

The Ohio State University
Geodetic Science and Surveying
Course Syllabus, Spring 2009

GS830: Advanced Methods of Processing Digital Imagery in Photogrammetry
Course level and credit: Graduate, 3 credits

Instructor: Alper Yilmaz

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Office: Bolz Hall 214C

Office Hours/ Availability Outside of Class Time: By appointment

Description

Utilization of advanced methods of image processing and computer vision techniques as it pertains to digital photogrammetry. Course also provides theoretical and practical aspects of implicit geometric relations between multiple images of a scene taken from different viewpoints. Several examples will be provided throughout the course to provide the students the tools to apply these concepts on real world images.

Course Content

Introduction

Background - Terminology – Camera projections – Euclidean reconstruction
– Auto calibration

Transformations of 2D

Planar geometry – 2D projective plane – Hierarchy of transformations –
Topology of projective plane – Conic sections

Transformations of 3D

Points and projective transformations – Representing points, lines, quadrics
– Plane at infinity – Absolute conic

Estimation – 2D Projective Transformations

DLT -Different cost functions – MLE – Transformation invariance – iterative
minimization methods – estimation of homography

Camera models

Finite cameras – projective cameras – cameras at infinity – other camera
models

Computing camera matrix

Basic equations – geometric error – restricted camera estimation – radial
distortion

Epipolar geometry and fundamental matrix

Epipolar geometry – fundamental matrix – geometry under special camera motions – geometric representation of the fundamental matrix – retrieving camera matrices – essential matrix

3D reconstruction of cameras and structure

outline of reconstruction method – reconstruction ambiguity – projective reconstruction theorem

Computation of fundamental matrix

Basic equations – normalized 8-point algorithm – algebraic minimization – geometric distance – special cases – degeneracies

Structure computation

Linear triangulation methods – geometric error cost function – Sampson approximation – line reconstruction

Homework and Programming Assignments

Biweekly homework assignments, and small programming projects to realize discussed topics. The programming assignments can be written in any programming language including Matlab, C, C++, etc.

Grading

Homework assignments	15%
Programming assignments	20%
Midterm Programming Project	20%
Final Programming Project	30%
Participation class discussions	15%

Attendance Policy

- A. Students are expected to make every effort to attend each class.
- B. You are allowed three absences during the duration of the course. Each subsequent absence will lower your grade by one third of a letter grade. A student with a total of six absences will receive an automatic F in the course.
- C. If you are late to class it will impact your grade. Three tardies will equal one absence. However if, you are more than 15 minutes late to class, you will be counted absent.
- D. Missing class on the day of a final project presentation is discouraged. If a final project or homework assignment is turned in late, your instructor will lower your grade by one letter grade for each class period that it is not turned in.

Cell Phone in the Classroom

Cell phones should be turned off before each class and not be used during class time.