GEOG 450/650: Advanced Geospatial Analysis (2025)
Term Project Description

This term project is designed to challenge students to apply advanced geospatial techniques in a realistic research scenario. **The focus is on reproducible workflows using code**.

The goal is to answer a research question while demonstrating advanced technical skills, critical thinking, and clear communication of results in the format of a research paper.

Project exampled could include:

- Develop a reproducible workflow to classify land cover over time using machine learning, integrate digital elevation models (DEMs) with other spatial datasets, and conduct an analysis that uses both raster and vector data.
- Develop a reproducible workflow to classify satellite imagery over time using lidar data, or even field plot data, to train the model. Metrics such as canopy height, crown closure, basal area, etc. could be predictors from things like spectral indices, slope, aspect, etc.
- Develop a reproducible workflow that detects the timing of a landslide from multiple satellite sensors.
- Develop an algorithm to predict where there is good hiking in BC based on where existing trails are located and a model that predicts the rest of BC based on the attributes of existing trails (e.g. slope, proximity to roads, elevation, lakes, etc.).

KEY REQUIREMENTS

1. Develop and implement **code-based geospatial workflows** (R or Python, or other upon request) or another approved workflow. Not every step can be done in code, but your code should be able to read data from any intermediate step (e.g. manually making training data) and run the bulk of your analysis.
2. Apply advanced techniques, such as machine learning (e.g., Random Forest, SVM), timeseries analysis (e.g. temporal interpolation, trends, breakpoint detection), or something equivalent using geospatial data.
3. Incorporate 2 or more datasets (e.g. satellite imagery, DEM, climate, etc.)
4. Perform spatial analyses that integrates both raster and vector data.
5. Produce publication quality figures that convey the results effectively
6. Produce a research-paper-style report with a reproducible code-based workflow.

DELIVERABLES AND DEADLINES

1. **Feb 6, 2025**
    - **Project Proposal:** 1-page proposal that includes a research question, data to be used and where/how to get it, point-form list of proposed workflow, anticipated results, and at least 5 references.
2. **March 25/27, 2025**
    - **Project Presentation**: 10 minute presentation summarizing the project findings.
3. **April 10, 2025**

- **Research Paper**: ~10 page report structured like a research paper, including tables, maps and figures (max 6), and references.
- **Code Submission**: A well-documented script in R or Python, or other if approved by the instructor.

EVALUATION CRITERIA

- **Proposal (5%)**
  Clear research question, data and methods are suitable, anticipated outcomes are reasonable, proposal is clear and professional.
- **Report (85%)**
  - **Report (25%)**: Clarity, structure, and professionalism of the research paper.
  - **Workflow (30%)**: Quality of the geospatial analysis and code reproducibility.
  - **Analysis (20%)**: Depth of analysis, and critical thinking and interpretation of results.
  - **Code clarity (10%)**: Clarity and organization of the code
- **Presentation (10%)**: Effectiveness and clarity of the oral presentation.

PAPER SHOULD INCLUDE

1. **Introduction:**
   - Define the research question and objectives
   - Provide a brief background on the topic / study area
   - Provide a brief background on methods and gaps
2. **Methods:**
   - Describe the data and methods used for preparing and processing the data.
3. **Results:**
   - Present results and highlight key finding
   - Present a validation process that demonstrates how well your workflow performed
4. **Discussion and Conclusion:**
   - Interpret the results in the context of the research question.
   - Discuss limitations and propose improvements or extensions for future work.