



Deep Learning

for Image Classification and Segmentation

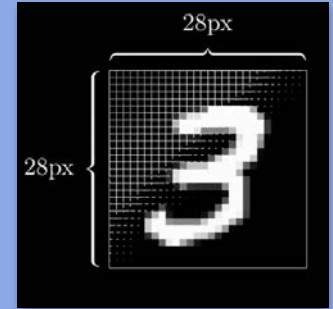
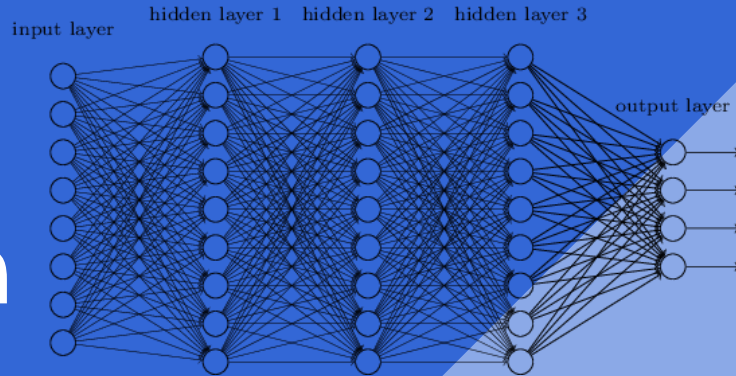


The study plan

- Unit 1: What is Tensorflow and how to solve linear regression problem in Python and Tensorflow?
- Unit 2: What is image classification and how to implement a solution?
- Unit 3: What is Neural Networks and how to apply on image classification?
- Unit 4: What is Convolutional Neural Networks and Deep Neural Networks?
- Unit 5: What is image segmentation and how to implement a solution?
- Unit 6: How to improve Deep Neural Networks?
- Short-Term Project Report Presentation



The study plan

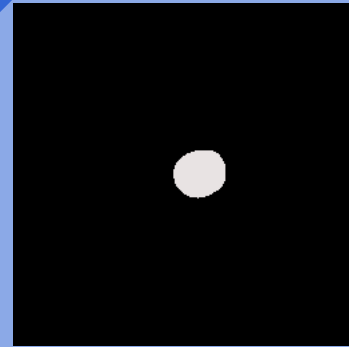
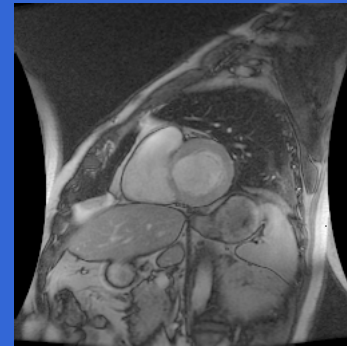


- Unit 3: What is Neural Networks and how to apply it on image classification ?



Individual Assignment

Activity of Unit 5: (option)

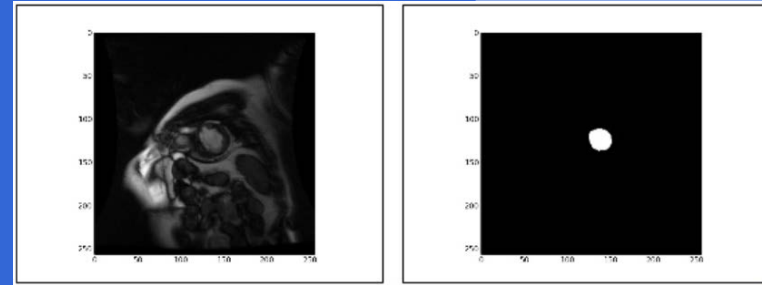


- Segment MRI images to measure parts of the heart by setting up a computer vision workflow using using NVIDIA DIGITS™.

[Web site](#)



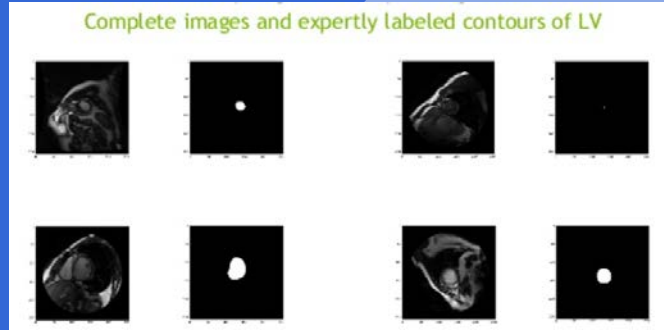
Short-Term Project in teams



Using MRI to measure cardiac volumes and derive ejection fraction
Ref: Kaggle challenge in the 2016 Data Science Bowl Competition.



Short-Term Project in teams



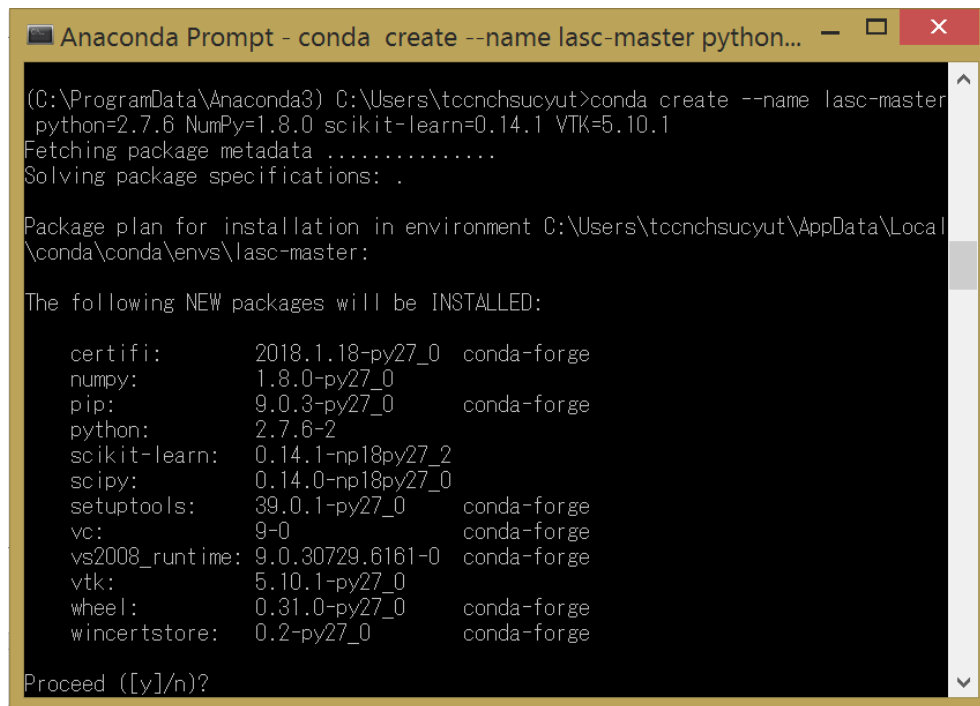
- Segment MRI images to measure parts of the heart by setting up a computer vision workflow using deep learning.

Anaconda Prompt Environment

- The scripts in this repository were successfully run with:
- Python 2.7.6
- NumPy 1.8.0
- scikit-learn 0.14.1
- VTK 5.10.1
- `conda create --name lasc-master python=2.7.6 NumPy=1.8.0 scikit-learn=0.14.1 VTK=5.10.1`

Anaconda Prompt Environment

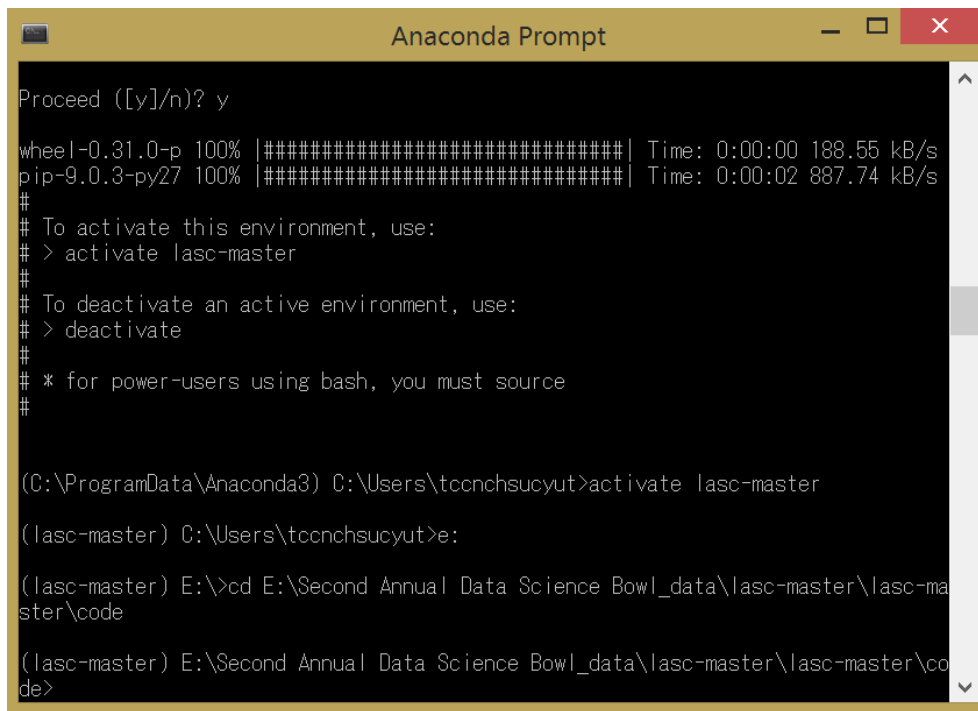
- conda create --name lasc-master python=2.7.6 NumPy=1.8.0 scikit-learn=0.14.1 VTK=5.10.1



```
Anaconda Prompt - conda create --name lasc-master python...  
(C:\ProgramData\Anaconda3) C:\Users\tccnchsucyut>conda create --name lasc-master  
python=2.7.6 NumPy=1.8.0 scikit-learn=0.14.1 VTK=5.10.1  
Fetching package metadata .....  
Solving package specifications: .  
  
Package plan for installation in environment C:\Users\tccnchsucyut\AppData\Local  
\conda\conda\envs\lasc-master:  
  
The following NEW packages will be INSTALLED:  
  
certifi:          2018.1.18-py27_0  conda-forge  
numpy:            1.8.0-py27_0      conda-forge  
pip:              9.0.3-py27_0      conda-forge  
python:           2.7.6-2            conda-forge  
scikit-learn:     0.14.1-np18py27_2  conda-forge  
scipy:            0.14.0-np18py27_0  conda-forge  
setuptools:       39.0.1-py27_0      conda-forge  
vc:               9-0                conda-forge  
vs2008_runtime:   9.0.30729.6161-0   conda-forge  
vtk:              5.10.1-py27_0      conda-forge  
wheel:            0.31.0-py27_0      conda-forge  
wincertstore:     0.2-py27_0         conda-forge  
  
Proceed ([y]/n)?
```


Anaconda Prompt Environment

- conda create --name lasc-master python=2.7.6 NumPy=1.8.0 scikit-learn=0.14.1 VTK=5.10.1



```
Anaconda Prompt

Proceed ([y]/n)? y

wheel-0.31.0-p 100% |#####| Time: 0:00:00 188.55 kB/s
pip-9.0.3-py27 100% |#####| Time: 0:00:02 887.74 kB/s
#
# To activate this environment, use:
# > activate lasc-master
#
# To deactivate an active environment, use:
# > deactivate
#
# * for power-users using bash, you must source
#

(C:\ProgramData\Anaconda3) C:\Users\tccnchsucyut>activate lasc-master

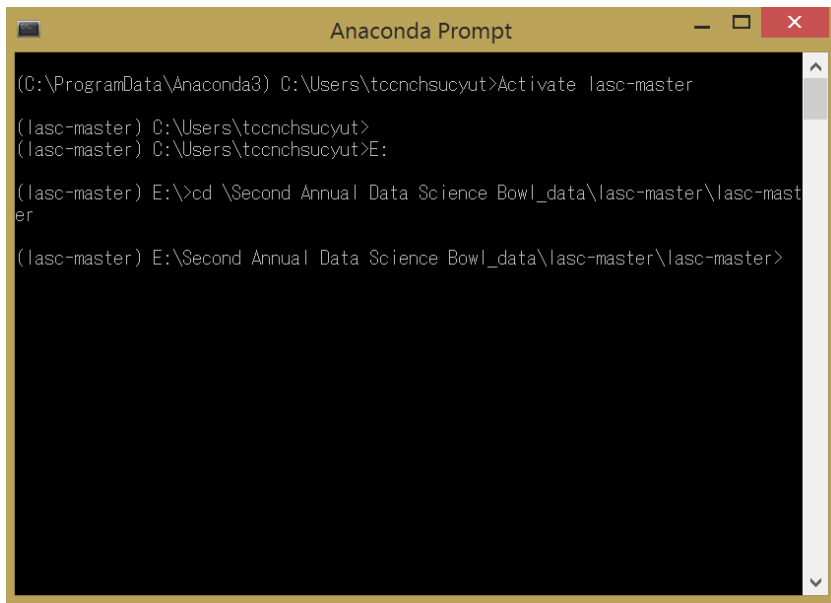
(lasc-master) C:\Users\tccnchsucyut>e:

(lasc-master) E:\>cd E:\Second Annual Data Science Bowl_data\lasc-master\lasc-master\code

(lasc-master) E:\Second Annual Data Science Bowl_data\lasc-master\lasc-master\code>
```

Anaconda Prompt Environment

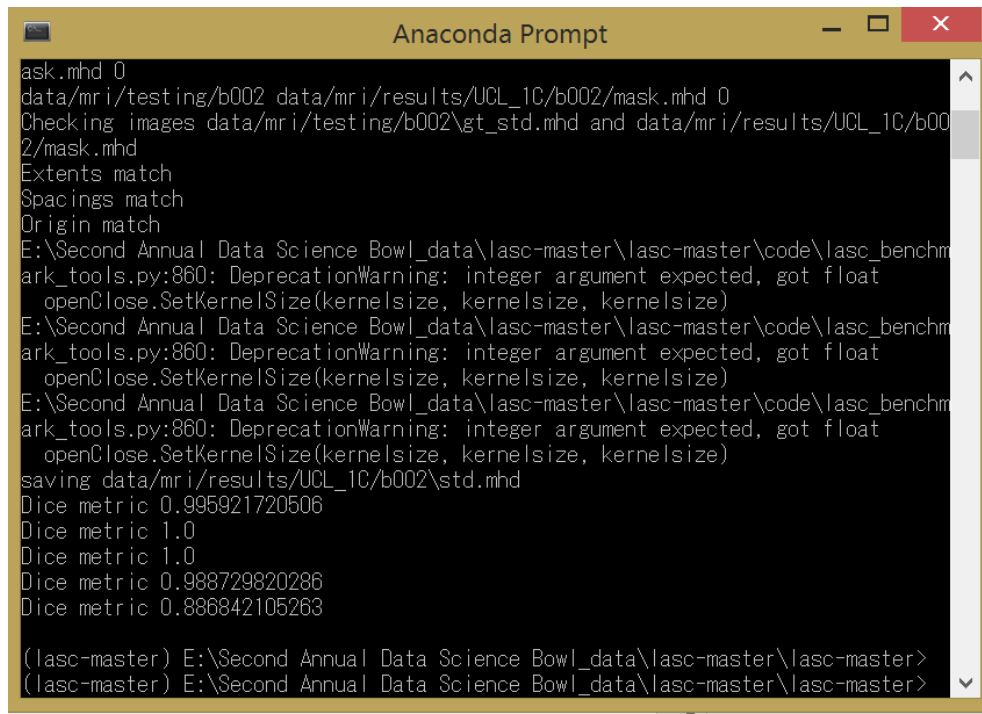
- Activate lasc-master
- E:
- `cd \Second Annual Data Science Bowl_data\lasc-master\lasc-master`



```
Anaconda Prompt
(C:\ProgramData\Anaconda3) C:\Users\tccnchsucyut>Activate lasc-master
(lasc-master) C:\Users\tccnchsucyut>
(lasc-master) C:\Users\tccnchsucyut>E:
(lasc-master) E:\>cd \Second Annual Data Science Bowl_data\lasc-master\lasc-master
(lasc-master) E:\Second Annual Data Science Bowl_data\lasc-master\lasc-master>
```

Anaconda Prompt Environment

- python code/lasc_benchmark.py data/mri/testing/b002 data/mri/results/UCL_1C/b002/mask.mhd 0



```
Anaconda Prompt
ask.mhd 0
data/mri/testing/b002 data/mri/results/UCL_1C/b002/mask.mhd 0
Checking images data/mri/testing/b002\gt_std.mhd and data/mri/results/UCL_1C/b002\mask.mhd
Extents match
Spacings match
Origin match
E:\Second Annual Data Science Bowl_data\lasc-master\lasc-master\code\lasc_benchmark_tools.py:860: DeprecationWarning: integer argument expected, got float
  openClose.SetKernelSize(kernelsize, kernelsize, kernelsize)
E:\Second Annual Data Science Bowl_data\lasc-master\lasc-master\code\lasc_benchmark_tools.py:860: DeprecationWarning: integer argument expected, got float
  openClose.SetKernelSize(kernelsize, kernelsize, kernelsize)
E:\Second Annual Data Science Bowl_data\lasc-master\lasc-master\code\lasc_benchmark_tools.py:860: DeprecationWarning: integer argument expected, got float
  openClose.SetKernelSize(kernelsize, kernelsize, kernelsize)
saving data/mri/results/UCL_1C/b002\std.mhd
Dice metric 0.995921720506
Dice metric 1.0
Dice metric 1.0
Dice metric 0.988729820286
Dice metric 0.886842105263

(lasc-master) E:\Second Annual Data Science Bowl_data\lasc-master\lasc-master>
(lasc-master) E:\Second Annual Data Science Bowl_data\lasc-master\lasc-master>
```

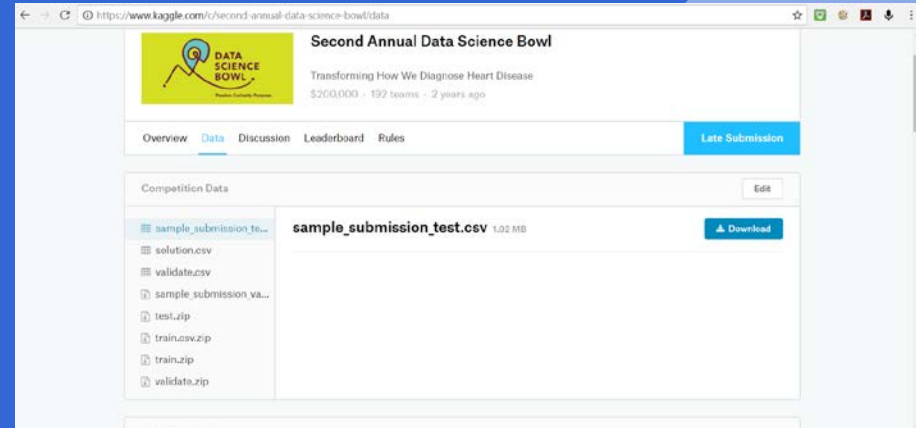
DIGITS medical image segmentation

- Using DIGITS to train a medical image segmentation network
- <https://github.com/NVIDIA/DIGITS/tree/master/examples/medical-imaging>





Short-Term Project Dataset



- Data Science Bowl Competition
Second Annual Data Science Bowl
- Transforming How We Diagnose Heart Disease
- <https://www.kaggle.com/c/second-annual-data-science-bowl>



Short-Term Project in teams

After completing this project, you will:

- Know how Convolutional Neural Networks (CNNs) work.
- Know how to prepare data for CNNs.
- Know how to design architecture of CNNs.
- Know how to tune CNNs to a problem.
- Know how to save an CNN model and use it to make predictions.



Short-Term Project Report

Report Contents involved as follows:

Section 1: Overview of concepts of Deep Neural Networks

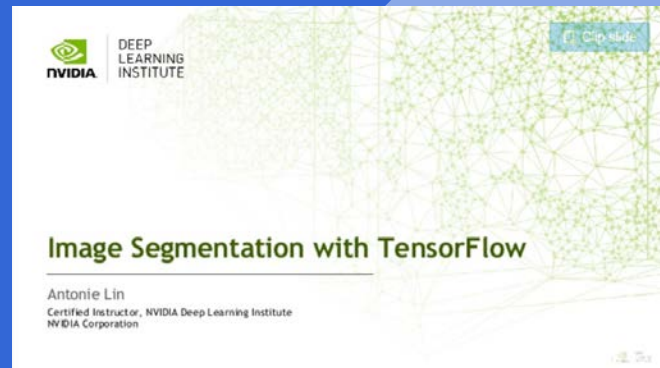
Section 2: Design a CNNs architecture for medical image segmentation.

Section 3: Impemetation of the CNNs architecture in Tensorflow and Python.

Section 4: Evaluation of the Design of a CNNs architecture.



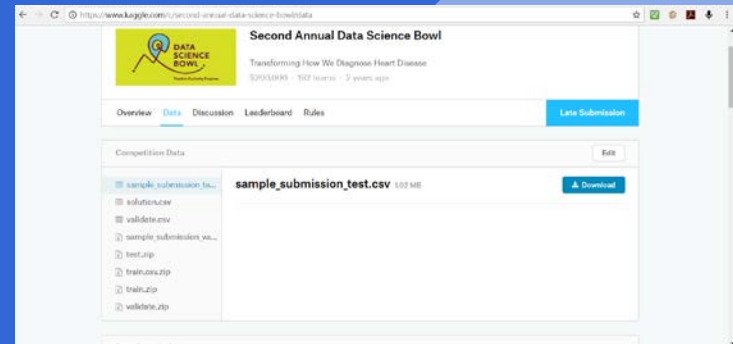
Short-Term Project Resources



- Introduction to Image Segmentation with TensorFlow
- <https://www.slideshare.net/NVIDIATaiwan/nvidia-dli-image-segmentation-with-tensorflow>



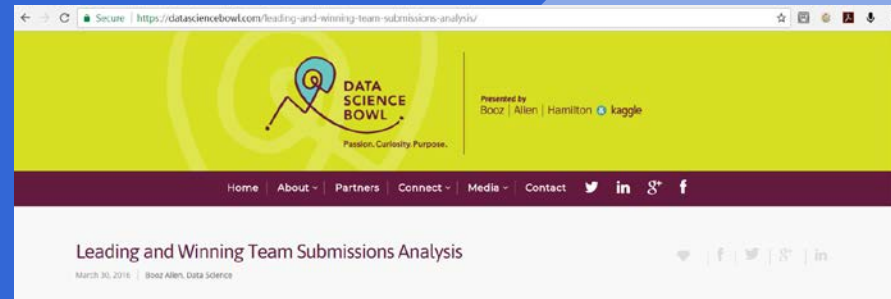
Short-Term Project Resources



- Diagnosing Heart Diseases in the Data Science Bowl: 2nd place, Team kunsthart
- <http://blog.kaggle.com/2016/04/13/diagnosing-heart-diseases-with-deep-neural-networks-2nd-place-ira-korshunova/>



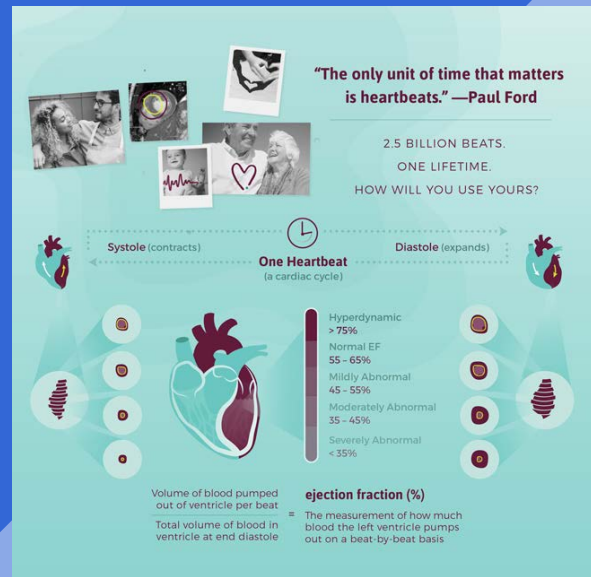
Short-Term Project Resources



- Leading and Winning Team Submissions Analysis
- <https://datasciencebowl.com/leading-and-winning-team-submissions-analysis/>



Short-Term Project Resources



- Left Atrial Segmentation Challenge 2013
- <https://github.com/catactg/lasc>



Short-Term Project Resources

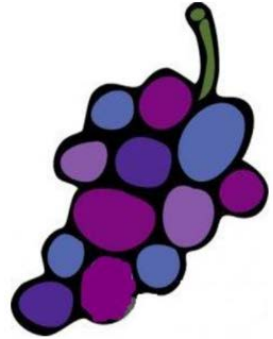
- Using DIGITS to train a medical image segmentation network
- <https://github.com/NVIDIA/DIGITS/tree/master/examples/medical-imaging>



Let the course make you feel like eating Grapes!

GRAPE Retention

- Growth
- Recognition
- Achievement
- Participation
- Enjoyment



Make you **G**rowth. Make you **R**ecognition.
Make you **A**chievement. Make you **P**articipation.
Make you **E**njoyment.