**Course Description:**

This course introduces the concepts, technologies, and applications of big data analytics and cloud computing in geospatial science. Students will learn how to manage, analyze, and visualize large-scale geospatial datasets using cloud platforms such as Google Earth Engine (GEE), Amazon Web Services (AWS), and open-source tools. Emphasis will be placed on remote sensing data processing, machine learning applications, and real-world environmental and societal problem-solving.

**Course Objectives:**

By the end of the course, students will be able to:

* Understand the fundamentals of geospatial big data and cloud computing concepts.
* Access, preprocess, and analyze satellite data using cloud platforms.
* Apply machine learning techniques to large-scale geospatial datasets.
* Develop scripts and workflows in platforms like Google Earth Engine and AWS.
* Communicate geospatial analysis results effectively through visualizations and reports.

**Prerequisites:**

Basic knowledge of remote sensing, GIS, and programming (Python or JavaScript) is recommended.

**Textbooks and References:**

* *Remote Sensing Big Data: Theory and Application* by Guangxing Wang and Qihao Weng (recommended)
* *Cloud-Based Remote Sensing with Google Earth Engine: Fundamentals and Applications* by Tamlin Pavelsky and Alexander S. M. P. Watanabe (recommended)
* Google Earth Engine Documentation
* Selected journal articles and case studies (provided weekly)

**Software and Platforms:**

* Google Earth Engine (GEE)
* Amazon Web Services (AWS) or Microsoft Azure (introductory level)
* Python (geemap, earthengine-api) and JavaScript (GEE Code Editor)
* QGIS with cloud plugins (optional)

**Weekly Topics:**

| **Week** | **Topics** |
| --- | --- |
| 1 | Introduction to Geospatial Big Data |
| 2 | Basics of Cloud Computing for Geospatial Analysis |
| 3 | Overview of Google Earth Engine and Earth Observation Data |
| 4 | GEE JavaScript and Python APIs |
| 5 | Data Preprocessing and Visualization in GEE |
| 6 | Temporal Analysis: Time-Series and Trend Detection |
| 7 | Supervised and Unsupervised Classification in GEE |
| 8 | Machine Learning for Land Cover Mapping |
| 9 | Change Detection and LULC Monitoring |
| 10 | Integration with Cloud Storage and AWS Basics |
| 11 | Advanced Topics: Deep Learning with Remote Sensing Data |
| 12 | Case Studies: Deforestation, Urbanization, Water Quality |
| 13 | Ethics, Privacy, and Challenges in Big Geospatial Data |
| 14 | Final Project Presentations and Course Wrap-up |

**Assessment:**

* Homework Assignments and Labs (30%)
* Midterm Project (20%)
* Final Cloud-Based Project (30%)
* Class Participation and Discussion (10%)
* Quizzes (10%)

**Final Project Examples:**

* Mapping land use change over decades using GEE.
* Monitoring forest degradation using cloud-based platforms.
* Flood mapping and analysis using SAR data on GEE.
* Applying Random Forest or CNNs for large-area classification tasks.

**Course Policies:**

* Active participation in labs and coding exercises is crucial.
* Collaboration is encouraged but individual projects must be original.
* Late submissions will be penalized unless prior approval is obtained.

**Important Dates:**

* Midterm Project Submission: Week 8
* Final Project Proposal Due: Week 10
* Final Project Presentation: Week 14