



Deep Learning

for Image Classification and Segmentation



Learning Objective

- First getting you acquainted with the basics of Tensorflow framework and ready to work.
- The contents focus on Deep learning theory and application together.
- You will learn things from the fundamentals and implement them throughout this course.
- Dive deeper into the word of Deep Learning with exciting and practical examples.

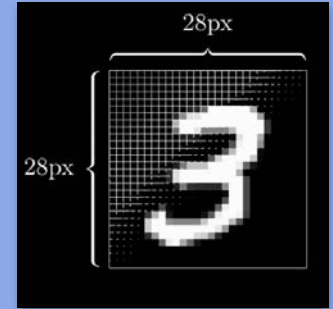
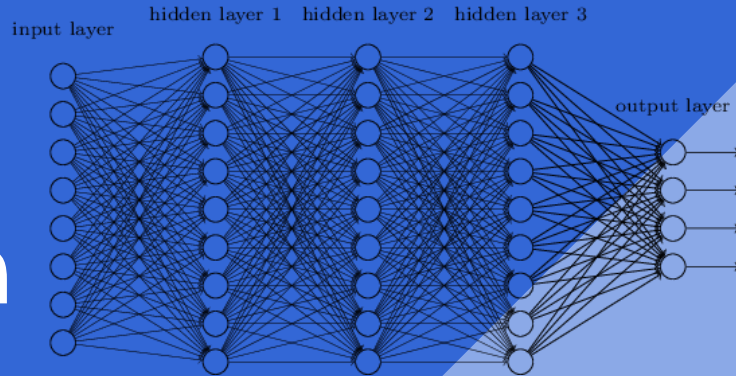


The study plan

- 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



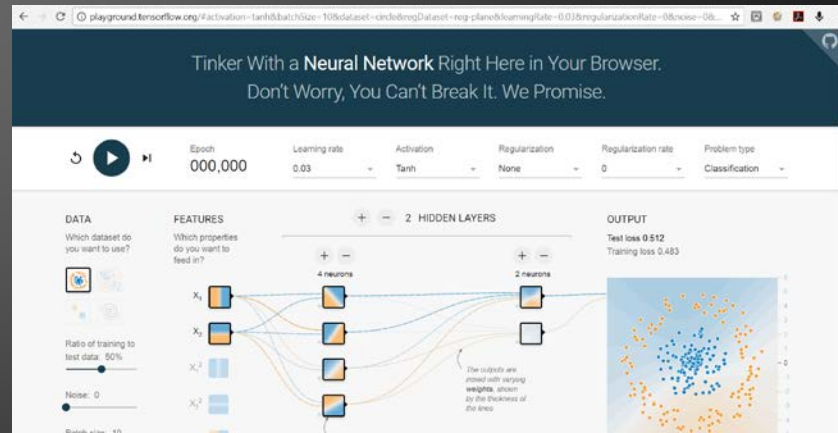
- Unit 3: What is Neural Networks and how to apply it on image classification ?
- mit opencourseware
- Introduction to Machine Learning <https://youtu.be/h0e2HAPTGF4>



Play Neural Network

Tinker With a Neural Network Right Here in Your Browser.
Don't Worry, You Can't Break It. We Promise.

<http://playground.tensorflow.org/>





Explaining the Math of how neural networks learn

Backpropagation

https://github.com/omar-florez/scratch_mlp

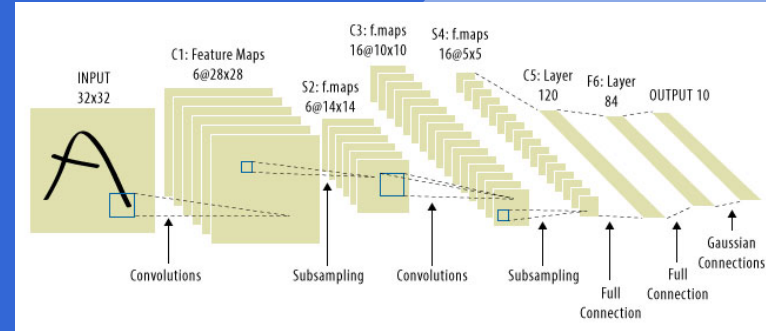
<https://en.wikipedia.org/wiki/Backpropagation>

Stochastic gradient descent

https://en.wikipedia.org/wiki/Stochastic_gradient_descent

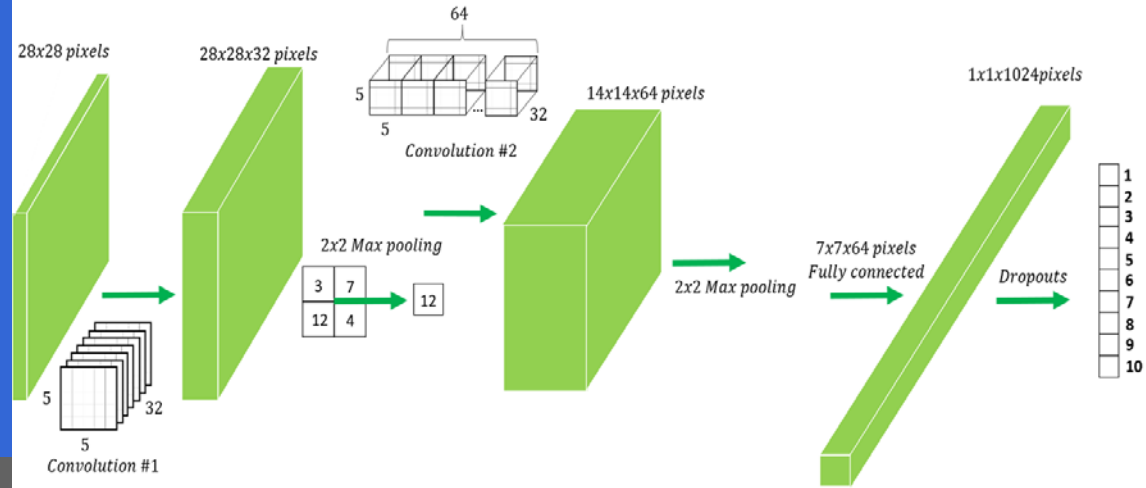


The study plan



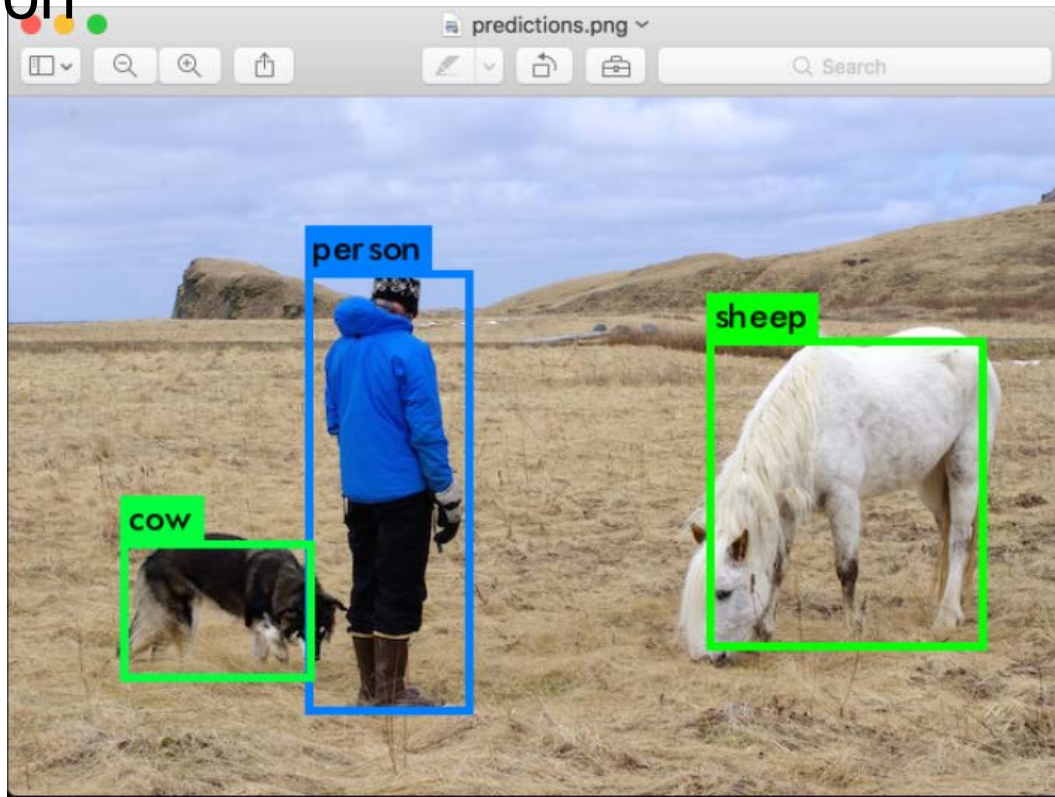
- Unit 4: What is Convolutional Neural Networks and Deep Neural Networks?

ConvNet



- Mnist Data Set
- Dropouts for overfitting problem
 - Visualization of dropouts
- Maxpooling Layer
 - Input 28x28x32
 - Output 14x14x32
- Convolution Layer2, 64 voloum filters
 - Input 14x14x32
 - Output 14x14x64

Real-Time Object Detection & Recognition

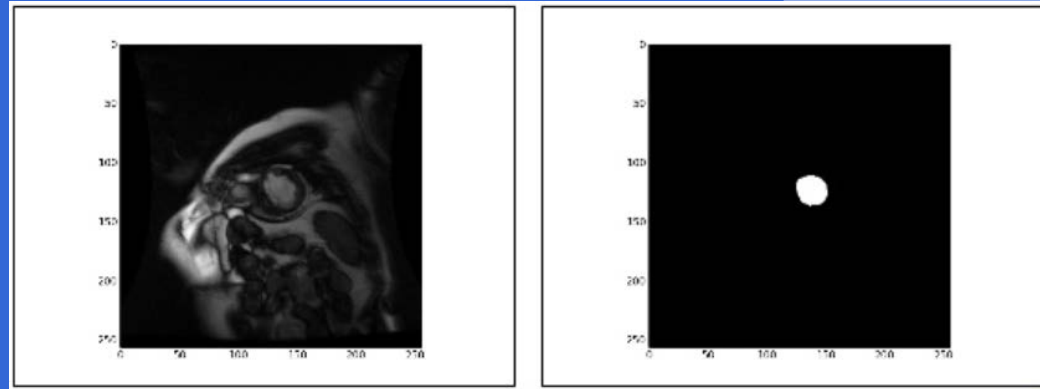


Real-Time Detection


- Real-Time Detection on a Webcam
- Running YOLO on test data isn't very interesting if you can't see the result. Instead of running it on a bunch of images let's run it on the input from a webcam!
- To run this demo you will need to compile Darknet with CUDA and OpenCV. Then run the command: `./darknet detector demo cfg/coco.data cfg/yolo.cfg yolo.weights`



The study plan



- Unit 5: What is image segmentation and how to implement a solution?
- Dice coefficient index
https://en.wikipedia.org/wiki/S%C3%B8rensen%E2%80%93Dice_coefficient


$$\text{Dice score} = \frac{\text{number of true positives}}{\text{number of positives} + \text{number of false positives}}$$

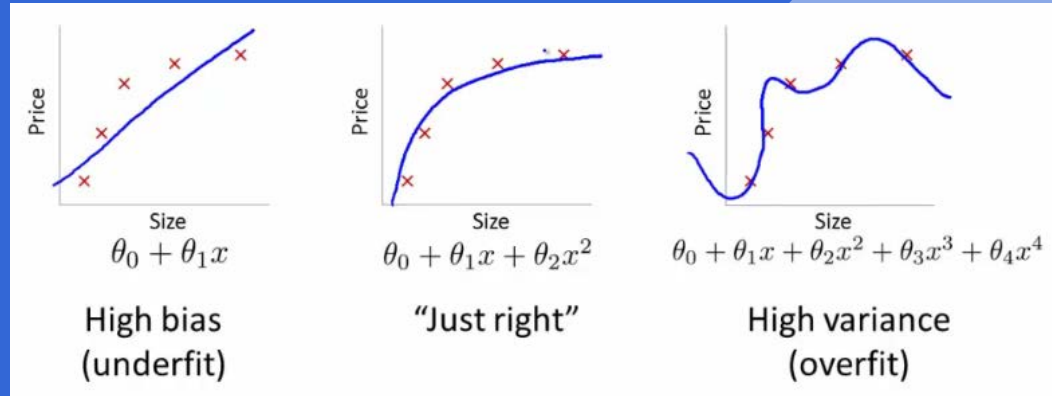
$$\text{Dice score} = \frac{|A \cap B|}{|A| + |B \setminus A|}$$

The Dice score

- The Dice score is often used to quantify the performance of image segmentation methods.
- <https://stats.stackexchange.com/questions/195006/is-the-dice-coefficient-the-same-as-accuracy>



The study plan

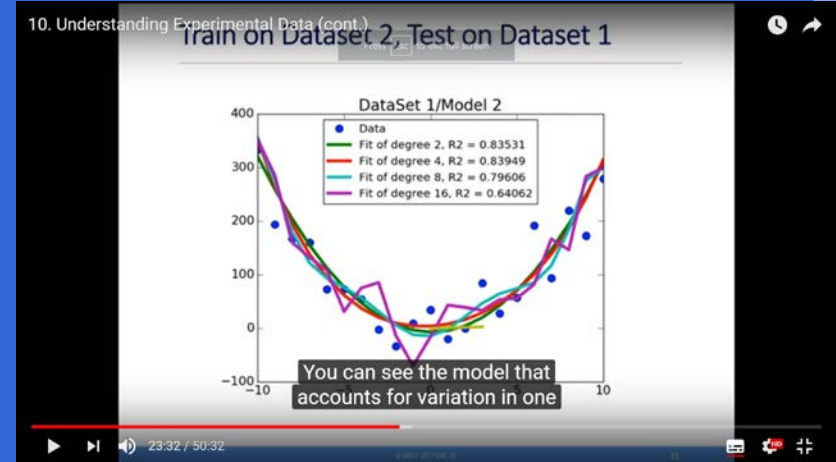


- Unit 6: How to improve Deep Neural Networks?
- mit opencourseware
- <https://youtu.be/fQvg-hh9dUw>



The study plan

- Underfit and Overfit
- mit opencourseware
- <https://youtu.be/fQvg-hh9dUw>





The study plan

- Short-Term Project Report Presentation



Major Course Assignments

- In-Class activity, assignment done in class
- Individual assignment at home
- Short-Term Project in teams



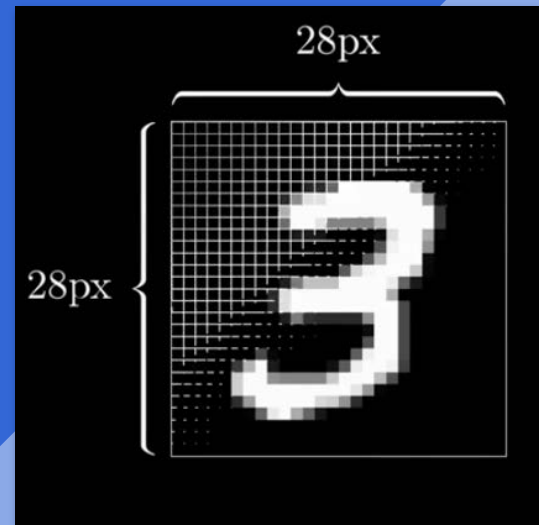
Major Course Assignments



Individual Assignment Activity of Unit 3:
Run the Lab: Image Classification with DIGITS
Individual Assignment Activity of Unit 5: (option)
Run the Lab: Medical Image Segmentation with DIGITS
<https://www.nvidia.com/en-us/deep-learning-ai/education/>



Individual Assignment Activity of Unit 3:

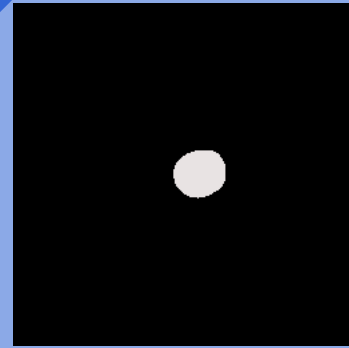
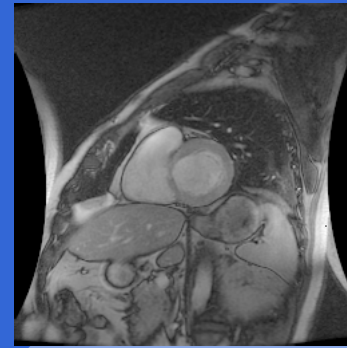


- Learn how to leverage deep neural networks (DNN) within the deep learning workflow to recognize handwritten characters using NVIDIA DIGITS™.



Individual Assignment

Activity of Unit 5: (option)

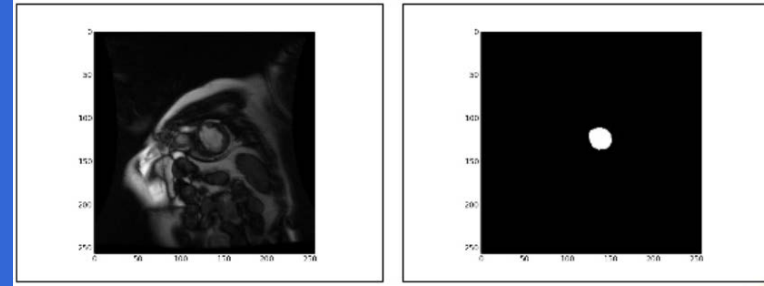


- Segment MRI images to measure parts of the heart by setting up a computer vision workflow using NVIDIA DIGITS™.

[Web site](#)



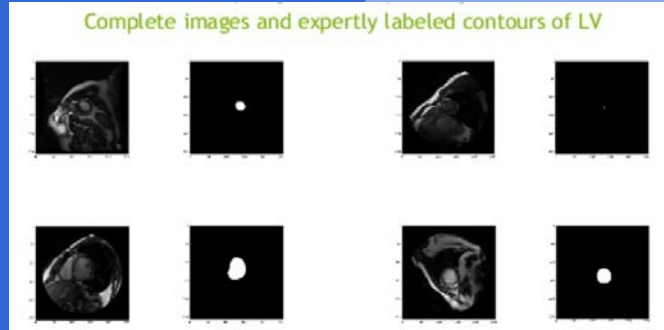
Short-Term Project in teams



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



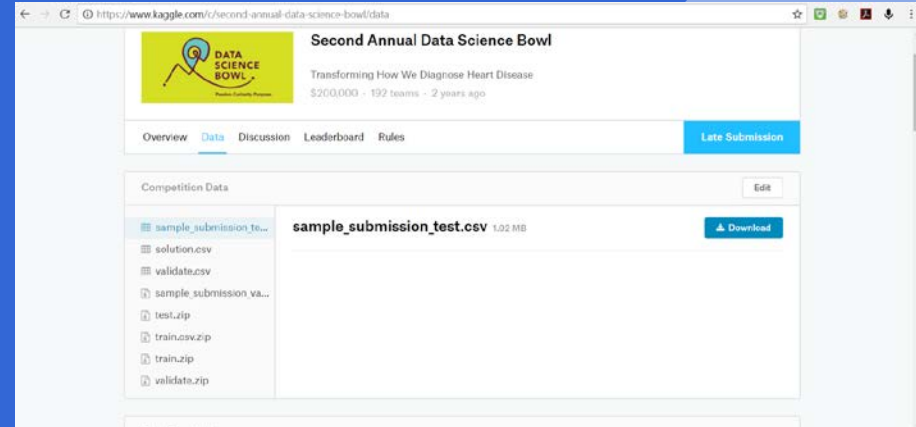
Short-Term Project in teams



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



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

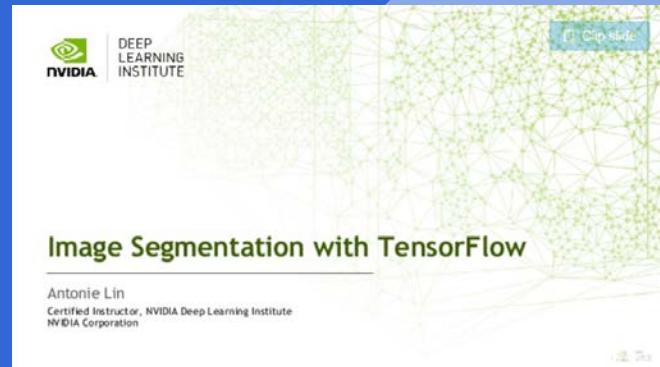
Section 2: Design a CNNs architecture for medical image segmentation.

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

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



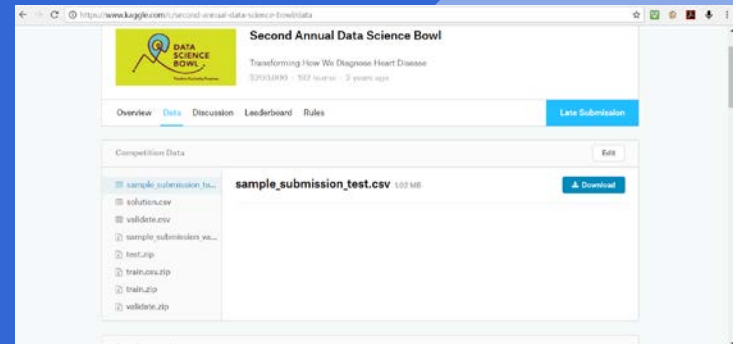
Short-Term Project Resources



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



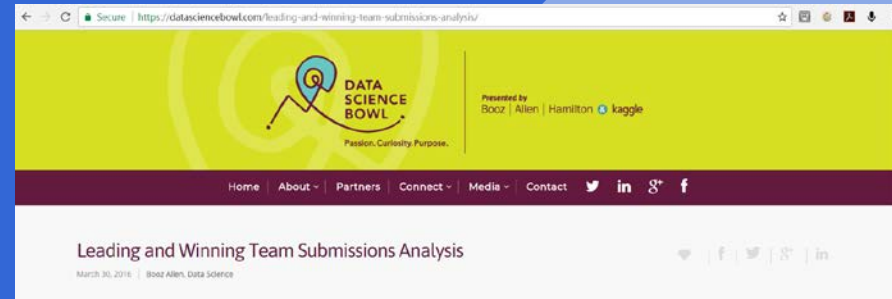
Short-Term Project Resources



- 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/>



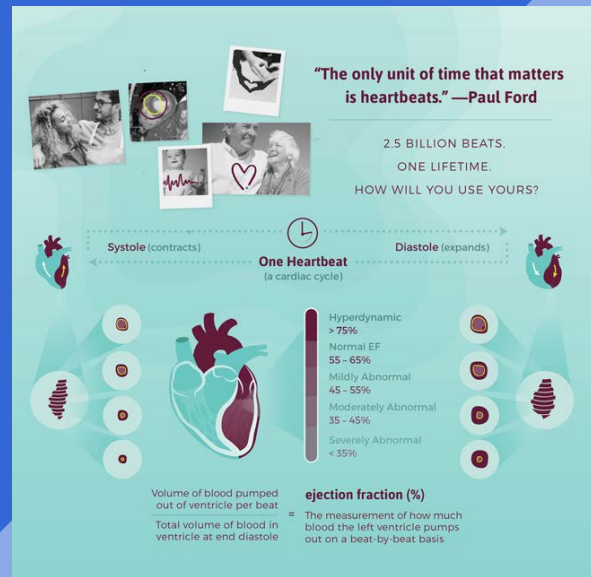
Short-Term Project Resources



- 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>



Herzlich Willkommen Welcome You

- Department of Information and Communication Engineering
- [ChaoYang University of Technology in Taichung, Taiwan](#)

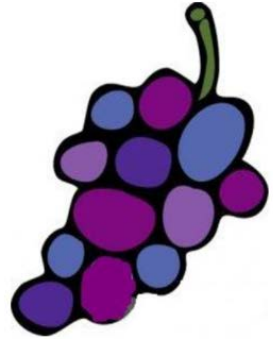




Let the course make you feel like eating Grapes!

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.