



Pattern Recognition Homework 5 announcement

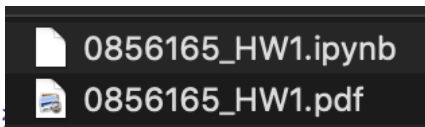
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Homework 5

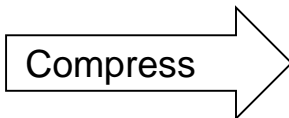
- **Deadline: June 23, Fri at 23:59.**
 1. Code assignment (100%): implement the deep neural network by any deep learning framework, e.g. Pytorch, TensorFlow and Keras, and then train DNN model by the Cifar-10 dataset
- Submit your **1) code (.py/.ipynb)** and **2) reports (.pdf)** on [E3](#)
 - [Sample Code](#)
 - [HW5 questions](#)
- Please follow the **file naming rules <STUDENT ID>_HW5.pdf**, otherwise, you will get penalty of your scores



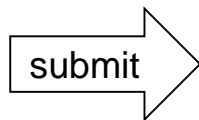
National Chiao Tung University



Compress



submit



[E3](#)

Coding

- Write beautiful Python codes with [PEP8 guidelines](#) for readability. Basic requirement: use whitespace correctly!
- [PEP8 online checker](#)

Python

Recommended

```
def function(default_parameter=5):  
    # ...
```

Not recommended

```
def function(default_parameter = 5):  
    # ...
```

PEP8 online

Check your code for PEP8 requirements

Just paste your code here

1

Check code



Reports

- Include the implementation details and hyperparameters of your model
 - <https://github.com/paperswithcode/releasing-research-code>
- Include the accuracy of your model in the reports!

DO NOT MODIFY CODE BELOW! ¶

Please screen shot your results and post it on your report

```
In [ ]: y_pred = your_model.predict(x_test)
```

```
In [14]: assert y_pred.shape == (10000,)
```

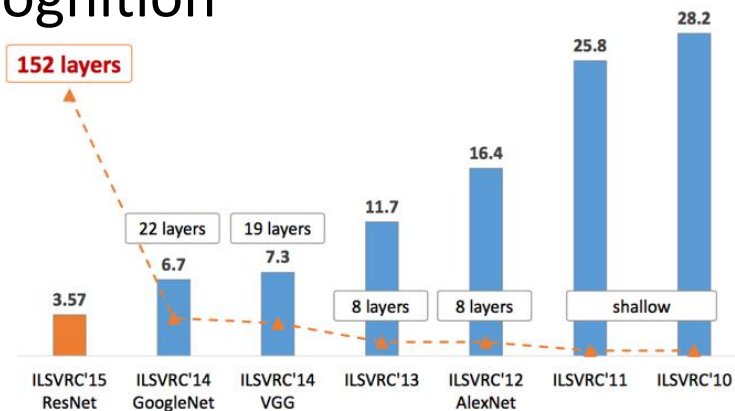
```
In [15]: y_test = np.load("y_test.npy")
          print("Accuracy of my model on test set: ", accuracy_score(y_test, y_pred))
```

Accuracy of my model on test-set: 0.6769

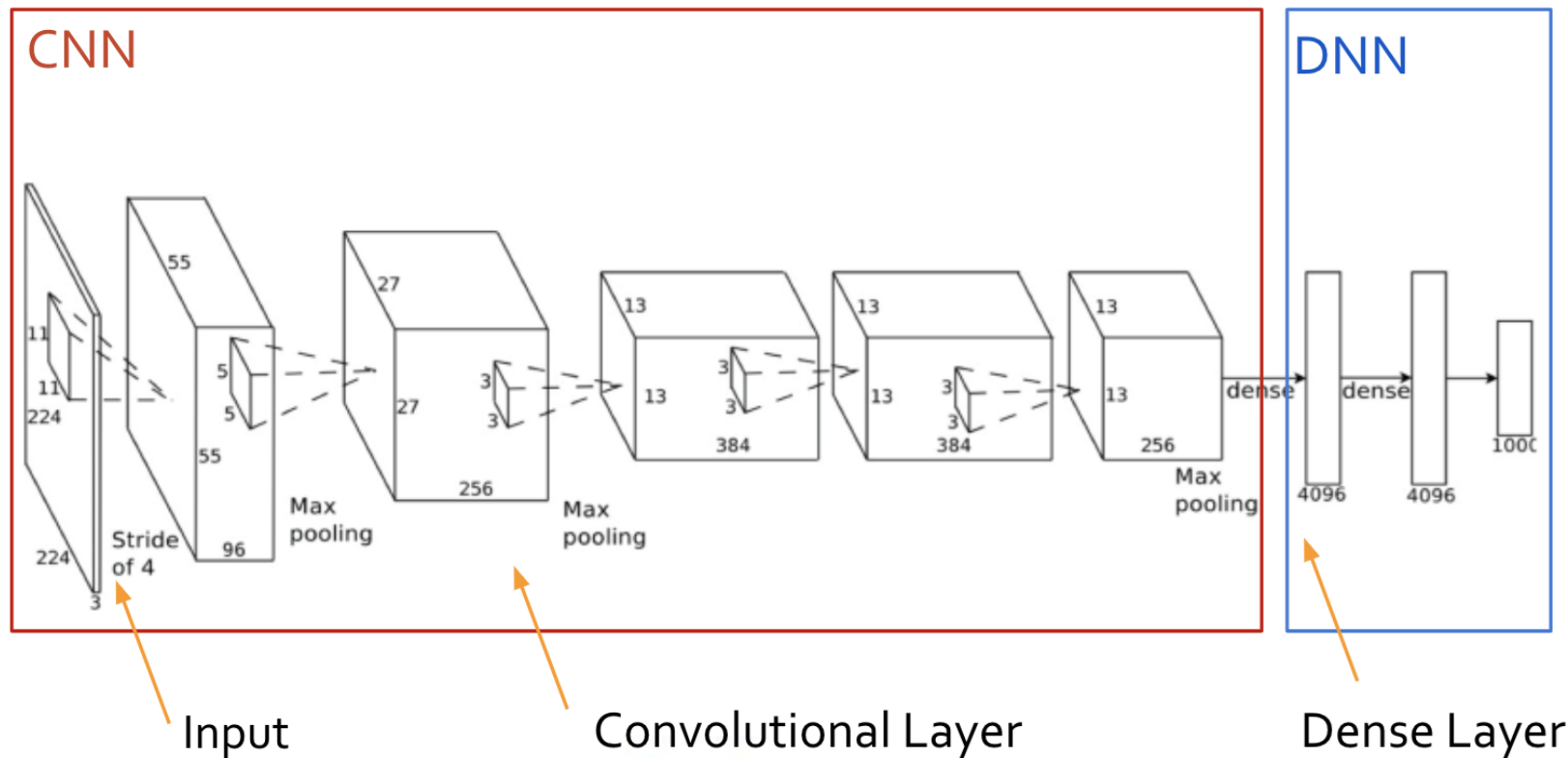


Deep neural networks

- Deep neural networks are a powerful category of machine learning algorithms implemented by stacking layers of neural network
- Convolutional neural networks (CNN), which at least one layer is a convolutional layer, have had great success in certain kinds of problems, such as image recognition

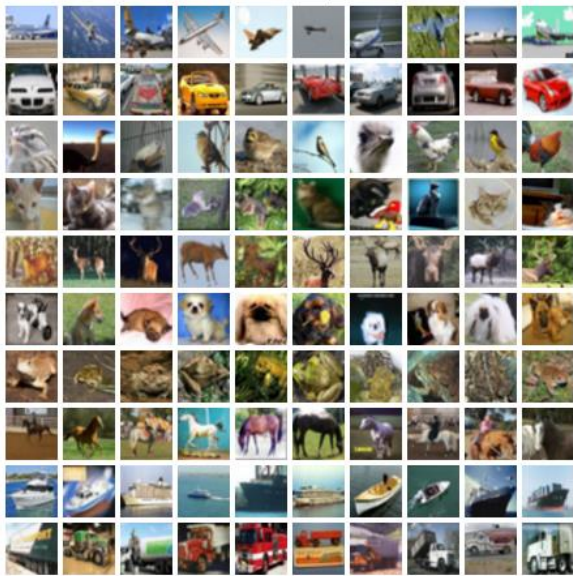


Typical struture of CNN



Cifar-10 dataset

- 60,000 (50,000 training + 10,000 testing) samples, 32x32 RGB images in 10 classes
 - airplane, automobile, ship, truck, bird, cat, deer, dog, frog, horse



Leaderboard of CIFAR-10

- **Baseline: accuracy over 70%**
- Note that you should only train and evaluate your model on the [provided dataset HERE](#)
- **DO NOT** download the data from other resources.

CIFAR-10

who is the best in CIFAR-10 ?



CIFAR-10 49 results collected

Units: accuracy %




Classify 32x32 colour images.

Result	Method	Venue	Details
96.53%	Fractional Max-Pooling	arXiv 2015	Details
95.59%	Striving for Simplicity: The All Convolutional Net	ICLR 2015	Details
94.16%	All you need is a good init	ICLR 2016	Details
94%	Lessons learned from manually classifying CIFAR-10	unpublished 2011	Details
93.95%	Generalizing Pooling Functions in Convolutional Neural Networks: Mixed, Gated, and Tree	AISTATS 2016	Details
93.72%	Spatially-sparse convolutional neural networks	arXiv 2014	
93.63%	Scalable Bayesian Optimization Using Deep Neural Networks	ICML 2015	
93.57%	Deep Residual Learning for Image Recognition	arXiv 2015	Details
93.45%	Fast and Accurate Deep Network Learning by Exponential Linear Units	arXiv 2015	Details
93.34%	Universum Prescription: Regularization using Unlabeled Data	arXiv 2015	
93.25%	Batch-normalized Maxout Network in Network	arXiv 2015	Details
93.13%	Competitive Multi-scale Convolution	arXiv 2015	
92.91%	Recurrent Convolutional Neural Network for Object Recognition	CVPR 2015	Details
92.49%	Learning Activation Functions to Improve Deep Neural Networks	ICLR 2015	Details
92.45%	cifar.torch	unpublished 2015	Details



Deep learning framework

- If you are a newbie in a deep learning framework, we recommend you learn Keras or Pytorch.
 - Keras: Only Few lines of code to build a CNN model
 - TensorFlow: Easy for depolyment
 - Pytorch: Flexible for research

	Keras 	TensorFlow 	PyTorch 
Level of API	high-level API ¹	Both high & low level APIs	Lower-level API ²
Speed	Slow	High	High
Architecture	Simple, more readable and concise	Not very easy to use	Complex ³
Debugging	No need to debug	Difficult to debugging	Good debugging capabilities
Dataset Compatibility	Slow & Small	Fast speed & large	Fast speed & large datasets
Popularity Rank	1	2	3
Uniqueness	Multiple back-end support	Object Detection Functionality	Flexibility & Short Training Duration
Created By	Not a library on its own	Created by Google	Created by Facebook ⁴
Ease of use	User-friendly	Incomprehensive API	Integrated with Python language
Computational graphs used	Static graphs	Static graphs	Dynamic computation graphs ⁵



Keyword for boosting your performance

- Beat the baseline
 - CNN structure (number of filters, number of CNN layers,...)
 - Data augmentation
 - Regularization
- Score over 90%!
 - Read some paper from [leaderboard of Cifar-10](#)



Accelerate your training by GPU

- You may need GPU to accelerate the training of deep neural network. We provide several free GPU resources for you, some of resources need registration and limited by usage.
 - [Google Colab](#): Free GPU usage for continuous 24 hours
 - [FloydHub](#): Registration for free GPU trials
 - [Microsoft Azure](#): Registration for free GPU trials



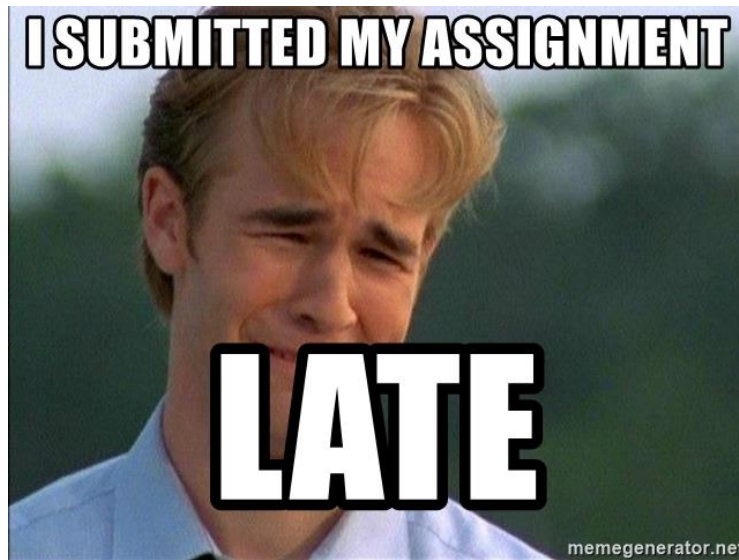
Reference

- [Convolutional Neural Networks Tutorial in PyTorch](#)
- [Building a Convolutional Neural Network \(CNN\) in Keras](#)



Late Policy

- We will deduct a late penalty of 20 points per additional late day
- For example, If you get 90 points of this HW but delay for **two days**, your will get only $90 - (20 \times 2) = 50$ points!



Notice

- Submit your homework on [E3-system](#) !
- Check your email regularly, we will mail you if there are any updates or problems of the homework
- If you have any questions or comments for the homework, please mail TAs and cc Prof. Lin
 - Prof. Lin, lin@cs.nctu.edu.tw
 - TA Jimmy, d08922002@csie.ntu.edu.tw
 - TA 柏聲, bensonliu0904@gmail.com
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Have fun!

