



## Department of Geography and Geoinformation Science

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# GG5 579 – Remote Sensing Fall 2020

## 1. General Information

**Instructor:** Dr. Konrad Wessels, kwessel4@gmu.edu  
**Teaching Assistant:** TBD  
**Location:** TBD  
**When:** Wednesdays 4:30-7:10 pm.  
**Course website:** Blackboard  
**Credits:** 3.0  
**Instructor's Office Hours:** TBD, or by appointment (Office: Exploratory Hall 2203, the Fairfax Campus).  
**TA's Office Hours:** TBD

**Contact method** Instructor will make every effort to respond to emails within 24-48 hrs, Monday to Friday during regular business hours.

## 2. Course Objectives

The world is currently experiencing a proliferation in image data from satellites, aircraft and UAV's. These images have to be processed to produce geospatial information to inform natural resource management, urban planning and business decisions. This graduate course will introduce advanced remote sensing theory, as well as the processing and analyses of imagery for diverse applications using ENVI. The objective of this course is to provide graduate students with in-depth knowledge of the theories, technologies, methods and application of remote sensing and remote sensing data analysis.

## 3. Learning Outcomes

By the end of the course each student will be able to:

- A. Understand and explain advanced theories of remote sensing and image analysis.
- B. Use advanced image processing tools to process imagery to geospatial products.
- C. Gain in-depth insight into the use of remote sensing for multiple, real-world applications.

## 4. Delivery Method

The course will be taught as a combination of lectures, on-line tutorials, hands-on image processing, class discussion and assignments.

## 5. Textbooks

The primary textbooks:

"Introductory Digital Image Processing: A Remote Sensing Perspective (4th edition)" by J.R. Jensen, ISBN: 9780134058160, Pearson

"Remote Sensing and Image Interpretation" by Lillesand, Kiefer and Chipman (7<sup>th</sup> edition, John Wiley & Sons).

## 6. Course outline (tentative)

In this course we will cover the following topics (subjected to change at the discretion of the instructor):

- Introductory Concepts

1. Energy Sources and Radiation
  2. Energy Interactions
  3. Remotely Sensed Data/Imagery
  4. Remote Sensing Systems
- Multispectral Remote Sensing/Thermal Imaging
    1. Physical principles of sensors
    2. Basic Photogrammetry
    3. Optical sensor systems (Landsat, Sentinel2, WorldView)
    4. Thermal imaging
    5. Hyperspectral sensing
  - Digital Image Processing:
    1. Preprocessing of Images
    2. Radiometric and atmospheric correction
    3. Geometric correction
    4. Image Enhancement
    5. Image Manipulation (filters, ratio's, indices, transforms)
    6. Supervised Classification
    7. Unsupervised Classification
    8. Classification of mixed pixels
    9. Object-based classification
    10. Machine learning classification
    11. Change detection and time series analysis
    12. Land cover mapping
  - LiDAR Sensing:
    1. Physical principles
    2. Systems and sensors
    3. Information extraction; Applications
  - Synthetic aperture Radar (SAR):
    4. Physical principles
    5. Systems and sensors
    6. Information extraction; Applications

## 7. Grading

Assignments and mini project	35%
Mini Project	15%
Midterm exam	20%
Pop Quizzes	10%
Final exam	20%
<b>Total:</b>	<b>100%</b>

Note that that final grades are based on following, slightly revised score ranges:

Weighted average range <sup>1</sup>	Letter grade
≥ 98.0	A+
97.9 – 93.0	A
92.9 – 90.0	A
89.9 – 87.0	A-
86.9 – 83.0	B+
82.9 – 80.0	B+
79.9 – 77.0	B

76.9 – 73.0	B-
72.9 – 70.0	C
69.9 – 60.0	D
≤ 59.9	F

Note: Final letter grades may be adjusted upwards at the discretion of the instructor.

**8. Assignments:**

Submission of weekly assignments should be done only **through the Blackboard course website**. Submit pdf files and not Word documents. Assignments that are submitted late will be penalized.

**9. Course website:**

The course has a Blackboard website. This website will provide you a single portal through which you may obtain lecture notes, retrieve assignment data and, review links to additional materials, and receive special announcements. You are required to visit the course website **regularly**.

**10. Electronic Communication:**

All course related email correspondence should be made through @gmu.edu addresses.

**11. Image processing software:**

This class uses ENVI v5.X. The software is available on lab PC's and your will be required to install it on your own computer. Harris corporation made temporary student licenses available for free during COVID, but students may be required to purchase a student license if this offer is not extended.

If you plan to use the lab PC's, purchase a USB3 flash drives to store all the data and your work. This allows you to do the processing on any machine with ENVI.

Please ensure you buy a drive that is USB3, preferably, one of the following:

[https://www.amazon.com/SanDisk-Ultra-Flair-Flash-](https://www.amazon.com/SanDisk-Ultra-Flair-Flash-Drive/dp/B015CH1GTO/ref=sr_1_fkmr3_1?keywords=10GB+usb+3.0+sandisk&qid=1555626129&s=gateway&sr=8-1-fkmr3)

[Drive/dp/B015CH1GTO/ref=sr\\_1\\_fkmr3\\_1?keywords=10GB+usb+3.0+sandisk&qid=1555626129&s=gateway&sr=8-1-fkmr3](https://www.amazon.com/SanDisk-Ultra-Flair-Flash-Drive/dp/B015CH1GTO/ref=sr_1_fkmr3_1?keywords=10GB+usb+3.0+sandisk&qid=1555626129&s=gateway&sr=8-1-fkmr3)

[https://www.amazon.com/Kingston-Digital-16GB-Traveler-](https://www.amazon.com/Kingston-Digital-16GB-Traveler-Flash/dp/B00G9WHN12/ref=sr_1_fkmrnull_2_sspa?keywords=10GB%2Busb%2B3.0%2Bsandisk&qid=1555625994&s=gateway&sr=8-2-fkmrnull-spons&th=1)

[Flash/dp/B00G9WHN12/ref=sr\\_1\\_fkmrnull\\_2\\_sspa?keywords=10GB%2Busb%2B3.0%2Bsandisk&qid=1555625994&s=gateway&sr=8-2-fkmrnull-spons&th=1](https://www.amazon.com/Kingston-Digital-16GB-Traveler-Flash/dp/B00G9WHN12/ref=sr_1_fkmrnull_2_sspa?keywords=10GB%2Busb%2B3.0%2Bsandisk&qid=1555625994&s=gateway&sr=8-2-fkmrnull-spons&th=1)

**Note:** Recording of any kind (audio, video), reuse of course materials, and further dissemination of the course contents is not permitted unless prior written consent of the professor and George Mason University has been given or if recording is part of an approved accommodation plan.