- In this lesson, we will analyze

associated to the values

for red, green, and blue respectively.

The combination of these three will, in turn,

give us a specific shade of the pixel color.

Since each number is an 8-bit number,

the values range from 0 to 255.

For example, a yellow value can be identified

by 255, 255, and 0 for RGB,

as we see in this diagram.

If all three values are at full intensity,

that means they are 255, it shows as white.

If all three colors are muted,

or has the value of 0, the color shows as black.

Since each value can have

256 different intensity or brightness value,

it makes 16.8 million total shades.

In Python, RGB images are ndarrays

of shape height times width times three

for each RGB layer.

Now that you have a basic background

in how color images are stored in Python,

we can look at WIFIRE data in more depth.

Over the next video, we will go through a notebook

in which we start by importing a high resolution image

from the NASA satellite LANsat.

We will mainly use numpy functions,

filtering techniques, and some domain

Earth science knowledge to analyze this image.

So how do we use the results of this analysis

in predictive fire modeling in the end?

We will make this fuel data set,

one of the many other data sets we use for fire modeling.

We see in this diagram how we can

make many real time analysis results

a part of the fire modeling.

Once integrated with other sources of information,

such better and automated fuel models

can lead to more accurate results.

We provide you a short video that further explains

how all these data sets are integrated and analyzed

using data science as the next video in this lesson

before we start with our notebook.

Please feel free to skip it

if you would like to jump ahead to the notebook.

a sample satellite image data set

from one of our research projects called WIFIRE,

and we'll use the numpy library in this analysis.

WIFIRE is an integrated system for wildfire analysis

which is capable of handling changing urban dynamics

and climate.

The system integrates networked observations

from a variety of sources including heterogeneous

satellite data and real time remote sensor data.

It then processes all these data

using computational techniques

in signal processing, visualization,

predictive fire modeling, and data assimilation

in a scalable way.

The result is a system capable

of monitoring weather patterns

and other factors to help predict

a wildfire's rate of spread.

You can read more about WIFIRE at wifire.ucsd.edu.

By the end of this video, you should be able to

describe what satellite image data is

and how it helps fighting wildfires,

and apply basic methods in numpy for image processing.

In this lesson, we'll go over a notebook

that uses a satellite image from landfire.gov

that can be used for analysis of the Earth's surface.

It is very common for any Earth science application

to include an analysis of visual graphs

in the form of maps, photos, or satellite imagery

as seen in this image.

Many other data science applications will also

involve a form of image processing.

We need to have a basic knowledge of image formats

and how to work with images in Python

to get started in this vast field.

So before we switch to our notebook for further practice,

let's review a few key points on image processing

and Earth science applications.

Simply speaking, we can say computers

store images as a mosaic of tiny squares.

This is like the ancient art form of tile mosaics,

or the melting bead kits kids play with today.

If these square tiles are too big,

it's hard to make smooth edges and curves.

The more and smaller tiles you use,

the smoother, or as we say less pixelated,

the image will be.

This sometimes gets referred to as resolution of the image.

Please note that vector graphics

are a somewhat different method of storing images

that aims to avoid pixel related issues,

but we'll set those aside for now.

Even vector images, in the end,

are displayed as a mosaic of pixels.

Each of these squares is called a pixel.

Each pixel is only one color, defined by a set of numbers.

A simple way to describe each pixel

is using a combination of three colors,

namely red, green, and blue.

This is what we call an RGB image.

In an RGB image,

each pixel is represented by three 8-bit numbers





