THE UNIVERSITY OF ARIZONA

BE/BAT 485/585

Remote Sensing Data and Methods

Lab - 3

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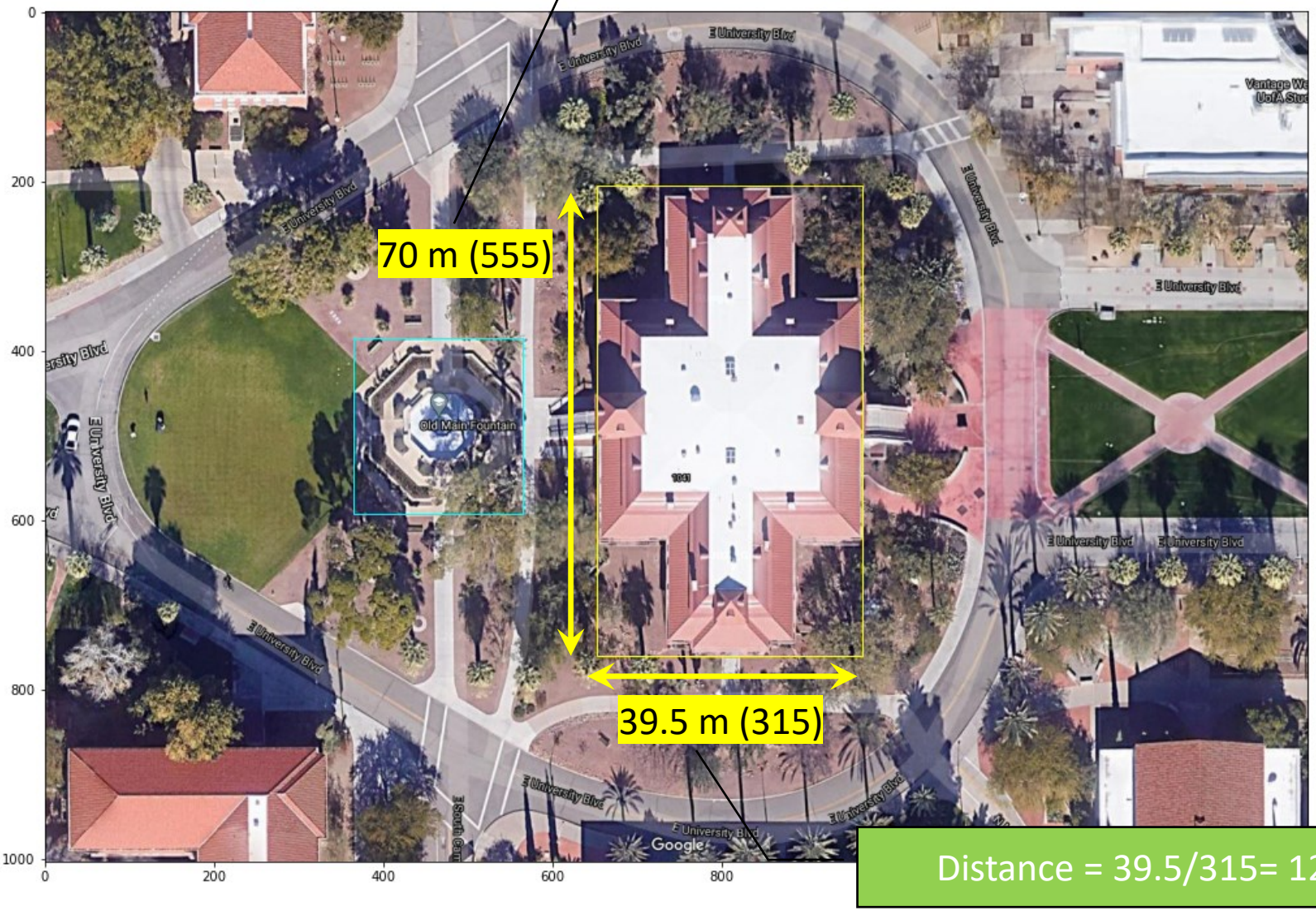
Revisit Lab #2

Finish your work, get help, or ensure accuracy.

Exercise #1: Pixel size

- Here is one way



New Lab #3 Work

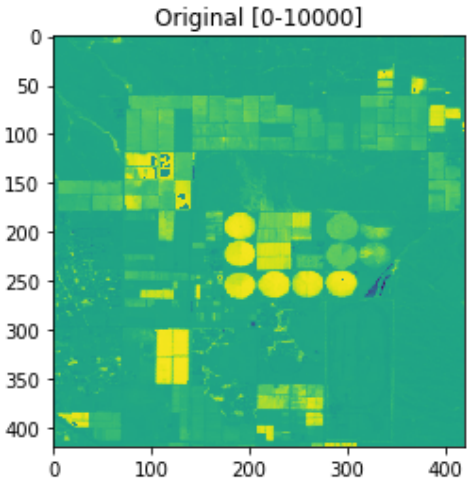
Today you will learn

- Degrading and Super sampling
  - There are two user defined functions that do that
  - They are straightforward and use simple averaging and/or repetition
  - Can you improve them? To use other sampling techniques/methods?
- You will learn some basic matplotlib functions
  - Load an image
    - Apply colors
    - Label the images
    - Add ticks
    - etc.
  - Create line plot
    - Graph Y vs. X
    - Superimpose more than one line graph
    - Label them
    - Add Title/X-Axis/Y-Axis

Basic Matplotlib operations

[10]:
```
# Display Input band
plt.figure()
plt.title('Original [0-10000]')
plt.imshow(DataNDVI)
```

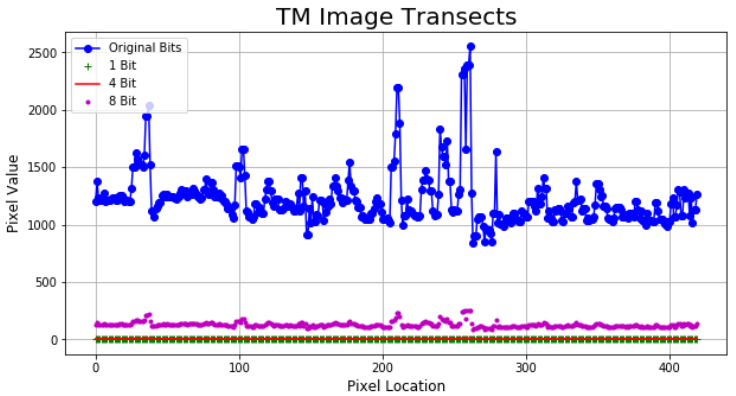
[10]: <matplotlib.image.AxesImage at 0x12950350d30>



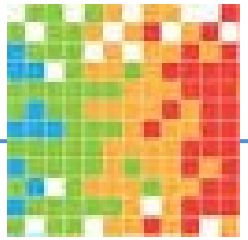
Todo: Look at presentation

[20]:
```
### Here we print the row of ddat to show what  happened to the orignal data
# Import plotting libraries
import matplotlib.pyplot as plt
import matplotlib.colors

# Create data holders for the data with the correct size
Xvalues=np.zeros(ncols)
for i in range(0,420):
  Xvalues[i]=i

# And we plot as usual
plt.figure(figsize=(10,5))
plt.title('TM Image Transects',fontsize=20)
plt.xlabel('Pixel Location',fontsize=12)
plt.ylabel('Pixel Value',fontsize=12)

plt.plot(Xvalues,DataNDVI[15,:],"b-o",label="Original Bits")
plt.plot(Xvalues,Data_1bit[15,:],"g+",label="1 Bit")
plt.plot(Xvalues,Data_4bit[15,:],"r-",label="4 Bit")
plt.plot(Xvalues,Data_8bit[15,:],"m.",label="8 Bit")
#'b', 'g', 'r', 'c', 'm', 'y', 'k', 'w'};
plt.grid()
plt.legend(loc='upper left')
```

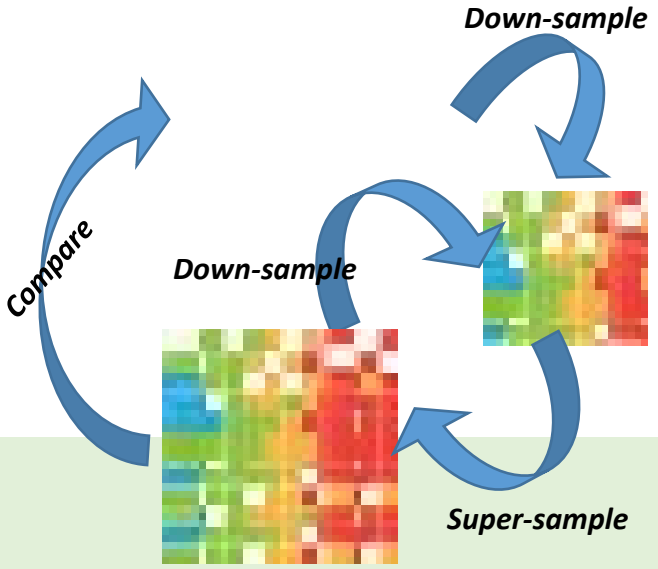
[20]: <matplotlib.legend.Legend at 0x26a525489e8>



Exercise #1: Resampling



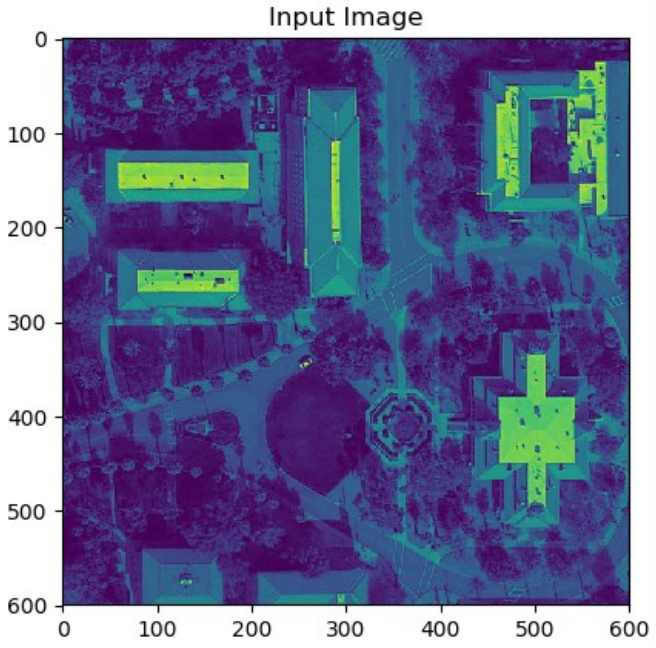
- **Resampling**
  - Down sample (previous lab)
  - Super-sample (increase resolution)
    - Why? Sometimes we need to super sample, so data sets match each other
  - Downsample the resolution of an input image, then reverse it with super-sampling then compare the resulting data
    - **Is it a reversible process?**
- **Homework**:
  - Down-sample then Super-sample the original image
    - Sample and graph a row of values from the original input image and compare to the super-sampled Image (same size).
    - What happened at each stage and how the pixel values changed
    - What does this tell you?
  - Now repeat the "down-sampling then super sampling" multiple times and watch the impact by plotting some data

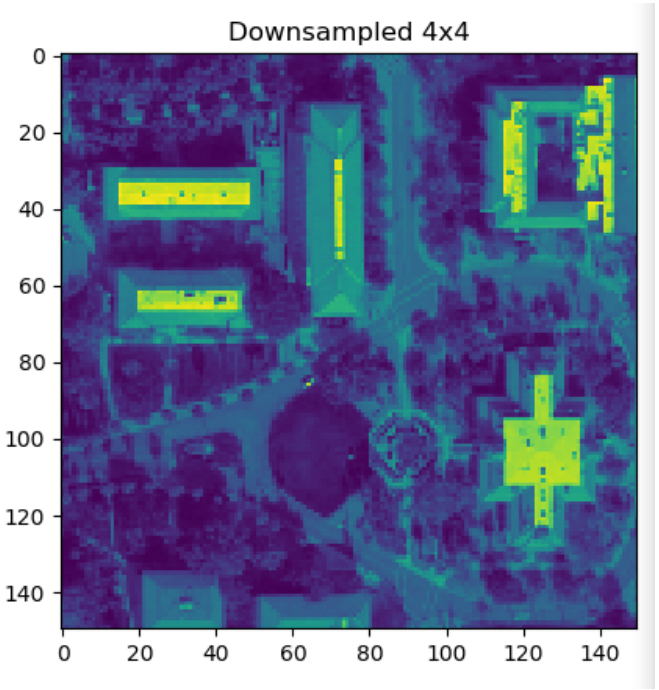


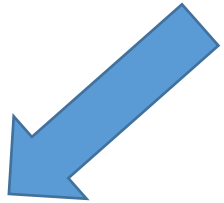
Instructions:

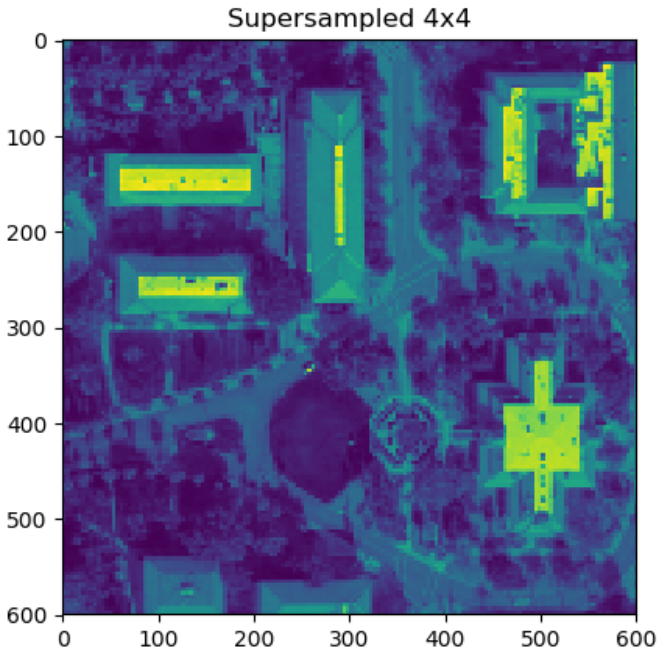
- Download from D2L files:
  - UA_Old_Main_New.jpg
  - viplab_lib.py
  - BE485_Lab_3_Ex1.ipynb

Resampling







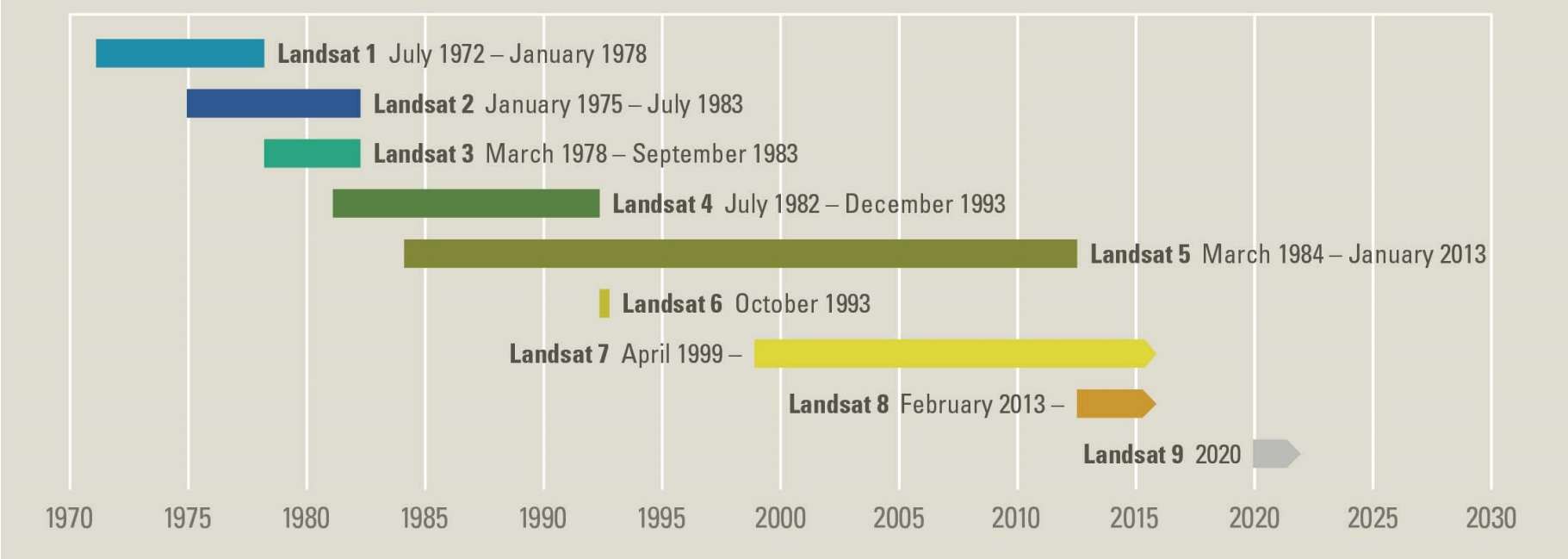


Notes:

- Look at the number of rows and columns
- Visually inspect the pixels
- Compare Images
- Was the process reversed?
    - Could this be a lossless process?
    - Recall the mixing from the lectute?

Landsat

- The Landsat series of satellites provides the longest temporal record of moderate resolution multispectral data of the Earth's surface on a global basis for over 40 years so far.
- The Landsat record has remained remarkably unbroken and is a unique resource to assist a broad range of specialists in managing the world's food, water, forests, and other natural resources for a growing world population. It is a record unmatched in quality, detail, coverage, and value (Source: USGS)



Landsat Data naming convention

- When working with landsat, it is important to understand both the metadata and the file naming convention.
- The metadata tell you how the data were processed, where the data are from and how they are structured.
- The file names, tell you what sensor collected the data, the date the data were collected, and more.

Scene ID

LXSPPPRRRYYYYDDDGSIVV

L = Landsat
X = Sensor
S = Satellite
PPP = WRS path
RRR = WRS row
YYYY = Year
DDD = Julian day of year
GSI = Ground station identifier
VV = Archive version number

Examples:
LC80290302015343LGN00
LE70160392004262EDC02
LT40170361982320XXX08
LM10170391976031AAA01

Landsat Product Identifier

LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX

L = Landsat
X = Sensor ("C" = OLI/TIRS Combined, "O"= OLI-only, "T" = TIRS-only, "E" = ETM+, "T" = TM, "M"= MSS)
SS = Satellite ("07" = Landsat 7, "08" = Landsat 8)
LLLL = Processing correction level ("L1TP": Precision Terrain, "L1GT": Systematic Terrain, "L1GS": Systematic)
PPP = WRS path
RRR = WRS row
YYYYMMDD = Acquisition year (YYYY) / Month (MM) / Day (DD)
yyyymmdd = Processing year (yyyy) / Month (mm) / Day (dd)
CC = Collection number ("01","02")
TX = Collection category: ("RT" for Real-Time, "T1" for Tier 1 , or "T2" for Tier 2)

Examples:
LC08_L1GT_029030_20151209_20160131_01_RT
LE07_L1TP_016039_20040918_20160211_01_T1
LT04_L1GS_017036_19821115_20160315_01_T2
LM01_L1GS_017039_19760131_20160225_01_T2

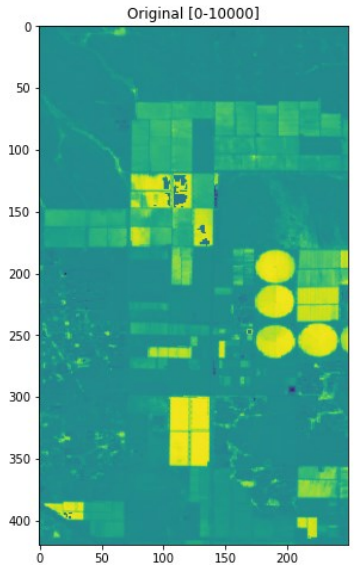
Exercise #2: Radiometric resolution

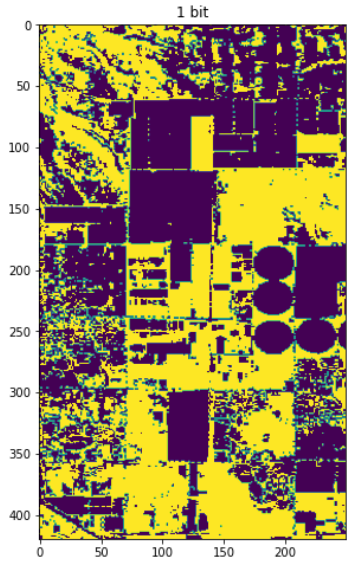
- Radiometric resolution
  - Read an image file/input (from Excel – we will eventually work directly with images)
  - Display the original image
  - Apply different Radiometric resolution
    - 1 or 8 bits from original (16 bits)
- **Homework**
  - Generate a dataset at 6 and 12 bits radiometric resolution
  - Display these images
  - Extract a row of values at each resolution and plot the values in an X-Y graph
  - Comment on what is happening to the data/values

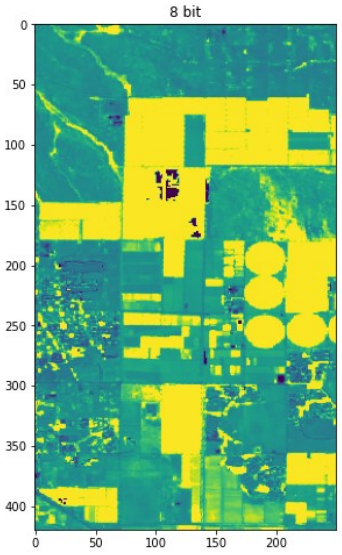
Instructions:

- Download from D2L files:
  - LANDSAT8.A2017164.xlsx
  - BE485_Lab_3_Ex2.ipynb

Radiometric resolution







Recall this is like scaling but in the data domain