Foliage obscured topographical mapping using kinematic GPS survey and aerial drone data

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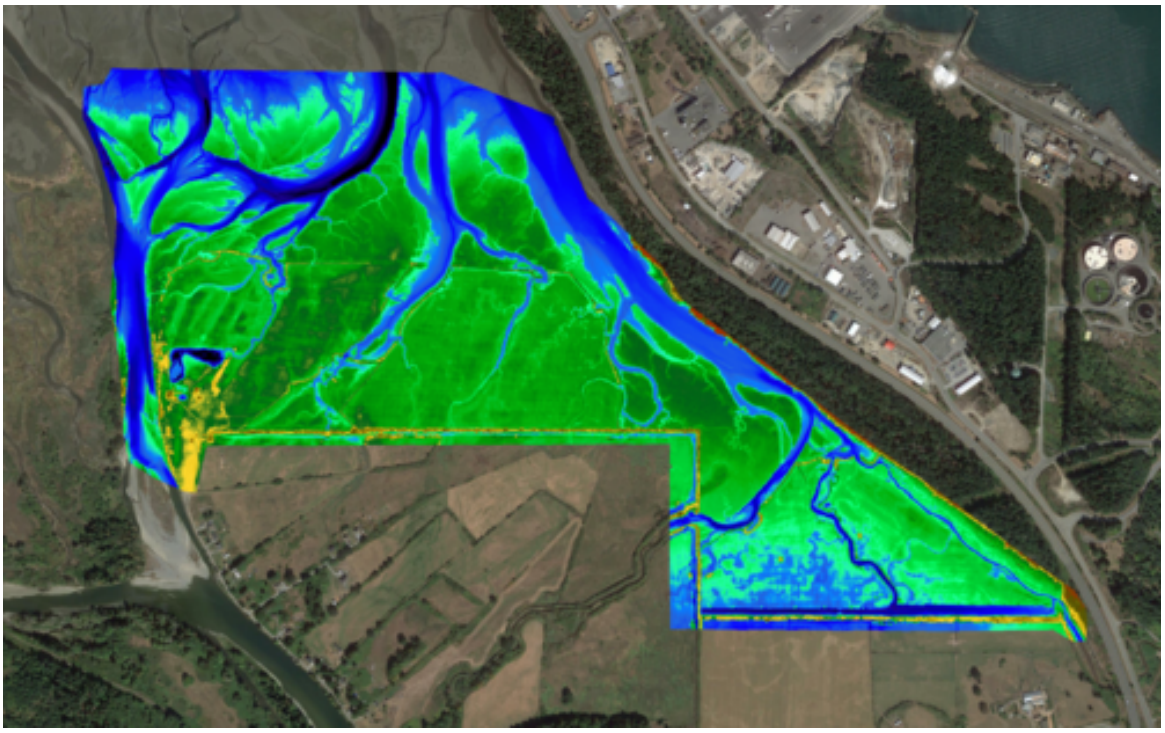
1 Background preparation

Approximations of functions, signal processing, image processing, statistics, data science.

2 Overview: Environmental mapping and drone data



Environmental data derived from drone-based surveys.

Smart Shores is a science-based tech company focused on making world-class environmental data accessible to everyone, from small not-for-profits to big governments. We provide affordable high-resolution spatial data, ecological analysis and visual media to support responsible and effective stewardship of our natural world.

We help tell the story behind the data by providing both technical (GIS) data and engaging content including interactive 3D environments, detailed maps, short videos, and outreach materials.

A key focus for our many of our clients is environmental management, which is crucial for our quality of life. For example, a well-managed shoreline can support salmon and shorebird

populations, provide recreation opportunities and buffer against flooding. However, shoreline development can also have unintended consequences that are harmful to ecosystems, the economy, recreation and culture. We help connect human and ecological needs to support progressive, twenty-first century land management.

3 Problem Description

Smart Shores produces orthomosaics, digital elevation models and 3D point clouds at up to 1 cm resolution and $<$ 5cm precision. We also offer satellite-derived measures of vegetation health and marine plant distributions, and a range of value-added products.

A key technology to achieve this uses a combination of on-demand drone (UAV) and ground survey. This ground-verified drone data provide a cost-effective way to obtain high-precision environmental data. These data support the planning and verification stages of environmental restoration projects, ecological change monitoring, coastal erosion and sediment transport assessment, and evaluation of vegetation health and the presence of invasive plants.

The data we have for this workshop consists of topographical data from both drones and ground surveys. The challenge is that much of the visual drone data is obscured by foliage, which makes the registration with ground-truth a difficult propostion. Some questions we would like to answer in analyzing this data are as follows:

- How many, or how few, ground-based survey points are required to calibrate the foliage-obscured drone data?
- How can the foliage data be adjusted for seasonal variations such as vegetation density or height?
- Are there long-term variations in the data that must be accounted for in calibrating the drone date to ground surveys?