The Hong Kong University of Science and Technology

Division of Arts and Machine Creativity (AMC)

AMCC6500B, in Fall 2025/26

Course code: AMCC6500B (3 credits)
Course title: Intelligent Remote Sensing Data Computation and Processing
Abbreviated title:
Course instructor: Prof. CAI Zhan Chuan
Target students: All RPg and MA AMC students
Class quota: 65
Grading requirement: Letter grades

Course description:
The course is designed for graduate students in computer science and related fields. It provides an introduction to the cutting-edge theories and technologies in intelligent remote sensing data computation and processing. The course combines deep learning, computer vision, and traditional remote sensing analysis methods to cultivate students' ability to solve practical problems
Enrolment requirement: N.A.

Course Intended Learning Outcomes
On successful completion of the course, students will be able to:

1. Gain an understanding of the formats of remote sensing data and the significance of processing such data.
2. Initially grasp the principles and structural framework of the processing method.
3. Develop a preliminary understanding of the mathematical models and evaluation approaches of remote sensing data processing algorithms.
4. Initially acquire a command of the specific procedures and implementation techniques for remote sensing data processing methods.

Teaching and learning activities:

- Lectures
- Student speeches and discussions

Planned Assessment & Weightings:

Assessment	**Percentage**
Class Participation	10%
Presentation	30%
Course Report	60%

Weakly Course Outline

Week	**Topics**	**Briefly outline what this topic will cover** *(Include reading assignments if available)*	**Indicate which course ILOs this topic is related to** *(Write CILO-1, CILO-2, etc.)*
1	Mathematical Foundations for Remote Sensing Data Processing	This lesson covers key mathematical underpinnings essential for remote sensing: floating-point arithmetic, vector-matrix ops, eigenanalysis &	CILO1,CILO2

		derivatives, laying groundwork for data processing & optimization.	
2	Remote Sensing Data Formation	This lesson covers remote sensing data basics: geometric modeling, photometric principles of light interaction, and digital sensor imaging, foundational for advanced analysis.	CILO1,CILO2
3	Remote Sensing Image Processing 1	This lesson covers key remote sensing image processing: point operators for pixel adjustments, linear filtering for enhancement, and non-linear filtering for edge detection & noise reduction.	CILO1,CILO2
4	Remote Sensing Image Processing 2	This lesson covers advanced remote sensing image processing: Fourier transforms for frequency analysis, pyramids/wavelets for multi-scale features, and geometric transforms for precise image manipulation.	CILO2, CILO3, CILO4
5	Remote Sensing Model Fitting	This lesson covers advanced remote sensing model fitting: data interpolation for reconstruction, variational methods & regularization for optimization, and MRFs for probabilistic pattern modeling.	CILO1,CILO2
6	Deep Learning for Remote Sensing 1	This lesson covers deep learning for remote sensing: learn supervised learning for precise predictions from labeled data & unsupervised learning to reveal patterns in unlabeled sets.	CILO1,CILO2
7	Deep Learning for Remote Sensing 2	This lesson explores deep learning for remote sensing: neural networks for pattern recognition, CNNs for imagery analysis, and transformers for advanced AI-driven applications.	CILO2, CILO3
8	Recognition in Remote Sensing	This lesson covers remote sensing recognition: instance recognition for specific objects, image classification for scenes, object detection for locations, and segmentation for pixel-level analysis.	CILO1, CILO2, CILO3, CILO4
9	Feature Detection in Remote Sensing	This lesson teaches advanced remote sensing feature detection: identifying key points/patches as landmarks, and edge/contour	CILO2

		detection for analyzing shapes & boundaries, enabling precise data interpretation.	
10	Image Matching in Remote Sensing	This lesson teaches advanced remote sensing image matching: contour tracking, line/vanishing point detection, and segmentation for change detection & motion analysis.	CILO2, CILO3, CILO4
11	Image Alignment and Stitching in Remote Sensing	This lesson delves into remote sensing image alignment & stitching, covering pairwise alignment via feature matching/homography, global refinement, warping/blending for mosaics, and compositing.	CILO1,CILO2
12	3D Reconstruction in Remote Sensing 1	This lesson teaches advanced remote sensing image alignment & stitching: pairwise alignment, global optimization, warping/blending for mosaics, and compositing for large-scale analysis.	CILO1,CILO2
13	3D Reconstruction in Remote Sensing 2	This lesson covers 3D remote sensing reconstruction: point clouds, volumetric models, parametric fitting, and texture mapping for realistic surface detail.	CILO1,CILO2, CILO3

Student learning resources:

Textbook (T)	No required textbook. Course Powerpoint
Reference 1 (R1)	Richard Szeliski, Computer Vision: Algorithms and Applications 2nd Edition,2021
Reference 2 (R2)	Gonzalez and Richard E. Woods' Digital Image Processing, Fourth Edition,2017
Reference 3 (R3)	Robert A. Schowengerdt Remote Sensing: Models and Methods for Image Processing, Third Edition.2006