**Asian Institute of Technology**
School of Engineering and Technology

**AT76.13** ***Remote Sensing Data Analysis*** **2 (1-3)** **Semester: Intersem**

**Course Objective**: This course aims at providing practical knowledge and in-depth understanding of of the Remote Sensing. Through practical applications and real-world examples, students will be provided with necessary skills to generate and analyze high-level remote sensing products.

Specific objectives are: i) to train students on remote sensing data type and formats, imagery products and their availability; ii) to give insights on processing methods and techniques for handling radiometric and geometric properties of remotely sensed; iii) to give principles and methods of multi-resolutions and multi-spectral data fusion, multitemporal processing and accuracy assessment; iv) to develop data processing automation through batch processing.

**Learning Outcomes**:

The students on the completion of this course would be able to:

1. Explain and communicate quantitative remote-sensing principles and integrate different tools for remote sensing data analysis.
2. Perform image corrections and enhancements and generate high-level remote sensing products.
3. Manipulate and process RS data using manual and automated techniques
4. Critically compare different type of remote sensing data products and analysis technique and select the more appropriate to solve a real-world problem.

**Prerequisite:** AT76.03 Remote Sensing

**Course Outline:**

I. Remote Sensing Raster Data Formats and Main Processing Platforms
   1. Remote Sensing data types and formats
   2. Commercial and open source remote sensing data processing options

II. Remote Sensing Imagery: Main Online Archives and Products
   1. Multi-source and multi-resolution data products (Landsat, ASTER, MODIS, EO-1, DTMs, Sentinel-2.
   2. Sentinel data products and download from the Copernicus Open Access Hub
   3. Modis data products and download from different NASA and USGS data repositories
   4. Common high resolution data products (Digital Globe, SPOT etc.)

III. Techniques of Radiometric and Geometric Correction
1. Atmospheric effects, TOA reflectance and dark object subtraction (DOS) technique
2. Orthorectification with rigorous camera models, rational function model (RFM) and automatic point measurement (APM) techniques,

IV. RS Image Fusion
1. Basic concepts
2. Pansharpening Techniques
3. Quality assessment

V. Multitemporal Remote Sensing and Accuracy Assessment
1. Multitemporal remote sensing (incl. time series): principles and concepts
2. Post classification comparison
3. Multitemporal accuracy assessment: principles and concepts

**Laboratory Session(s)**:

1. ERDAS IMAGINE basic and advanced processing capabilities (incl. raster format management, advanced subset, layer stack and mosaicking; Spatial Modeler for batch processing)
2. Radiometric correction (exoatmospheric TOA reflectance, dark object subtraction within ERDAS IMAGINE model maker)
3. Geometric Correction using rational function model (RFM) and automatic point measurement (APM) techniques
4. Pansharpening of very high resolution multispectral images
5. ESA Sentinel Toolboxes: visualization, analysis and processing tools for different Sentinel products
6. Multitemporal RS: bitemporal change detection and accuracy assessment
7. Multitemporal RS: Time series analysis of Chlorophyll concentration estimation

**Learning Resources:**

Textbooks: No designated textbook, but class notes and handouts will be provided

Reference Books:

*John A. Richards:*
Remote Sensing Digital Image Analysis - An Introduction (Fifth Edition). Springer-Verlag Berlin Heidelberg, 2013.

*R. G. Congalton, K. Green:*
Assessing the Accuracy of Remotely Sensed Data: Principles and Practices, Second Edition, Boca Raton, CRC Press, 2009.

*Gustavo Camps – Valls, Lorenzo Bruzzone:*

Kernel Methods for Remote Sensing Data Analysis. John Wiley & Sons, Ltd, 2009.

*J. G. Liu, P.J. Mason:*

Image processing and GIS for remote sensing: techniques and applications, Chichester, Chichester, Wiley-Blackwell, 2016.

Journals and Magazines:

Remote Sensing, MDPI
International Journal of Photogrammetry and Remote Sensing; (ISPRS), Elsevier
Photogrammetric Engineering and Remote Sensing, ASPRS
Remote Sensing of Environment,Elsevier

Others: None

**Teaching and Learning Methods**:

1. **Lectures and class discussion**: Students will received the lecture notes and lecture schedule at the beginning of the course, and requested them to read the lecture notes before coming to the class.
2. **Laboratory sessions**: The laboratory instruction will be provided to the students. Lab instruction will provide a basic guideline for student to learn and be familiar with the remote sensing software and remote sensing data. Students are requested to understand the algorithm of each operation so that they able to operate with other software. The home assignments and discussion are requested to submit.
3. **Mini project**: Students (as the group project) are asked to propose a mini project. Students are provided mini project to show their ability to apply tools of Remote Sensing Analysis in problem solving. Data is provided and proposals are evaluated. They are also evaluated extensively on concept and expertise on the Remote Sensing software.

**Time Distribution and Study Load**:

Lecture: 15 Hrs
Laboratory: 20 Hrs
Miniproject: 10 Hrs
Group meeting: 15 Hrs
Self-study: 60 Hrs

**Evaluation Scheme:**

The final grade will be based on the following weight distribution: assignments (30), final exam (50%), Mini project (20%). An "A" would be awarded if a student can elaborate the knowledge learned in class by giving his/her own analysis on real case examples given in this course and from journal articles and including assigned readings. A “B” would be awarded if a student shows an overall understanding of all given topics, a “C” would be given if a student meets below average expectation on both knowledge acquired and analysis. A “D” would be given if a student does not meet basis expectations in understanding and analyzing the topics and issues presented in the course.

Grades will be assigned according to the AIT Policies on Grading.

**Instructor(s):** Dr. Salvatore G.P. Virdis