



# Deep Learning

for Image Classification and Segmentation



# Study Abroad Fair

Subject: Study Abroad Fair (Fakultät IM)

When: 11 April 2018 16:00-18:00.

Where: Foyer Fakultät IM

- Department of Information and Communication Engineering
- ChaoYang University of Technology in Taichung, Taiwan



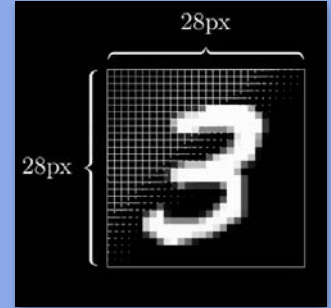
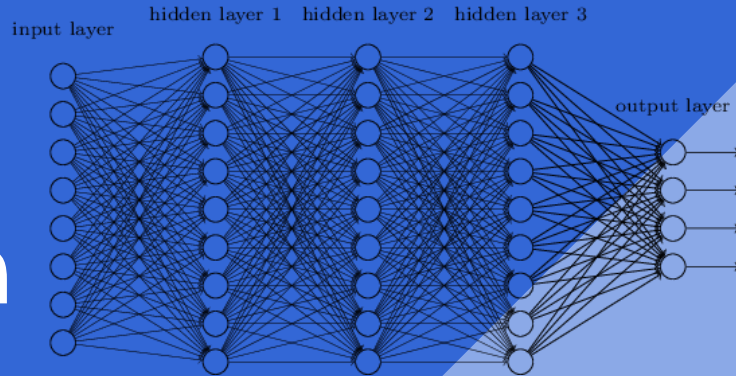


# The study plan

- 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



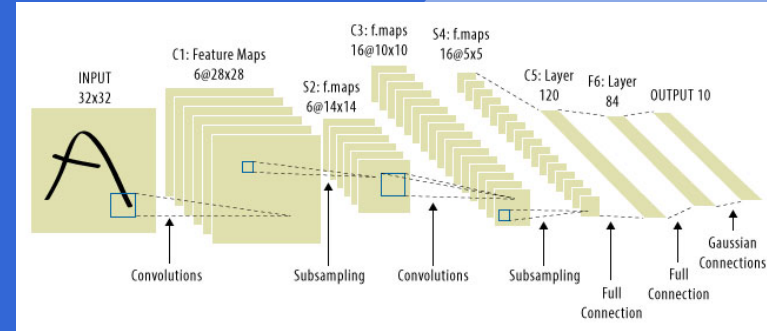
# The study plan



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



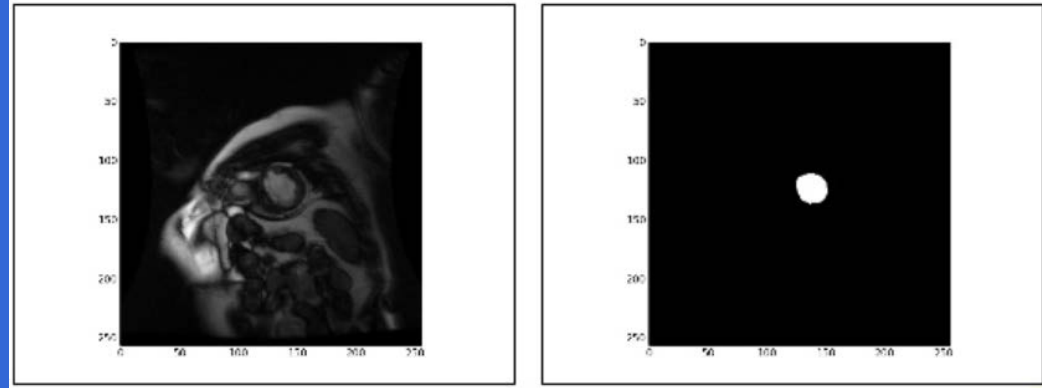
# The study plan



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



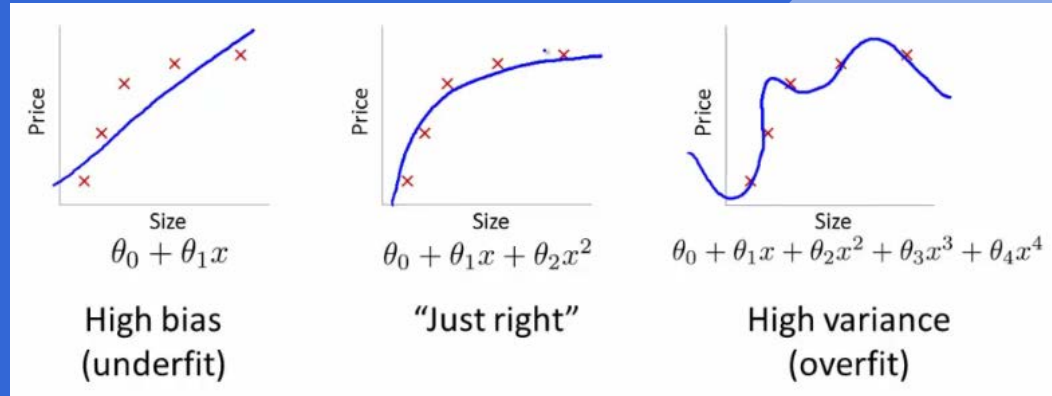
# The study plan



- Unit 5: What is image segmentation and how to implement a solution?



# The study plan



- Unit 6: How to improve Deep Neural Networks?



# The study plan

- Short-Term Project Report Presentation





# Major Course Assignments

In-Class activity, assignment done in class

Individual assignment at home

Presentation(each group 25min.) on 14<sup>th</sup> April. Saturday

About the proposal of the Short-Term Project in teams

For fairness

1. Python/Tensorflow
2. Same Data

Performance

1. Dice coefficient for each images and average of all images
2. ROC curve and Area AUC for for each images and average of all images

Reference: [https://en.wikipedia.org/wiki/S%C3%B8rensen%E2%80%93Dice\\_coefficient](https://en.wikipedia.org/wiki/S%C3%B8rensen%E2%80%93Dice_coefficient)



# Short-Term Project in teams? is a completion and results are related to the grade of your achievement.

This benchmark provides data, ground-truth and code for quantitative evaluation of left atrial segmentation algorithms. The left atrium is clinically important for the management of atrial fibrillation in patients. MRI and CT are commonly used for imaging this structure. Segmentation can be used to generate anatomical models that can be employed in guided treatment and also more recently for cardiac biophysical modelling. There are several anatomical variants and this means that segmentation of the endocardial boundary and pulmonary veins is challenging. The benchmark was launched as part the STACOM'13 workshop, in conjunction with MICCAI'13.

<http://www.cardiacatlas.org/challenges/left-atrium-segmentation-challenge/>



# Major Course Assignments

In-Class activity, assignment done in class

Individual assignment at home

Presentation on 14<sup>th</sup> April. Saturday on and Short-Term Project in teams

Kaggle challenge in the 2016 Data Science Bowl Competition.

<https://www.kaggle.com/c/data-science-bowl-2017>

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>

**Left Atrial Segmentation Challenge 2013**

<https://github.com/catactg/lasc>

<http://www.cardiacatlas.org/challenges/left-atrium-segmentation-challenge/>



# Team members for the short term project

Hello everybody,

The following GitHub repositories are related to our short term project.

A team could include people good at Platform, for example, Windows and Linux.

A team could include people good at Programming, for example, debugging.

A team could include people good at Mathematical Theory, for example, modifying model.

You maybe good at playing game and having a good equipment with NVIDIA GPU to shorten the processing time.

Please fill the Google form to know each other in our classroom for finding your team members.

<https://goo.gl/F7bFhf>

We will finalize team members on 6th April in our classroom.

Good Luck

Jerry



# Team members for the short term project

<https://github.com/jocicmarko/kaggle-dsb2-keras>

<https://github.com/NVIDIA/DIGITS/tree/master/examples/medical-imaging>

<https://github.com/yidarvin/FirstAid>

<https://github.com/vuptran/cardiac-segmentation>

<https://github.com/mshunshin/SegNetCMR>

<https://github.com/alexattia/Medical-Image-Analysis>

<https://github.com/woshialex/diagnose-heart>

<https://github.com/catactg/lasc>

<https://github.com/Ieriomaggio/deep-learning-keras-tensorflow/>



# The short-term project

Please organize your team (less than three people) for the short-term project.

Down load all data sets from the web site.

<https://www.kaggle.com/c/second-annual-data-science-bowl/data>

<http://www.cardiacatlas.org/studies/sunnybrook-cardiac-data/>

How to use the Sunny brook data? Q&A <https://www.kaggle.com/c/second-annual-data-science-bowl/discussion/18642>

Your presentation and report can refer the following documents.

Presentation

<https://www.slideshare.net/NVIDIATaiwan/nvidia-dli-image-segmentation-with-tensorflow>

[https://docs.google.com/presentation/d/10XodYojlW-1iurpUsMoAZknQMS36p7lVlFZ-Z7V\\_aY/edit#slide=id.p](https://docs.google.com/presentation/d/10XodYojlW-1iurpUsMoAZknQMS36p7lVlFZ-Z7V_aY/edit#slide=id.p)



# The short-term project

## Report

### Format:

[http://cs231n.stanford.edu/reports/2016/pdfs/323\\_Report.pdf](http://cs231n.stanford.edu/reports/2016/pdfs/323_Report.pdf)

### Contents:

[https://github.com/woshialex/diagnose-heart/blob/master/TenciaWoshialex\\_model\\_documentation.pdf](https://github.com/woshialex/diagnose-heart/blob/master/TenciaWoshialex_model_documentation.pdf)

## Github

[https://gist.github.com/ajsander/b65061d12f50de3cef5d#file-fcn\\_tutorial-ipynb](https://gist.github.com/ajsander/b65061d12f50de3cef5d#file-fcn_tutorial-ipynb)

<https://github.com/jocicmarko/kaggle-dsb2-keras/>



# Major Course Assignments

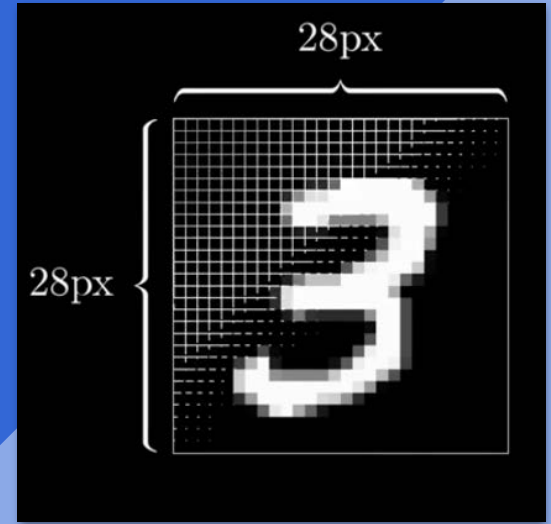


Individual Assignment Activity of Unit 3:  
Run the Lab: Image Classification with DIGITS  
Individual Assignment Activity of Unit 5: (option)  
Run the Lab: Medical Image Segmentation with DIGITS  
<https://www.nvidia.com/en-us/deep-learning-ai/education/>





# Individual Assignment Activity of Unit 3:

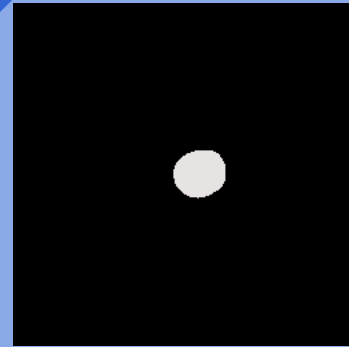
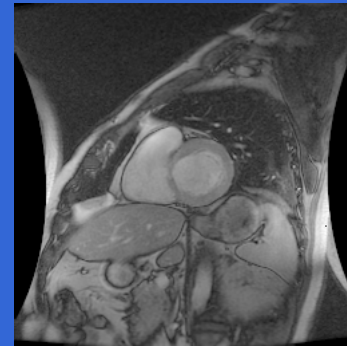


- Learn how to leverage deep neural networks (DNN) within the deep learning workflow to recognize handwritten characters using NVIDIA DIGITS™.



# Individual Assignment

## Activity of Unit 5: (option)

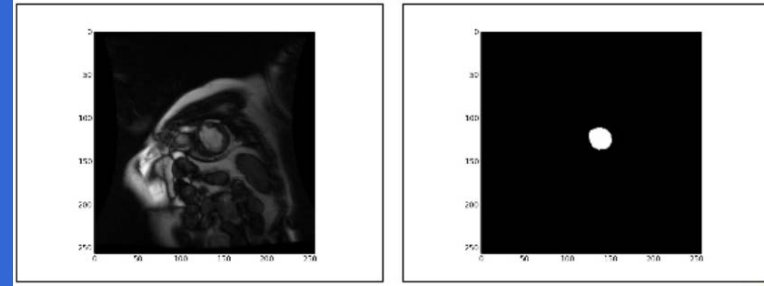


- Segment MRI images to measure parts of the heart by setting up a computer vision workflow using using NVIDIA DIGITS™.

[Web site](#)



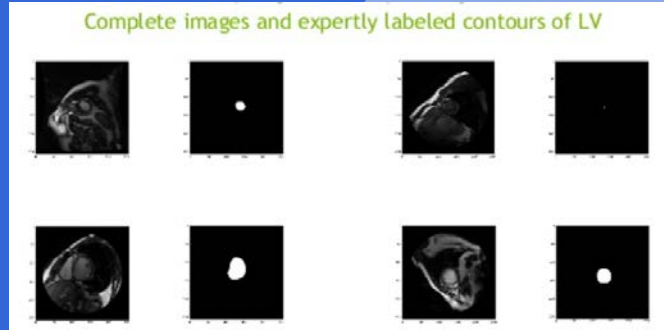
# Short-Term Project in teams



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



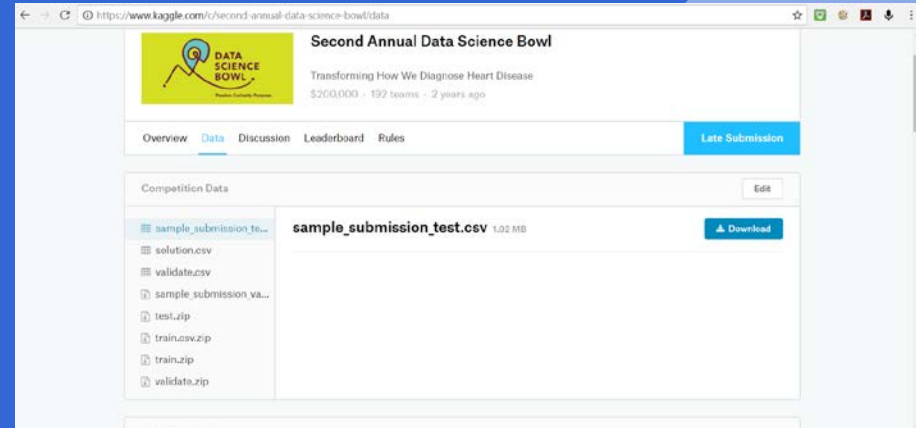
# Short-Term Project in teams



- 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

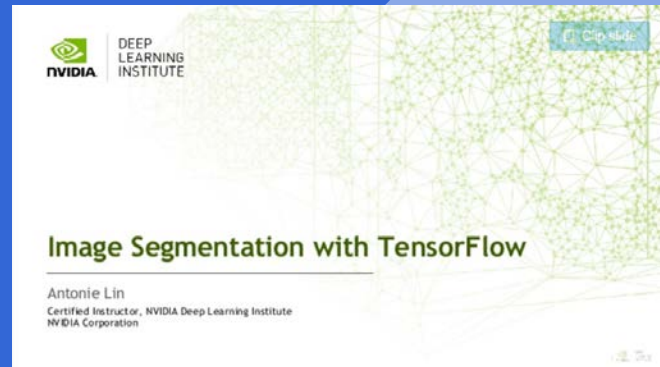
Section 2: Design a CNNs architecture for medical image segmentation.

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

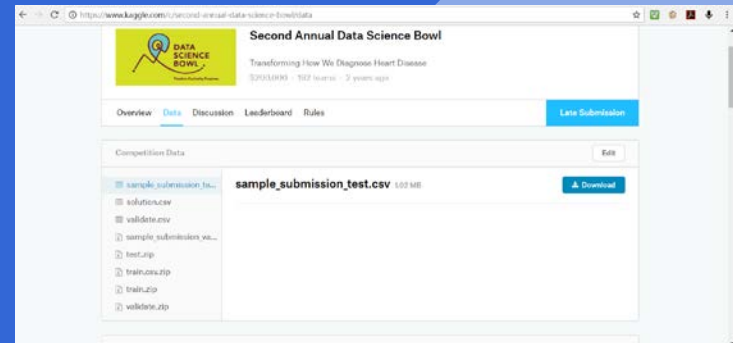


- Introduction to Image Segmentation with TensorFlow
- <https://www.slideshare.net/NVIDIATaiwan/nvidia-dli-image-segmentation-with-tensorflow>





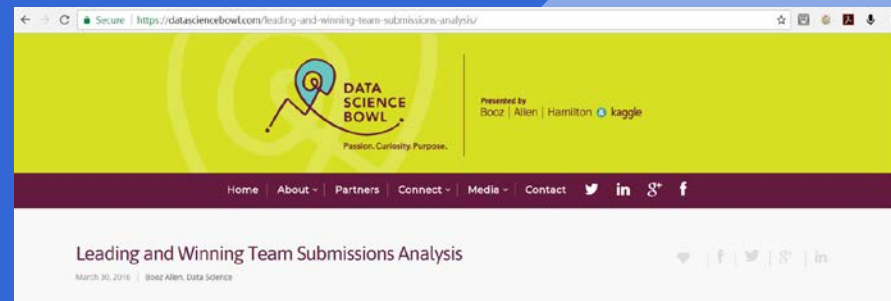
# Short-Term Project Resources



- 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/>



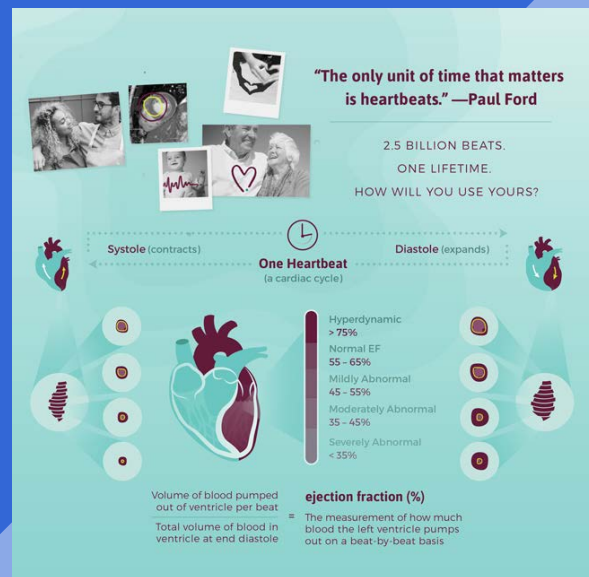
# Short-Term Project Resources



- 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

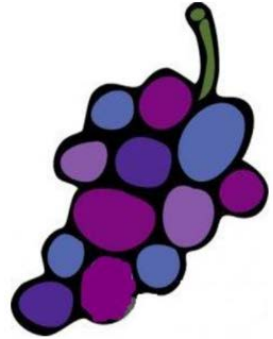
- Using DIGITS to train a medical image segmentation network
- <https://github.com/NVIDIA/DIGITS/tree/master/examples/medical-imaging>



# 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.