

Photogrammetry (CE 474) [1]

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What is Photogrammetry ?

Photogrammetry is the **technology** of obtaining **reliable 3-D information** about physical objects and the environment through processes of **recording, measuring,** and **interpreting** photographic **images**.

Two distinct types of photogrammetry:

- **Aerial/spaceborne photogrammetry**
- **Close range photogrammetry**

Remember: this photogrammetry is the metric interpretation of image data.

What is Photogrammetry ?

“Photogrammetry is the technique of measuring objects from photographs.”

Definition:

“The art, science, and technology of obtaining reliable spatial information about physical objectives and the environment through the processes of recording, measuring and interpreting image data.”

Uses of Photogrammetry

Two stereo images allow reconstruction of the 3D shape.

From photographs we produce:

- Coordinates of real world points on objects
- Maps or plans (Topographic maps)
- Ortho-rectified Imagery
- Digital Terrain Models (DTMs)

Photogrammetry is used where ever you need a 3-D reconstruction:

- map making; Geographic Information Systems (GIS);
Surveying (Architecture, accident analysis)
- medical imaging (map body shape)
- vehicles (collision avoidance);
- mining and heavy industry (online Quality control)
- virtual Reality (Simulators)

Historical Perspective

- 1859, Tournachon, uses balloon and photography for Napoleon's reconnaissance in battle of Solferino.
- 1864, Aime Laussedat, the "Father of Photogrammetry" surveys Paris by rooftop photography.
- 1909, Eduard Dolezal, University of Vienna, founded International Society of Photogrammetry.
- 1920-1960: Analog reconstruction Instruments
- 1960-1990: Semi-automated (computer based) systems
- 1995: Digital Photogrammetry
- 1999: Continuous Coverage from Space Images

Historical Phases of Photogrammetry

- 1. Analogue Instruments**
- 2. Analytical Instruments**
- 3. Digital Instruments**

1. Analogue Instruments

- reconstruct via optical and/or mechanical means the geometry of stereo image formation.



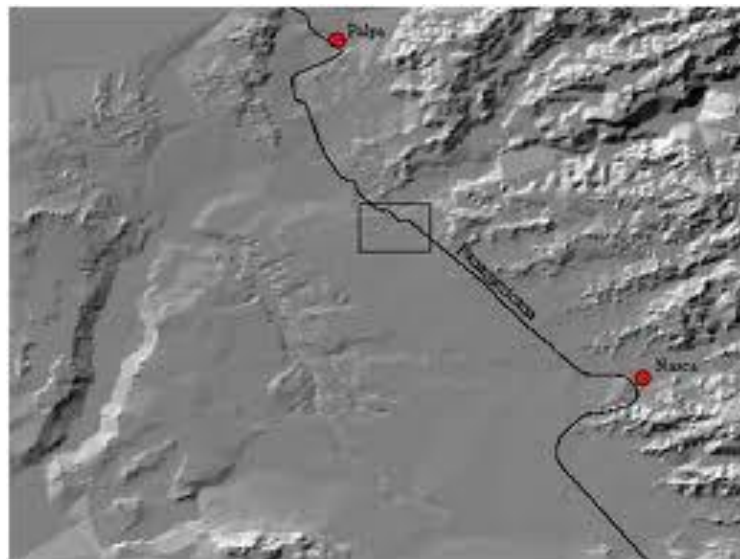
2. Analytical Instruments

- measure image coordinates on photographs using electro-optical or mechanical methods aided by human visual system.
- Use mathematical models to compute 3D coordinates.



3. Digital Instruments

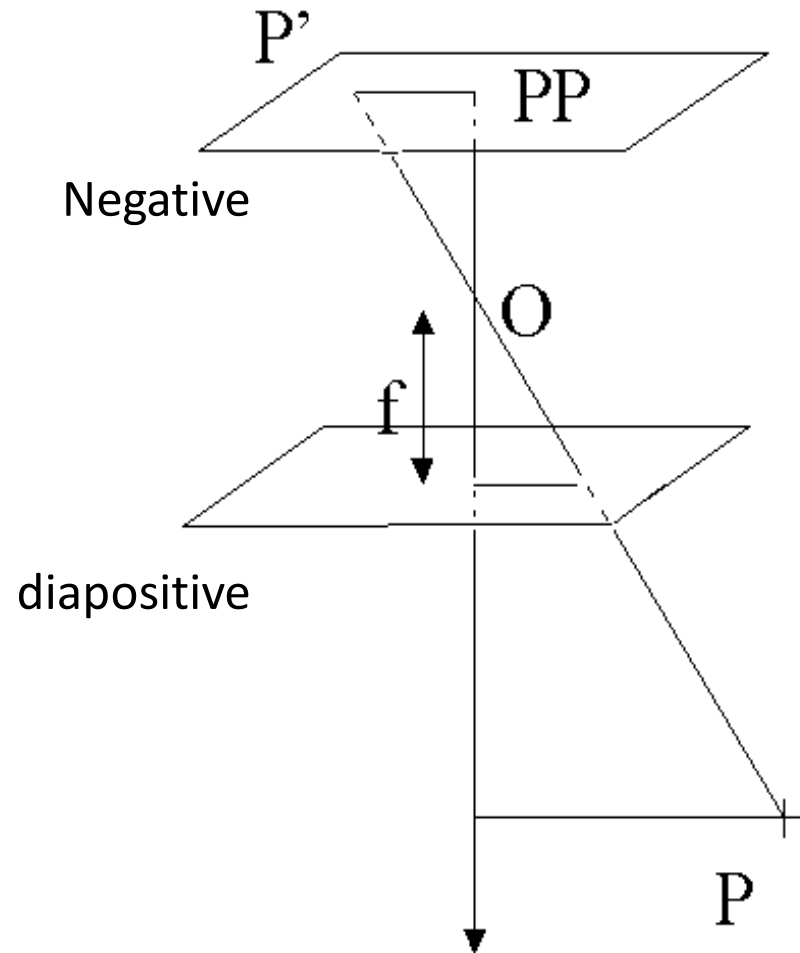
- Convert images to digital format.
- Use mathematical techniques to find matching points.
- Use mathematical models to compute 3D coordinates.
- Cost is lower because of lack of requirement for high accuracy electro-mechanical-optical linkages.
- Accuracy
 - depends on the pixel size.
 - has not surpassed the accuracy of analytical methods.
 - Matching still problematic in difficult areas.



Central Projection

Figure 1-1 shows

- Fundamental Image
- Formation Maths
- O: Projection Centre
- (Camera Position)
- PP: Principal Point
- (intersection of optical axis and image)
- f : focal length, principal distance, camera constant
- P: point in space
- P': image of point P



Central Projection, cont.

If you knew

- the exact location of the camera, O ,
- the exact orientation of the image plane w.r.t some coordinate system
- the distance PP' (image coordinate)

The line upon which P falls is uniquely determined. But there is no way to tell where on the line that P falls.

To determine P 's position exactly, an intersecting line is required. This is the basis of photogrammetry.