

## DAILY ASSESSMENT FORMAT

Date:	30 June 2020	Name:	Karegowda kn
Course:	IIRS outreach program on satellite programmetry and its applications	USN:	4a116ec029
Topic:	Concept of stereophotogrammetry	Semester & Section:	6 sem B sec
Github Repository:	Karegowda-courses		

### AFTERNOON SESSION DETAILS



## Report--

Methods that allow for the objective assessment of facial form are becoming increasingly important for research in dysmorphology, genetics, orthodontics and surgical disciplines among others. Such methods also have the potential to enhance clinical care by facilitating surgical planning, improving outcome assessment, and aiding in syndrome delineation. Non-contact 3D surface imaging systems are rapidly replacing traditional "hands-on" anthropometry as the preferred method for capturing quantitative information about the facial soft-tissues. These systems offer a number of distinct advantages: minimal invasiveness, quick capture speeds (often under one second), and the ability to archive images for subsequent analyses. In addition, a number of independent studies have demonstrated a high degree of precision and accuracy across a wide variety of 3D surface platforms. The safety, speed and reliability of data acquisition that these systems offer are particularly helpful when working with young children, for whom quantification of facial features can be challenging.

The most common class of 3D surface imaging system is based on digital stereophotogrammetric technology. These systems are capable of accurately reproducing the surface geometry of the face, and map realistic color and texture data onto the geometric shape resulting in a lifelike rendering. The mathematical and optical engineering principles involved in the creation of 3D photogrammetric surface images have been thoroughly described. The combination of fast acquisition speed and expanded surface coverage (up to 360 degrees) offer distinct advantages over older surface imaging modalities like laser scanning.

With decreasing cost, 3D stereophotogrammetric imaging systems are becoming increasingly common in clinical and research settings. With any new technology, a number of factors must be considered in order to achieve optimal performance. Though camera manufacturers provide suggestions for device set up and calibration, limited information is available on the practical issues that will inevitably confront new users of this technology. However, such issues can adversely impact the reliability of data collection, and consequently, influence the clinical and research study results. In order to ensure optimal interpretation of the study results, all aspects of data collection should be rigorously evaluated.

The name photogrammetry comes from two Greek words, phos 'light' and gramma 'writing'; it has been defined as the art, science and technology of obtaining reliable quantitative information about physical objects and the environment through the process of recording, measuring and interpreting images and patterns of radiant or transmitted energy derived from sensor systems. Since its inception over a century ago, the principal application of photogrammetry has been the compilation of topographic maps and plans on the basis of measurements and information obtained primarily from aerial photographs and employing optical, mechanical and mathematical analogies for an analogue or digital evaluation. The primary characteristic of photogrammetry is that the measurements are carried out indirectly, not on the object itself. Classically, the object to be evaluated was photographed from two or more locations and the measurements made on the photographs using a wide range of methods. Such photographs provide a stereoscopic pair, or stereogram, which, after correct



viewing alignment, can yield a solid, three-dimensional view of the scene either by using a viewing aid (stereoscope), or by viewing the left and right picture each by a separate eye, separately and simultaneously (Adams, 1974). The ability of the human brain to turn two pictures of the same object taken from two points of view, into a solid, three-dimensional space object, is known as stereoscopy. Stereo photogrammetry is concerned with obtaining precise three dimensional (X, Y, Z) coordinates of common discrete points appearing on a stereoscopic pair of images. The use of hard-copy photographs has remained the dominant force in applications of close-range photogrammetry; substantial technical advances have been, and are still being made in the provision of other imaging techniques which are being used in stereo photogrammetry. The basic geometry of central projection applies to most of the important imaging sensors, such as the traditional camera, the solid-state video camera and the X-ray. In all these cases the image of a three-dimensional spatial object is 'captured' on a two-dimensional sensor - a film in the case of photography or an X-ray and the matrix of light-sensitive diodes in a solid-state video camera. It is therefore not possible to recreate the third dimension by back projection of the image. If two pictures of the same scene are captured using two sensors with their perspective centres apart then, by knowing certain orientation parameters of the separate sensors, and by measuring two-dimensional coordinates of common image points in the two planes, it is possible to derive space (X, Y, Z) coordinates of the common space point using the theory of photogrammetry. This is shown schematically in Figure 2.1. The most generally used method of evaluating an X-ray image, for example, is to make measurements on a single-plane X-ray photograph. Such an evaluation has many shortcomings; it cannot provide an accurate measure of the relative location of discrete image points and, most important, it cannot reveal the true three-dimensional nature of the space structure. This has led to the development of stereo X-ray photogrammetry. Provided that certain fundamental photogrammetric rules of stereoscopy are followed, this can provide a three-dimensional view of the object being studied or a precise derivation of (X, Y, Z) coordinates of discrete common image points appearing on the stereoscopic pair of X-ray photographs. If a visual stereoscopic view is not required and only coordinates are needed, then the configuration of the pair of imaging X-ray foci is very much less restrictive. The mathematical theory of stereo photogrammetry is complex and its full details are beyond the scope of this chapter. Most problems of deriving three-dimensional coordinates from a stereoscopic pair of images can be solved by using the mathematics of projective transformations.

