

SVT 531 Advanced Digital Photogrammetry

Number of credits: 3

Syllabus Spring 2020

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office hours: 11:30-12:30T,12:00-1:00W,11:00-12:00R (or email questions or to set an appointment - email and you get your answers fast)

Prerequisites: prior coursework in photogrammetry/remote sensing or experience

Required Texts:

- (1) Wolf, P. and B. Dewitt. *Elements of Photogrammetry*, latest edition
- (2) Course Handouts (provided on internet)

Reference Text:

- (1) McGlone, J. C., ed. 2004. *Manual of Photogrammetry*. latest edition. American Society for Photogrammetry and Remote Sensing

Student Learning Outcomes

At the end of SVT 531 students can

- (1) analyze GPS-IMU.
- (2) perform geodetic coordinate transformations.
- (3) apply various aspects of pixel matching to 3-D model creation.
- (4) analyze system requirements of metric digital cameras.
- (5) calibration metric digital cameras.
- (6) optimize aerotriangulation solutions.
- (7) optimize feature extraction.
- (8) synthesize various geospatial data types.
- (9) optimize imagery in georectified products.
- (10) apply multi-ray photogrammetry successfully.

Course overview: airborne GPS-IMU processing techniques; conversion between local cartesian and conventional mapping coordinate systems; techniques in automated pixel matching; digital cameras and their calibration; optimization of automated photocoordinate measurement for aerotriangulation; recursive partitioning techniques for aerotriangulation solution optimization; techniques for automated feature extraction; synthesis of digital imagery and Lidar; image enhancements issues in orthophotos and mosaics; multi-ray considerations

Course Delivery: Lectures and all other material like syllabus, homework, powerpoints, handouts, exams, etc. are available on Blackboard at

<https://bb.courses.maine.edu/>

Measurement of outcome: Examination and completion of homework

Course Grading:

3 exams @ 100 pts. each 300
10 homework @ 30 pts. each 300

TOTAL 600

Generally A is 90%+, B is 80-89, C is 70-79, and D is 60-69.
Each exam is 20 multiple choice questions. No final exam is given.

NOTE: Lateness on homework is not allowed unless prior arrangements have been made. If homework is turned in late it receives no credit.

Week #Topic

- 1 basics of UAV/drone photogrammetry; systems, planning, processing
Homework #1: basics of UAV photogrammetry
- 2 control measurement in UAV; analysis of processing results; simple
Classification of produced 3-D information
Homework #2: UAV processing results; classification
- 3 Review of photogrammetric equations; review of mathematical solutions of
analytical equations; optimization procedures for photogrammetric solutions
Homework #3: Review of analytical photogrammetry
- 4 Use of airborne GPS-IMU; processing considerations; differential vs. precise
point positioning; datum and coordinate system considerations; IMU calibration
Homework #4: GPS-IMU
- 5 Exam #1
- 6 Aerotriangulation with GPS-IMU derived exposure stations; self-calibration
considerations/limits; georeferencing
Homework #5a: Aerotriangulation
- 7 Use of large format digital cameras; Geodesy considerations in digital
photogrammetric processing; types of possible coordinate systems - their
advantages and limits
Homework #5b: Photo Geodesy
- 8 Image matching in aerial photography; Digital Elevation Models from digital
photography; when are break lines needed
Homework #6 Image Matching algorithms
- 9 From digital photography to orthophoto mosaic production
Homework #7: Orthophoto mosaic production
- 10 Exam #2
- 11 Taking advantage of sparsity of the normal equations in aerotriangulation;
utilizing recursive matrix partitioning to efficiently solve large data sets
Homework #8: Solving aerotriangulation efficiently
- 12 Synthesis of digital photography with Lidargrammetry; Status of automated
feature extraction algorithms
Homework #9: Feature extraction and data integration
- 13 Industrial Photogrammetry; pushing measurement to its limits
Homework #10: Industrial Photogrammetry; Geodetic Services Inc.
- 14 Exam #3

- **Academic Honesty Statement:** Academic honesty is very important. It is dishonest to cheat on exams, to copy term papers, to submit papers written by another person, to fake experimental results, or to copy or reword parts of books or articles into your own papers without appropriately citing the source. Students committing or aiding in any of these violations may be given failing grades for an assignment or for an entire course, at the discretion of the instructor. In addition to any academic action taken by an instructor, these violations are also subject to action under the University of Maine Student Conduct Code. The maximum possible sanction under the student conduct code is dismissal from the University.

- **Students Accessibility Services Statement [This should be customized to include the instructor's name]:** If you have a disability for which you may be requesting an accommodation, please contact Student Accessibility Services, 121 East Annex, 581.2319, as early as possible in the term. Students who have already been approved for accommodations by SAS and have a current accommodation letter should meet with me (the instructor of the course) privately as soon as possible.
- **Course Schedule Disclaimer (Disruption Clause):** In the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.

Observance of Religious Holidays/Events: The University of Maine recognizes that when students are observing significant religious holidays, some may be unable to attend classes or labs, study, take tests, or work on other assignments. If they provide adequate notice (at least one week and longer if at all possible), these students are allowed to make up course requirements as long as this effort does not create an unreasonable burden upon the instructor, department or University. At the discretion of the instructor, such coursework could be due before or after the examination or assignment. No adverse or prejudicial effects shall result to a student's grade for the examination, study, or course requirement on the day of religious observance. The student shall not be marked absent from the class due to observing a significant religious holiday. In the case of an internship or clinical, students should refer to the applicable policy in place by the employer or site.

Sexual Discrimination Reporting

The University of Maine is committed to making campus a safe place for students. Because of this commitment, if you tell any of your teachers about sexual discrimination involving members of the campus, **your teacher is required to report** this information to Title IX Student Services or the Office of Equal Opportunity.

Behaviors that can be "sexual discrimination" include sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct, and gender discrimination. Therefore, all of these behaviors must be reported.

Why do teachers have to report sexual discrimination?

The university can better support students in trouble if we know about what is happening. Reporting also helps us to identify patterns that might arise – for example, if more than one victim reports having been assaulted or harassed by the same individual.

What will happen to a student if a teacher reports?

An employee from Title IX Student Services or the Office of Equal Opportunity will reach out to you and offer support, resources, and information. You will be invited to meet with the employee to discuss the situation and the various options available to you.

If you have requested confidentiality, the University will weigh your request that no action be taken against the institution's obligation to provide a safe, nondiscriminatory environment for all students. If the University determines that it can maintain confidentiality, you must understand that the institution's ability to meaningfully investigate the incident and pursue disciplinary action, if warranted, may be limited. There are times when the University may not be able to honor a request for confidentiality because doing so would pose a risk to its ability to provide a safe, nondiscriminatory environment for everyone. If the University determines that it cannot maintain confidentiality, the University will advise you, prior to starting an investigation and, to the extent possible, will share information only with those responsible for handling the institution's response

The University is committed to the well-being of all students and will take steps to protect all involved from retaliation or harm.

If you want to talk in confidence to someone about an experience of sexual discrimination, please contact these resources:

For confidential resources on campus: Counseling Center: 207-581-1392 or Cutler Health Center: at 207-581-4000.

For confidential resources off campus: Rape Response Services: 1-800-871-7741 or Partners for Peace: 1-800-863-9909.

Other resources: The resources listed below can offer support but may have to report the incident to others who can help:

For support services on campus: Title IX Student Services: 207-581-1406, Office of Community Standards: 207-581-1409, University of Maine Police: 207-581-4040 or 911. Or [see the OSAVP website for a complete list of services.](#)