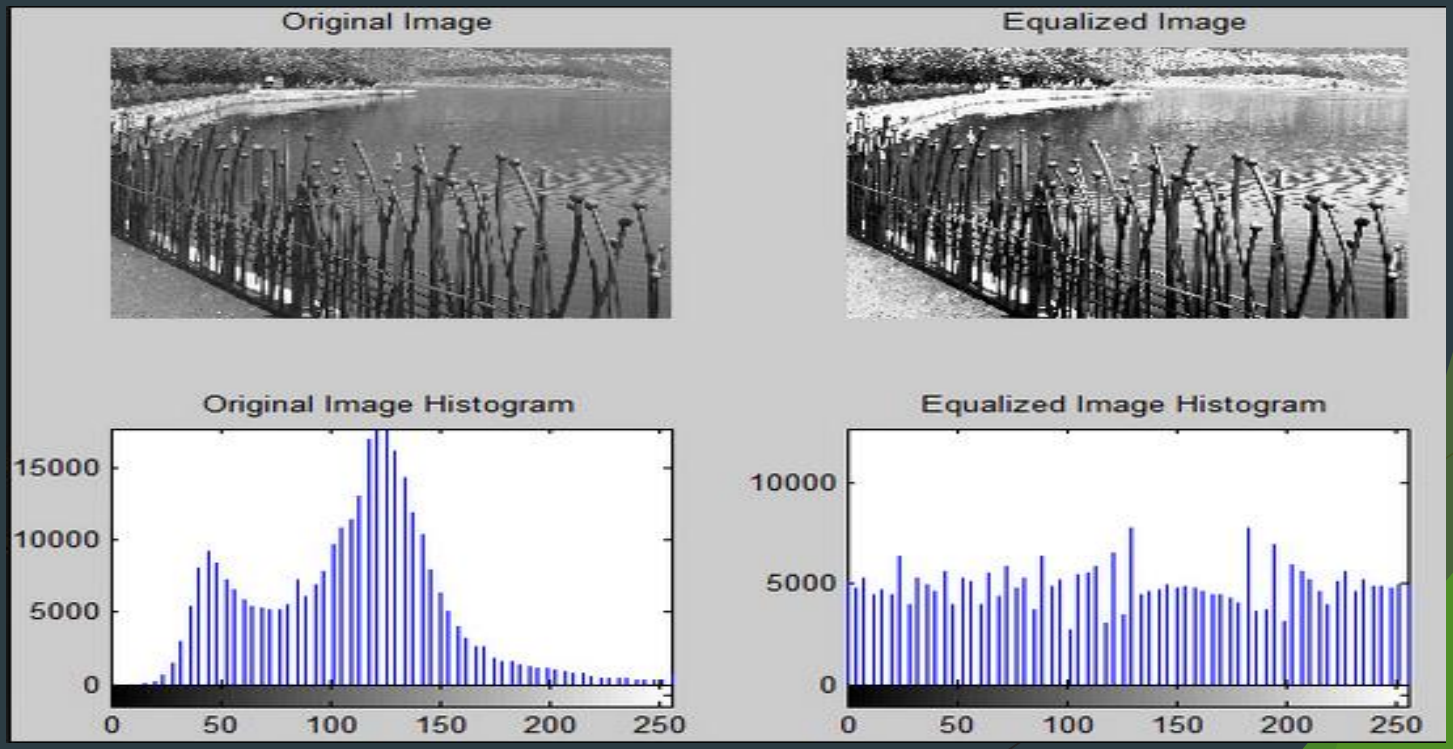




Example – Contrast Stretching

Histogram Equalization

- The process of adjusting intensity values can be done automatically using histogram equalization.
- Histogram equalization involves transforming the intensity values so that the histogram of the output image approximately matches a specified histogram.



Thank you!!