

# Lecture 5: About Images

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# 1 Scenes & Images — The Basics

## 1.1 Intro

- Images represent a projection of the information from a scene in 2D.
- Scenes are real in vision, and created in graphics.

## 1.2 What is an image?

- An image is a grid of pixels characterised by image size and pixel values.
- Each grey-level image pixel has 8 bits so its value ranges from 0–255.
- Each colour pixel has 3 colour components: red, green and blue.

## 1.3 Histograms

Histograms represent the *the global statistical information* from the image, which may or may not correspond to a specific object. They count the frequency of each value in the image.

Histograms are represented as 1-D arrays for grey-level images and as 3-D arrays for colour images - one for each component.

Histogram stretching represents a mapping of the histogram aiming to improve contrast.

## 1.4 Graphical Objects and 3D

- Voxel representations can be made by adding layers of images together, producing a volumetric (3D) image.
- A *graphical object* can be represented as a mesh which is a sequence of vertices joined by polygons (usually triangles).

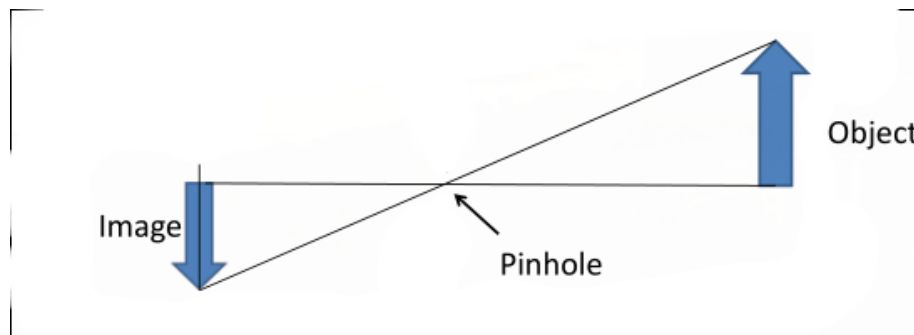
# 2 Image Production

## 2.1 Abstract View

Stepping back, one can see that image production has four important properties, the latter two of which will be discussed in greater detail later in the notes.

1. Images represent projections of real scenes as viewed by the human eye or as taken by a camera.
2. Images also represent projections of artificially generated scenes in computer graphics.
3. The theoretical model of vision we use is called the *Pinhole Camera*
4. The more accurate model of real life is known as the *Thin Lens Camera*

## 2.2 Pinhole Camera



The pinhole camera model allows us to use a simplified model of a camera as in figure 2.2. Properties of a pinhole camera:

- Continuous sharpness of depth.
- Very wide angle range.
- Exact perspective projection.

**Note:** Pinhole cameras can produce dark images because not enough light enters the camera.

Methods to improve pinhole images:

- Increase exposure time (however movement will blur the image).
- Increase the size of the pinhole (spread of light causes blurring).
- Use lenses to concentrate the light.

## 2.3 Thin Lens Camera

Real images have lenses which collect light over a finite aperture controlling the amount of light received. Lenses are characterised by the focal distance  $f$  that depends on *lens curvature* and *lens material*.

**Note:** we discuss single lenses however real cameras use a sequence of lenses.

## 3 The View Plane

The *View Plane* represents where the image is formed.

In practice the view plane could be any of the following:

- Photo-reactive chemicals.
- Charge-Coupled Device (CCDs) or CMOS sensors.
- Retina in the human eye.