THE UNIVERSITY OF ARIZONA

BE/BAT 485/585

Remote Sensing Data and Methods

Lab - 2

Instructor: Kamel Didan[1,2]

Helpers: Dr. Armando Barreto[1,2]

Mr. Truman Combs[1,2]

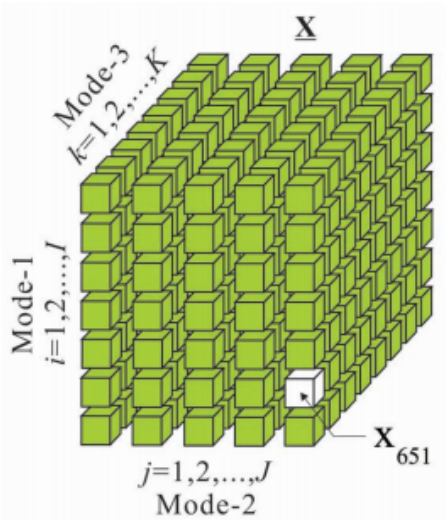
[1]BE Dept., University of Arizona,

[2]VIP Lab.

Recall

Scalars, Vectors, Matrices, and Tensors?

- Tensor: Array of numbers arranged in a regular grid with variables number of axes
  - A higher-order tensor can be interpreted as a multiway array, [...]
  - A tensor can be thought of as a multi-index numerical array, [...]



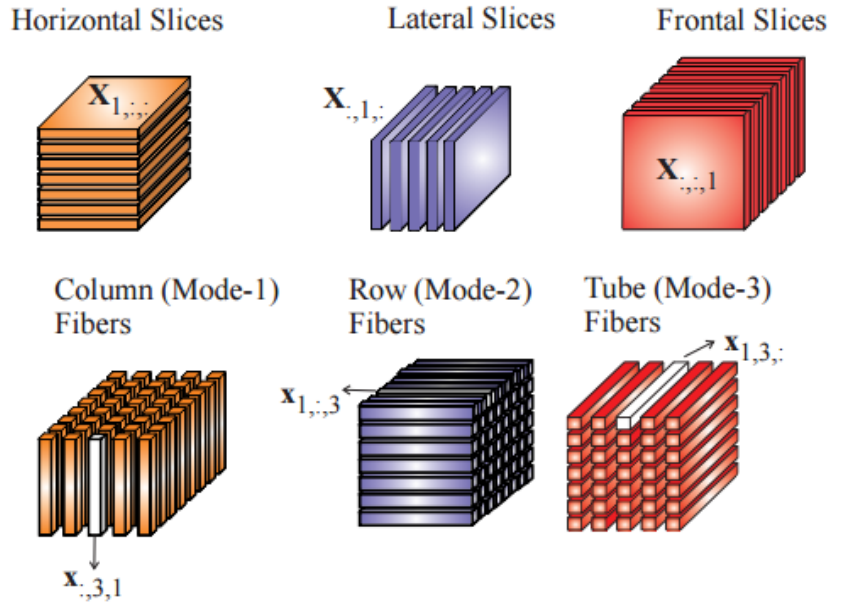
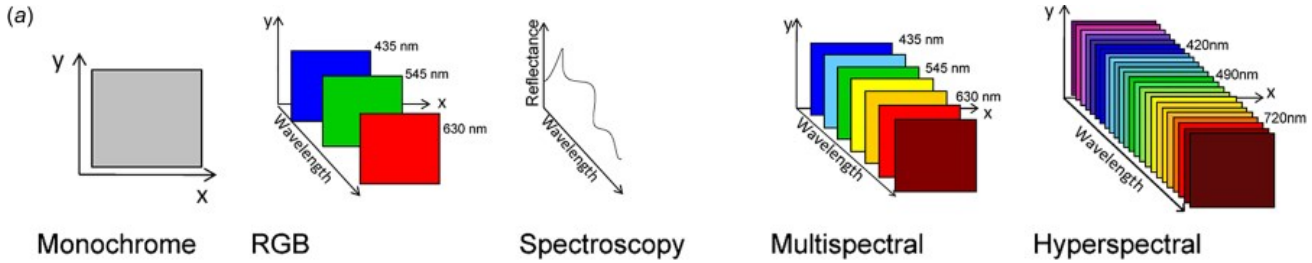
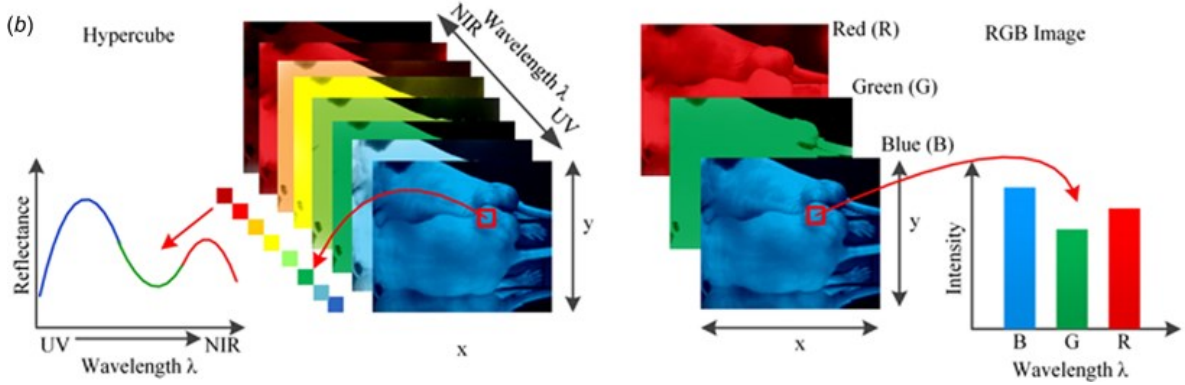
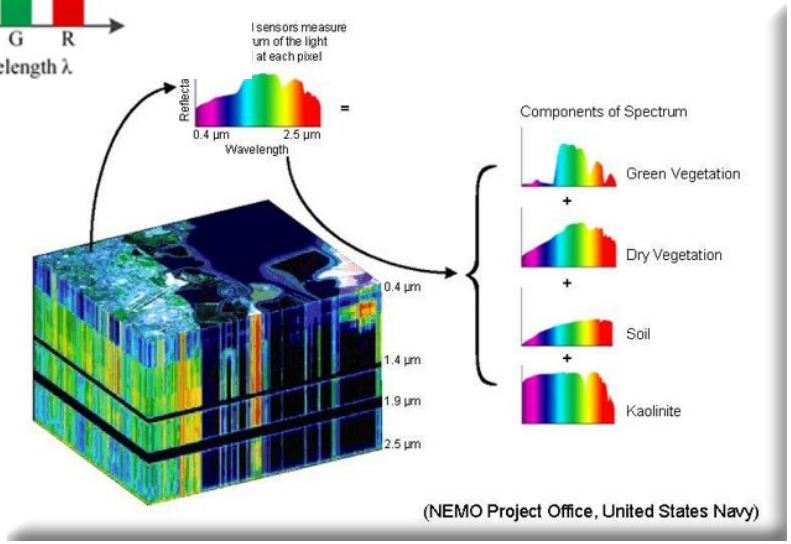


Figure 2: A 3rd-order tensor $\underline{\mathbf{X}} \in \mathbb{R}^{I \times J \times K}$, with entries $x_{i,j,k} =$

Become familiar with

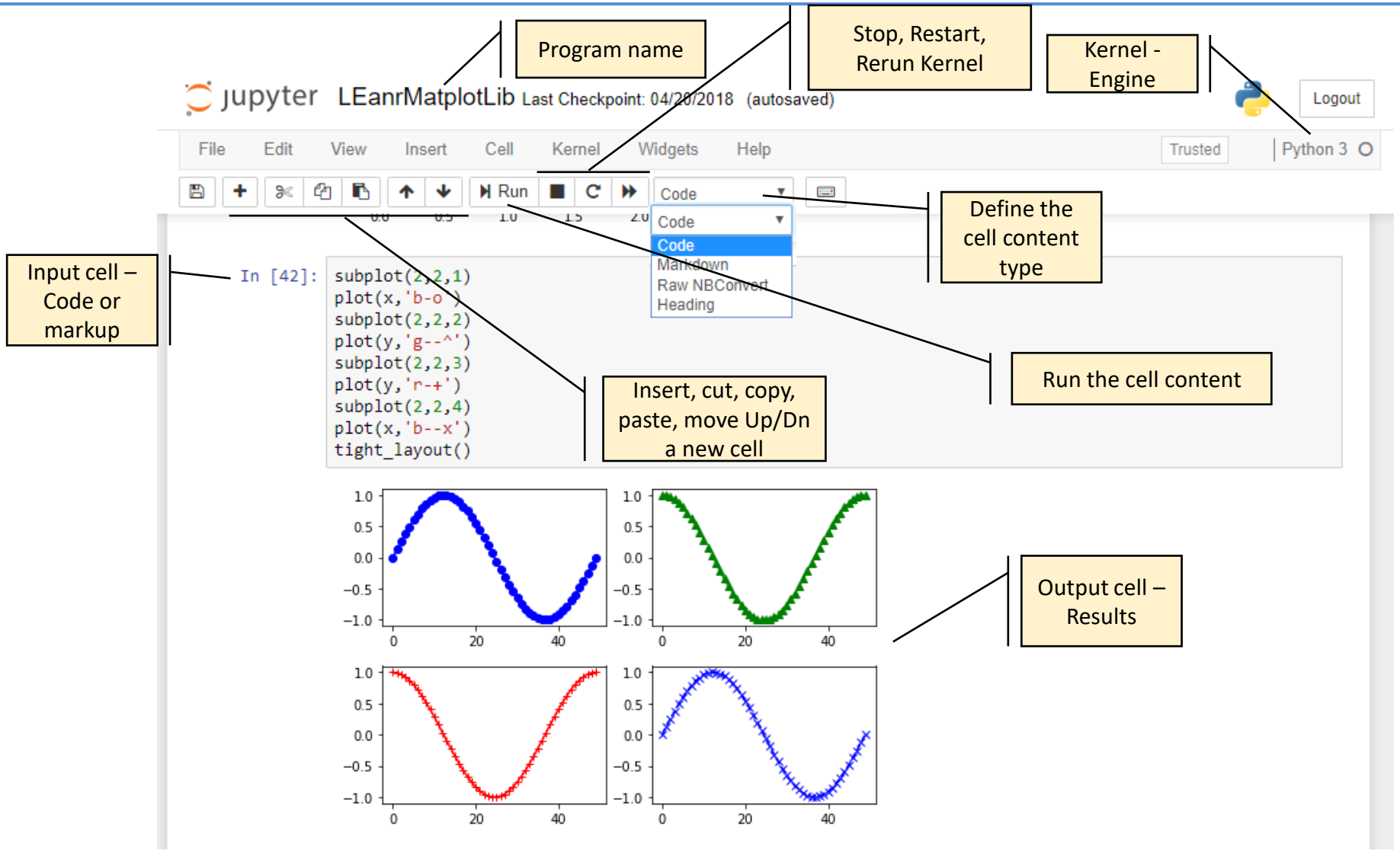






Programming with Python – JupyterLab

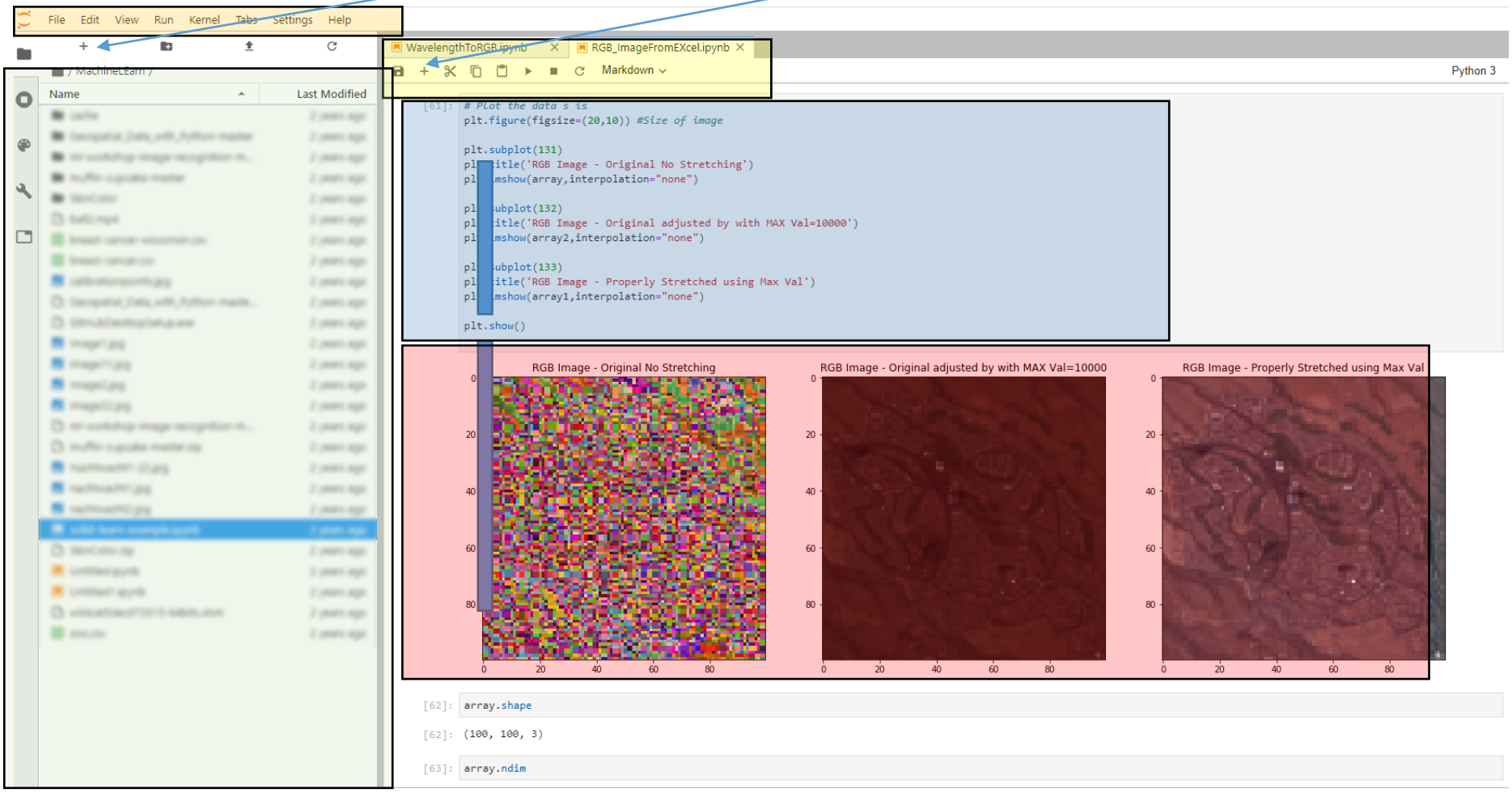
Notebook - View



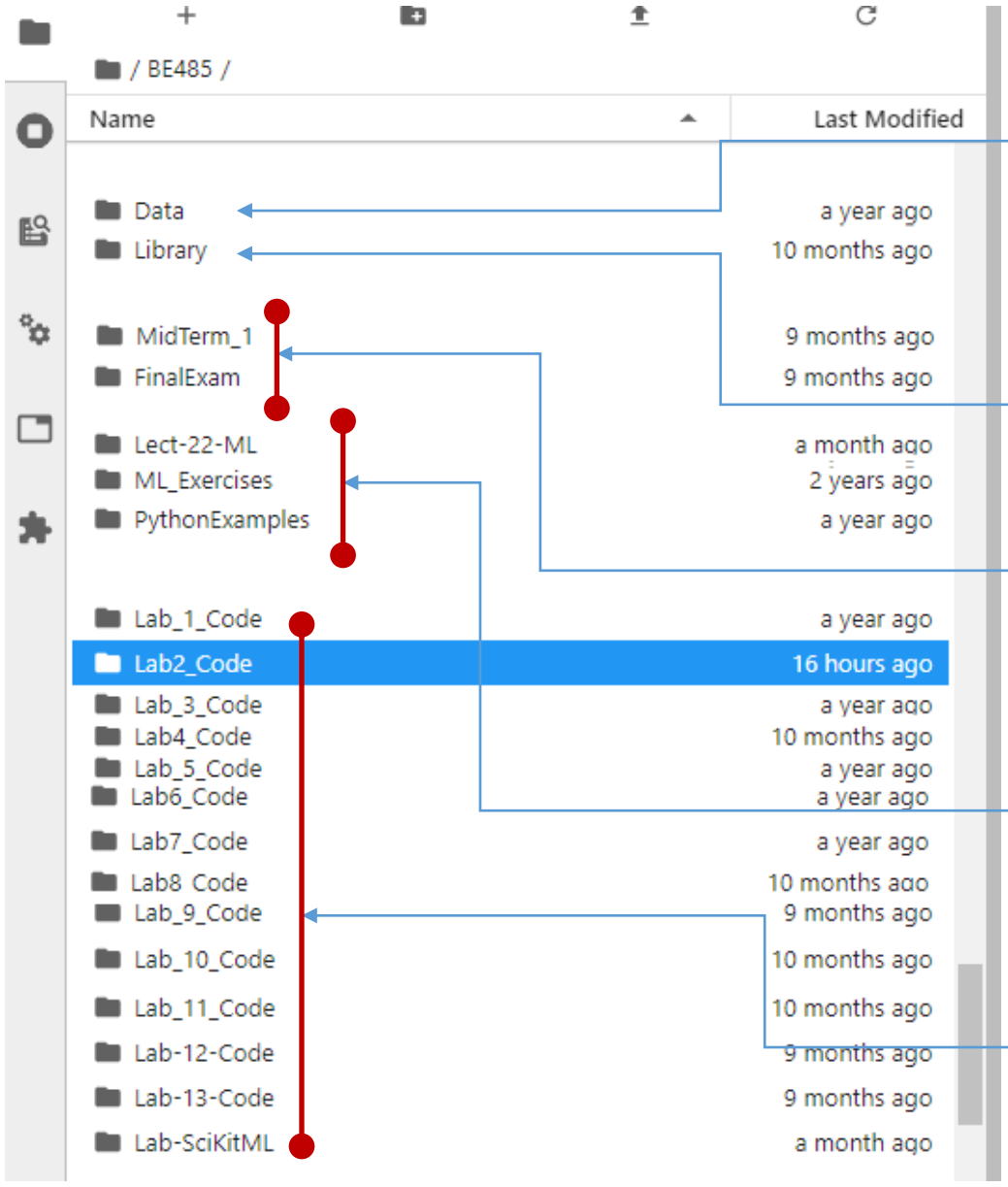
Jupyterlab – View (not that different)

Create a new project/file

A new cell



How to best organize your workspace



Store all data here.
Use subdirectories if needed
Use relative path addressing (./ or ../, etc.)

Special libraries
The VIP ones or your own

Exams

Additional Work/HW/Exercises

Lab work

How to add packages (libraries to Anaconda/Python

- There are many ways but the simplest are:

Installing a conda package

Enter the command:

```
conda install package-name
```

Installing specific versions of conda packages

Include the desired version number or its prefix after the package name:

```
conda install package-name=2.3.4
```

To specify only a major version, run:

```
conda install package-name=2
```

These commands install into the environment that is currently active. To install into a nam

```
conda install package-name=2.3.4 -n some-environment
```

conda install

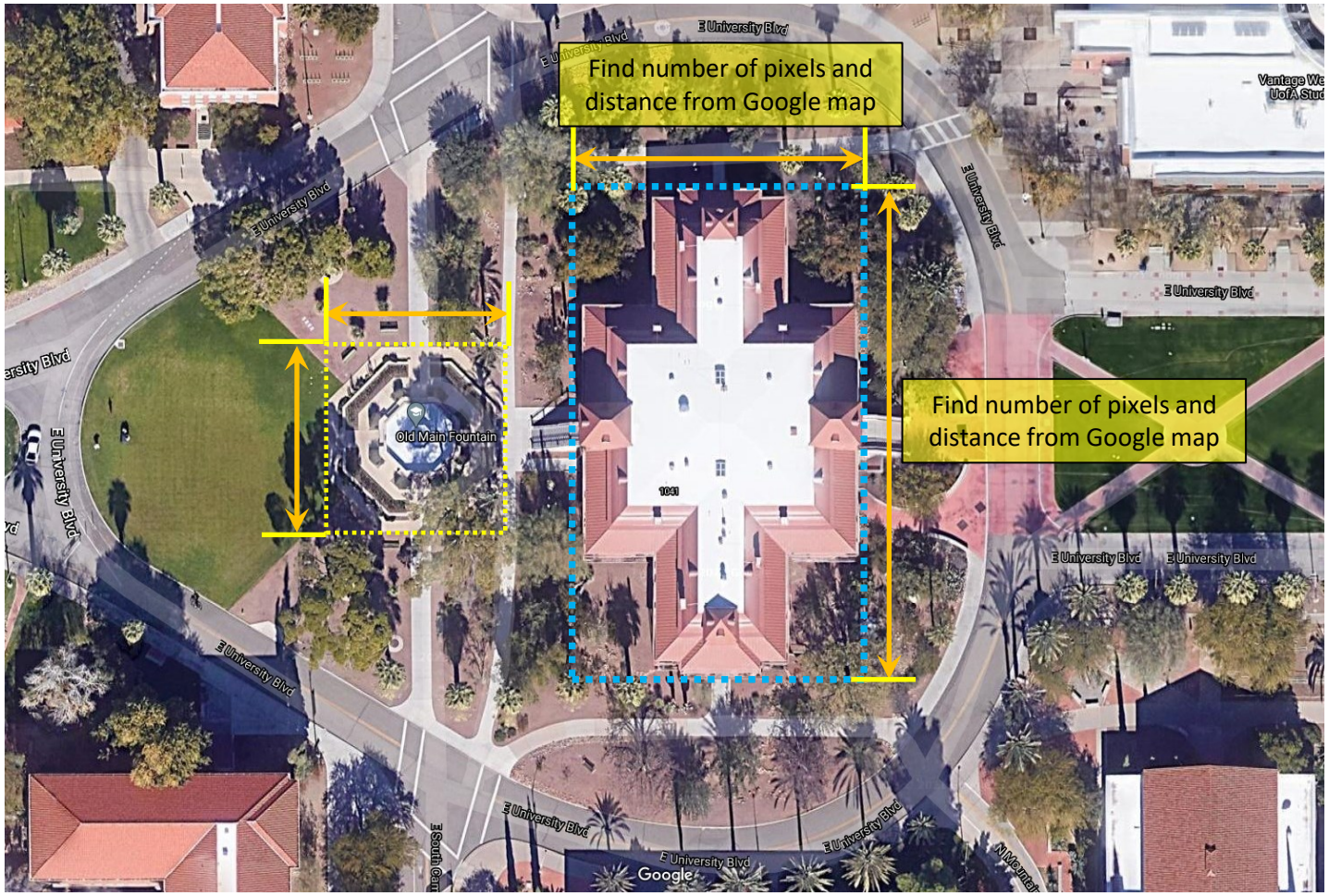
To install a conda package from this channel, run:

```
conda install --channel "conda-forge" package
```

Today’s Lab.

Old Main

- How many pixels in X and Y direction?
- What is the distance from Google maps/or Google Earth?



Exercise #1: Pixel size

- Estimate the image pixel size (spatial resolution)
  - Use Old Main building or any known reference in the image
  - What are the 'real' dimensions in the X/Y directions
  - What is the number of pixels used to represent that distance?
  - Use Google Maps measurement tool
  - Then compute the pixel size?,
    - Pixel size is useful for many thing (areas, distance, etc.)
- **Homework**
  - What is the area of the Old Main building?
  - Estimate the extent of the Fountain ?
  - Can you compute the surface of the Green area in front of Old Main fountain?
    - If you know the size of one pixel the area is simply the sum of all pixels

Instructions:

- Download from D2L files:
  - BE485-585-Lab2-Ex1.ipynb
  - UA_Old_Main.jpg

Exercise #2: Resampling

- How resampling works?

42	55	81	87	75	82	82	49	13	20	16	24
50	44	64	75	57	55	69	68	28	39	14	26
67	79	97	90	83	70	62	44	30	54	39	45
76	84	105	107	78	77	60	44	54	58	42	18
57	107	112	110	91	84	61	37	62	70	41	6
81	113	107	117	109	101	74	44	59	59	31	9
86	108	107	111	115	89	50	50	51	29	17	0
54	90	116	108	109	57	13	29	27	25	19	11
33	92	111	101	111	91	34	16	21	21	24	28
28	84	104	101	89	68	36	17	21	15	8	14
27	71	111	87	80	23	20	21	21	18	10	7
25	76	105	72	80	32	20	13	11	12	12	9

Input

Color visual representation

42	55	81	87	75	82	82	49	13	20	16	24
50	44	64	75	57	55	69	68	28	39	14	26
67	79	97	90	83	70	62	44	30	54	39	45
76	84	105	107	78	77	60	44	54	58	42	18
57	107	112	110	91	84	61	37	62	70	41	6
81	113	107	117	109	101	74	44	59	59	31	9
86	108	107	111	115	89	50	50	51	29	17	0
54	90	116	108	109	57	13	29	27	25	19	11
33	92	111	101	111	91	34	16	21	21	24	28
28	84	104	101	89	68	36	17	21	15	8	14
27	71	111	87	80	23	20	21	21	18	10	7
25	76	105	72	80	32	20	13	11	12	12	9

ex: 42+55+50+44)/4 = 47.75 = **48**

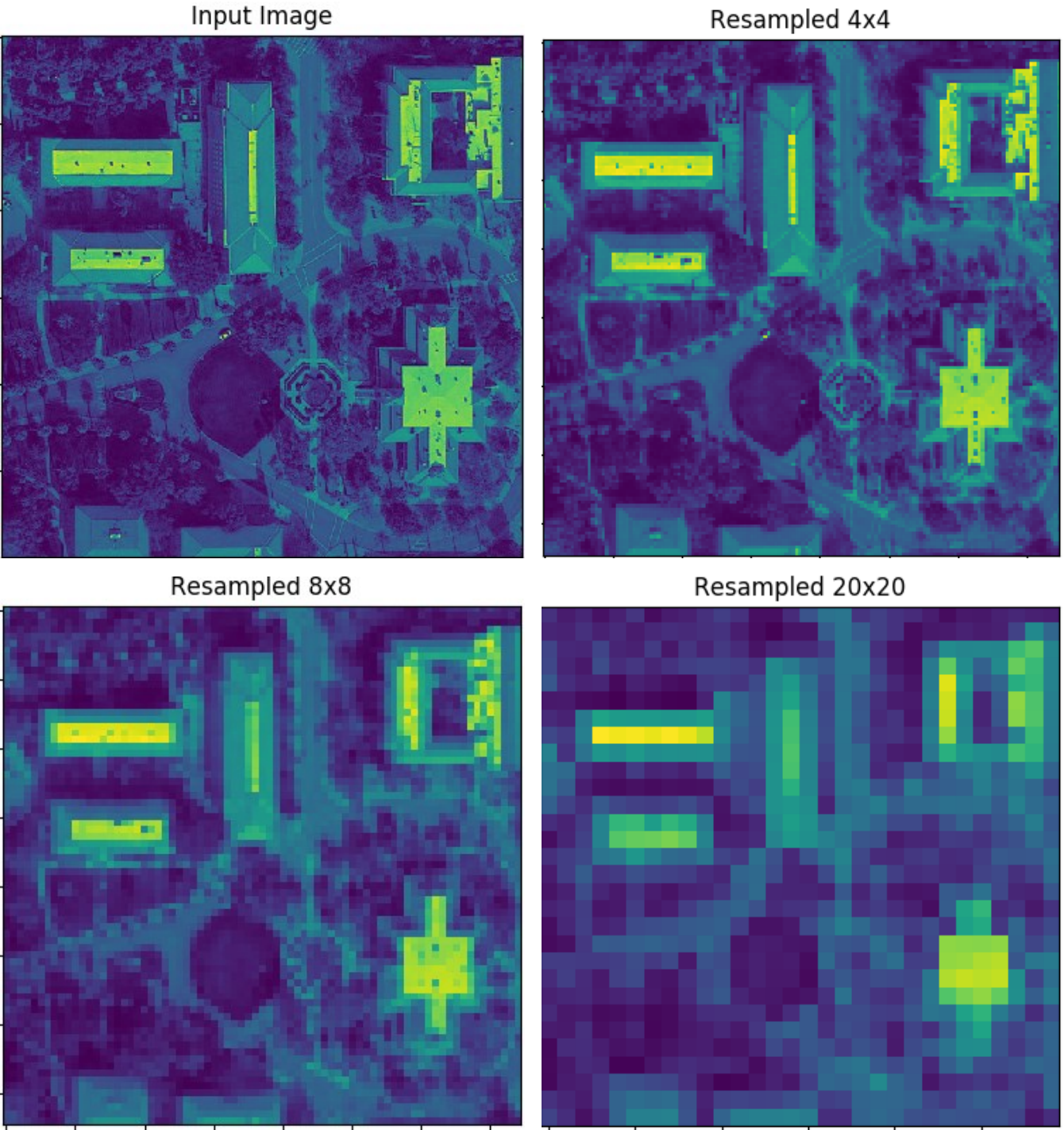
Resampling 2x2

48	77	67	67	25	20
77	100	77	53	49	36
90	112	96	54	63	22
85	111	93	93	36	12
59	104	90	26	20	19
50	94	54	19	16	10

ex: 91+84+37….+13+29)/16 = **70**

Resampling 4x4

75	66	33
99	70	32
77	47	16



Program output examples.

You can try whatever resampling you want

Exercise #2: Resampling

- **Resampling**
  - Learn about custom user-defined functions?
  - How to loop through the image (rows and columns)
  - Get data from a subset (slicing) and an average of a subset
  - Assign values to a pixel

- **Homework**:
  - The Example shows how to resample one single band
    - Modify the code to resample all bands and display the RGB resampled Images
    - You will need to resample all bands to the same size to create a proper RGB

Instructions:

- Download from D2L files:
  - UA_Old_Main.jpg
  - viplab_lib.py [From Lab #1]
  - BE485-585-Lab2-Ex2.ipynb