Remote Sensing - CPS (RMS)

RMS 5105. Fundamentals of Remote Sensing. (3 Hours)
Introduces remote sensing principles, datasets, and basic interpretation/analysis. Covers four general categories: physical processes/theories involved in remote sensing, e.g., the nature and properties of electromagnetic radiation and how it is affected by interactions with the atmosphere and earth's surface; different sensor types and platforms, including optical, thermal, and microwave systems, from UAVs to environmental satellites; different applications of remote sensing such as land-use, land-change, vegetation, natural hazards, precision agriculture, and military; and starting methods of remote sensing to analyze images and extract desired information. Software used includes ArcGIS Pro, ArcGIS Online, GIMP, and FOSS.

RMS 5106. Fundamentals of Remote Sensing. (2.25 Hours)
Introduces remote sensing principles, datasets, and basic interpretation/analysis. Covers four general categories: physical processes/theories involved in remote sensing, e.g., the nature and properties of electromagnetic radiation and how it is affected by interactions with the atmosphere and earth's surface; different sensor types and platforms, including optical, thermal, and microwave systems, from UAVs to environmental satellites; different applications of remote sensing such as land-use, land-change, vegetation, natural hazards, precision agriculture, and military; and starting methods of remote sensing to analyze images and extract desired information. Software used includes ArcGIS Pro, ArcGIS Online, GIMP, and FOSS.

RMS 6110. Introduction to Machine Learning for Image Data. (3 Hours)
Explores a range of machine learning routines, including image classifications and clustering, PCAs, and data reduction. Students perform exercises corresponding to concepts introduced in weekly lessons. Focuses on computer thinking, algorithms involved in preprocessing, spectral and spatial enhancement, spatial analysis, and linear transformations. Utilizes a variety of data types and an opportunity to experience the journey of geospatial image data from its origin (raw data) to its end (transformation) in the context of the process, scope, and real-world scenarios. Examples provided with GBDX notebooks and customized work flows as entry to Python, cloud-based analytics, and web-based GUI software: ENVI, ArcGIS, and GBDX.

Prerequisite(s): RMS 5105 (may be taken concurrently) with a minimum grade of C-

RMS 6225. Value of Information and Geospatial Analytics. (3 Hours)
Focuses on Value of Information (VOI) theory as applied to solving geospatial intelligence problems. Introduces students to VOI theory by working with a series of case studies where various types of data are introduced at different times in the problem-solving process. Offers students an opportunity to develop an understanding of the value of numerous data types (satellite, airborne, terrestrial; LiDAR; existing maps and GIS data; open source data including social media), the incremental value of each piece of data, and how to quantify the incremental value. Analyzes VOI theory as it relates to geospatial intelligence and demonstrates how to set up an analytic problem to calculate the value of data within that analytic problem construct. Software: GIS and remote sensing analytic software; VOI analytic framework (e.g., SAS).

Prerequisite(s): RMS 5105 with a minimum grade of C ; GIS 5103 with a minimum grade of C

RMS 6240. Introduction to Radar and LiDAR Remote Sensing. (3 Hours)
Introduces the techniques and methods of active imaging used in radar and Light Detection and Ranging (LiDAR). Covers the underlying principles of the measurement techniques and the interaction of microwaves and LiDAR signals with natural surfaces and the atmosphere. Regarding radar, the course focuses on the role of synthetic aperture radar (SAR) systems and their application to monitoring aspects of the Earth's surface, including 3-D. Regarding LiDAR, the course introduces the different airborne and satellite systems and applications in terrestrial surfaces, principally for urban applications. Students complete a weekly lab project related to the processing and analysis of these data. Software: ArcGIS; ENVI; LIDAR Analyst; ESA SNAP Toolbox; ASF MapReady; ASF SAR Training Processor; USDA FS FUSION; FugroViewer.

Prerequisite(s): RMS 5105 (may be taken concurrently) with a minimum grade of C-

RMS 6280. Automated Feature Extraction for the Geospatial Professional. (3 Hours)
Introduces machine learning and automated feature extraction software and how it is utilized for image interpretation. Explores a variety of techniques and work flows associated with collecting features of interest from multiple data sources, e.g., aerial and satellite imagery, LiDAR, and elevation data. Students use AFE software to solve real-world problems in exercises corresponding to concepts introduced in weekly lessons. Offers students an opportunity to learn how to use feature extraction to create industry-standard analytical products and develop processing models for automation. Discusses the fundamentals of machine learning, supervised and unsupervised classification, hierarchical learning, postprocessing, cleanup, automation, modeling, and publication. Software: Esri ArcGIS 10.5; Feature Analyst for ArcGIS; LIDAR Analyst; ENVI; ENVI LiDAR.

Prerequisite(s): RMS 5105 with a minimum grade of C-

RMS 6290. Spectroscopic Image Analysis. (3 Hours)
Explores the various techniques and work flows associated with nonliteral imagery analysis using hyperspectral data from numerous airborne and space-borne hyperspectral imaging (HSI) sensors. The course is divided into four modules: (1) basic theoretical concepts that underpin HSI analysis; (2) data preparation and other ancillary concepts such as spectral libraries and atmospheric correction that are critical to nonliteral analysis but are preprocessing steps; (3) nonliteral exploitation techniques, covered in sufficient depth to give the students an opportunity to understand the different methods and procedures used; (4) a final project where students are expected to conduct nonliteral analysis of a hyperspectral image from pre- through postprocessing. The ENVI software system is used extensively each week.

Prerequisite(s): RMS 5105 (may be taken concurrently) with a minimum grade of C- ; RMS 6110 with a minimum grade of C-

RMS 6293. Allied Technologies in Remote Sensing. (3 Hours)
Includes an overview of unmanned aerial systems (UAS), small satellites (CubeSats), and photogrammetry and GPS. Includes a review of digital elevation models, datums, projections, coordinate systems and scale for integration with components of a command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) network. Focuses on various technology applications and skills to recognize, evaluate, and develop systems and overall networks for a range of functions. These include military, security, scientific, and commercial applications in government and market ventures. Software used includes PixElement (Platform as a Service), DroneMapper (free version), DroneDeploy (for flight planning), and drone2map.

Prerequisite(s): RMS 5105 with a minimum grade of C-

RMS 6962. Elective. (1-4 Hours)
Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

RMS 6983. Topics. (1-4 Hours)
Covers special topics in remote sensing. May be repeated without limit.