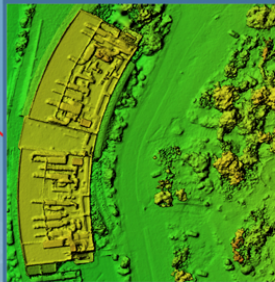# DRONE DATA COLLECTION & ANALYSIS

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## DIGITAL SURFACE MODEL (DSM)



**WHAT**

A digital surface model (DSM) captures the heights of the natural and built features on the earth's surface, and represents different heights with different values and colors. This is different from a digital terrain model (DTM), which represents the elevation of the bare earth without any features on it.

**HOW**

The DJI Matrice 210 flew a mission pre-planned in DroneDeploy to capture the data (i.e. multiple overlapping photos) needed to create the DSM. The overlapping photos were processed using the photogrammetric tools in Agisoft Photoscan to derive distances, depths, and heights through the process of triangulation. The highest points on campus are shown in red, and the lowest points on campus are shown in blue.

**USES**

DSM can be used for a variety of applications. In natural disasters like earthquakes, a DSM can show the pre and post heights of collapsed buildings. In urban planning, DSM can be used to show how a proposed building may obstruct the view of residents.

156m ◼◼◼◼◼ 233m

## THREE-DIMENSIONAL MODEL



**WHAT**

A 3D model can be a digital reconstruction of an actual building, made from data collected by a drone flying around the building at different angles and altitudes. The data are processed and stitched together to create a digital 3D model, which gives an overview of the building with accurate volume and measurements.

**HOW**

To create this 3D model, the DJI Inspire 2 with the Zenmuse X4s camera was used. DroneDeploy was used to plan the mission, there we were able to create the flight path by plotting waypoints around the designated flight area. In the settings, overlap was set to 80% and altitude was set to 20 feet above the structure's height for a high quality model. The drone collected about 135 images all around the building in about 15 minutes. Once the mission was completed, the drone returned to its launch point autonomously.

**USES**

3D models can be used to examine construction progress. They can also be used for evaluating topography, inspecting towers, assessing coastal erosion, and measuring the volume of mineral stockpiles.

## NORMALIZED DIFFERENCE VEGETATION INDEX (NDVI)
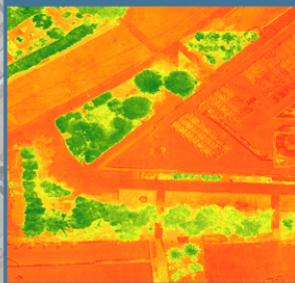


**WHAT**

About 50 years ago, scientists discovered an indicator of plant health by taking into account visible and near infrared (NIR) wavelengths. Satellite missions such as Landsat contain sensors that gathered data to produce Normalized Difference Vegetation Index (NDVI) measurements.

**HOW**

The DJI Matrice 210 with the SLANTRANGE 3PX multispectral sensor was used to retrieve the NDVI data. The bands on the sensor were red, green, red edge, and near infrared (NIR). The third party application DroneDeploy was used to plan the mission.

**USES**

NDVI is most commonly used in agriculture because plant and crop health can be detected using information from different wavelengths. Specifically, healthy plants reflect more near infrared light while absorbing more red light, thus enabling us to use the red and NIR wavelengths to distinguish healthy plants from stressed ones. It is important for farmers who need to identify healthy or stressed crops.

NDVI Value: -1 ◼◼◼◼◼ 1

## THERMAL INFRARED IMAGE
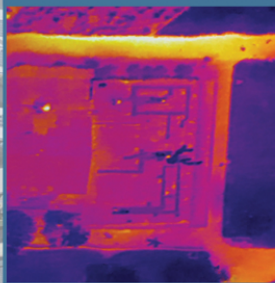


**WHAT**

A thermographic camera senses long infrared wavelengths to produce thermal images that are otherwise not visible to the human eye. Thermal imaging can see through smoke and operate in complete darkness. These sensors or cameras can not only be attached to drones, but can also be used on satellites and manned aircrafts.

**HOW**

The DJI Inspire 1 with the Zenmuse XT were flown manually over campus buildings and surrounding areas to show features that reflected and emitted heat. The results show that manmade features (e.g. sidewalks) emit a lot more heat than surrounding vegetation.

**USES**

The camera is useful in different industries ranging from pipeline inspection to search and rescue. Since the content of the pipeline may have very different temperature than its surroundings, much like how a lost hiker will be much warmer than his/her surroundings, a thermographic camera can be used to identify spills or lost hikers.