INTRODUCTION TO DEEP LEARNING

Course number: 00240332

Course Arrangement

Xiaolin Hu (胡晓林)

Dept. of Computer Science and Technology

Tsinghua University

Instructor and teaching assistant

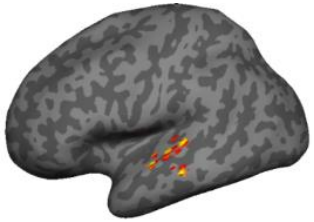
胡晓林

- Tel: 62799932
- Office: FIT 1-508
- Email: xlhu@tsinghua.edu.cn
- Homepage: www.xlhu.cn

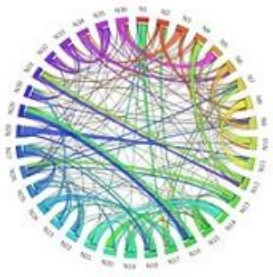
陈果

- Office: FIT 1-508
- Email: cg22@mails.tsinghua.edu.cn

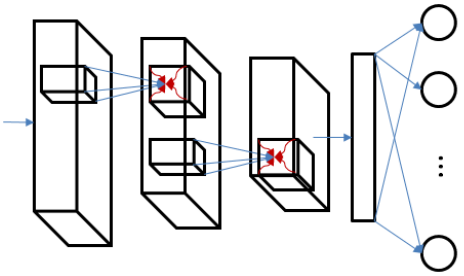
Research interests



Zhang et al., 2016

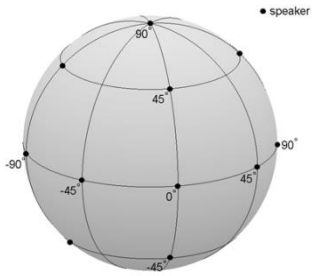


Hu, Zeng, 2021



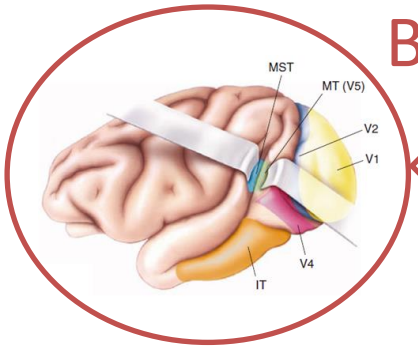
Liang et al., 2015

Liu et al., 2018

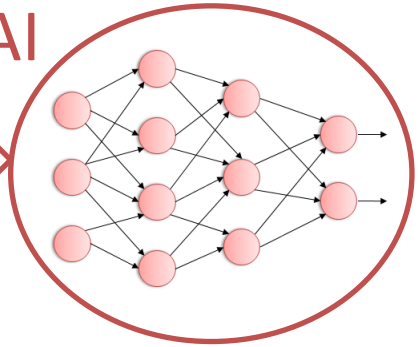


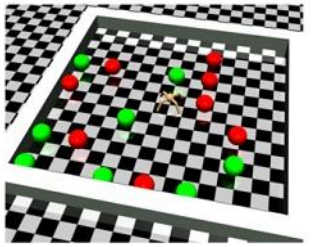
Zhang et al., 2015

BI

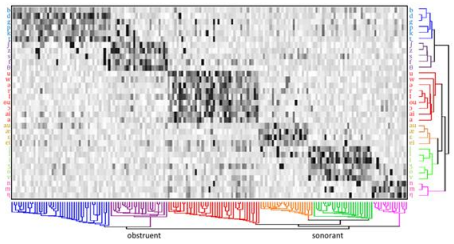


AI

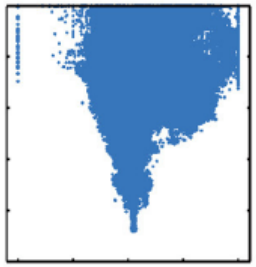




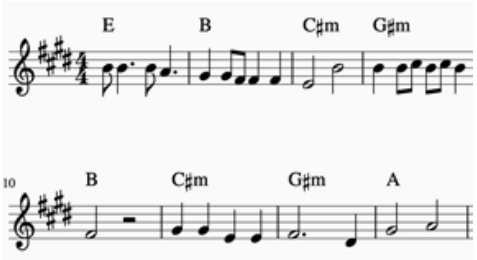
Zhang et al., 2020



Zhang et al., 2019



Zhuang et al., 2017



Wu et al., 2020

Zhang et al., 2021

Goals of the course

- Master basic knowledge and skills in deep learning
- After this course, you should be able to
  - Construct basic DL models for solving various science and engineering problems
  - Understand the cutting edge research papers easily
- You are encouraged to make your own contributions to the DL society or other research society with DL

投票

最多可选1项

设置

你是几年级学生?

A 大一

B 大二

C 大三

D 大四

提交

投票 最多可选4项

设置

你为什么选这门课?

A 凑2个学分

B 拉高GPA

C 大致了解一下深度学习

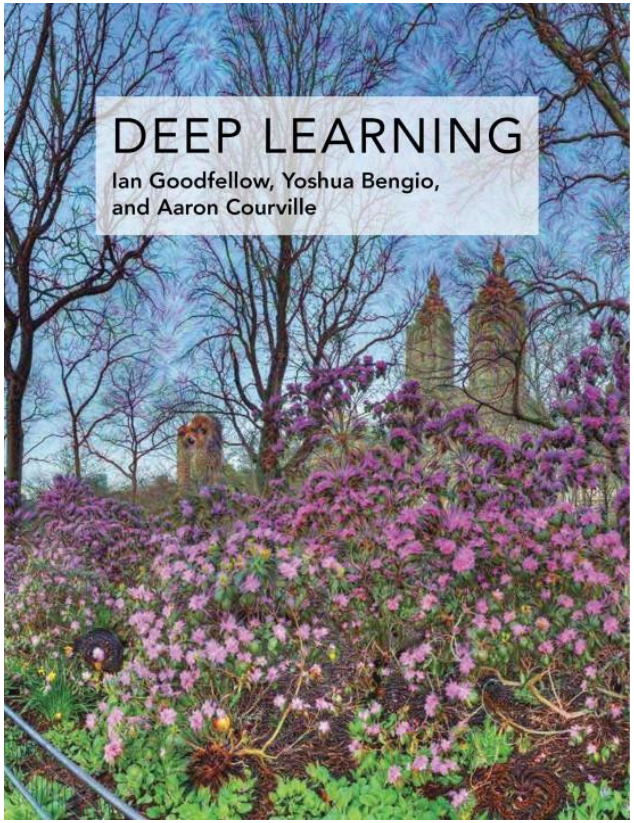
D 打好基础，将来可能从事相关工作

提交

Prerequisites

- Good English reading ability
- Basic knowledge about calculus, linear algebra, statistics
- Basic skills about Python, or willing to learn

Reference book



Deep Learning
Ian Goodfellow, Yoshua Bengio and Aaron Courville
The MIT Press, 2018

https://github.com/janishar/mit-deep-learning-book-pdf

Only Part I will be taught in class. Other contents do not follow this book.

Recommended reading

1. Before every lecture, I'll upload the modified PPT to Web Learning for reading
2. Usually, after every lecture, I'll recommend one or two research papers for reading
   - Sometimes you are required to do a presentation in the next class

Schedule

No.	Content	Date
1	Introduction	9.18
2	Math and ML basics Python tutorial by TA (optional)	9.25(hwX1: python)
3	Regression and classification	10.9(hw1: softmax)
4	Multilayer Perceptron	10.16(hwX2: MLP)
5	Convolutional neural networks Pytorch tutorial by TA (optional)	10.23(hw2: pytorch)
6	Training techniques Huawei Ascend & Mindspore	10.30(hwX3: Mindspore)
7	Typical CNNs Jittor tutorial by TA (optional)	11.6(hw3: MLP&CNN)

Schedule

No.	Content	Date
8	Applications of CNN in computer vision	11.13(hwX4: medical)
9	Recurrent neural networks	11.20(Project proposal)
10	Word representation	11.27
11	Sentence processing	12.4(hw4: sentence)
12	Frontiers in DL (by guest lecturer)	12.11
13	Transformer	12.18
14	Generative adversarial networks	12.25
15	Project presentation	TDB

Homework & projects

- HwX1: Python basics
- Hw1 (10): Softmax for MNIST classification
- HwX2: MLP for MNIST classification
- Hw2 (10): Pytorch basics
- HwX3: Mindspore basics
- Hw3 (10): MLP&CNN for MNIST
- HwX4: Medical image segmentation
- Hw4 (10): Sentence classification
- Project: choose your own topic

Python

Pytorch/
Jittor/
Mindspore

Huawei will provide free GPU resource for us

与某学堂在线课程的作业比较

- 实验一-Softmax实现手写数字识别 → Hw1
- 案例二-构建自己的多层感知机MNIST手写数字识别 → HwX2
- 实验三-PyTorch实战 CIFAR图像分类 → Hw3
- 实验四-脑部MRI图像分割 → HwX4
- 实验五-滴滴出行-交通场景目标检测
- 案例六-图像自然语言描述生成
- 实验七-图像超分辨率重建

Grading

- Homework (40%)
- Project (60%)
  - Proposal (5%)
  - Presentation (10%)
  - Report (45%)

1. You can use either Chinese or English for assignments and projects
2. HwX3 and project: a group consists of 2-3 members and the members in the same group get the same grade

- Rainclassroom Quizzes (4% extra credit)
  - Scores for every test: 4/N where N denotes the number of quizzes

只按答题正确率算分，不计考勤

Final score： min(100, 100+extra credit)

Late policy & plagiarism

- We will deduct a late penalty of 10% per late day
  - If your score for a homework is s, for N late days, your score is $s * 0.9\text{^}N$
  - For more than 7 late days, your score will be zero

- People who plagiarize in any part of a homework and people who are copied, will both get zero score in that homework

Q&A

- 课程微信群

群聊：深度学习导论 - 2023秋

该二维码7天内(9月25日前)有效，重新进入将更新

- 网络学堂（Web Learning）
  - 课程答疑
- 开放交流
  - Monday, 08:30-09:30
  - Appointment

Selected projects in previous course

Convolution Neural Networks With Two Pathways for Image Style Recognition

Tiancheng Sun, Yulong Wang, Jian Yang, and Xiaolin Hu, *Senior Member, IEEE*

***Abstract*— Automatic recognition of an image's style is important for many applications, including artwork analysis, photo organization, and image retrieval. Traditional convolution neural network (CNN) approach uses only object features for image style recognition. This approach may not be optimal, because the same object in two images may have different styles. We propose a CNN architecture with two pathways extracting object features and texture features, respectively. The object pathway represents the standard CNN architecture and the texture pathway intermixes the object pathway by outputting the gram matrices of intermediate features in the object pathway. The two pathways are jointly trained. In experiments, two deep CNNs, AlexNet and VGG-19, pretrained on the ImageNet classification data set are fine-tuned for this task. For any model, the two-pathway architecture performs much better than individual pathways, which indicates that the two pathways contain complementary information of an image's style. In particular, the model based on VGG-19 achieves the state-of-the-art results on three benchmark data sets, WikiPaintings, Flickr Style, and AVA Style.**

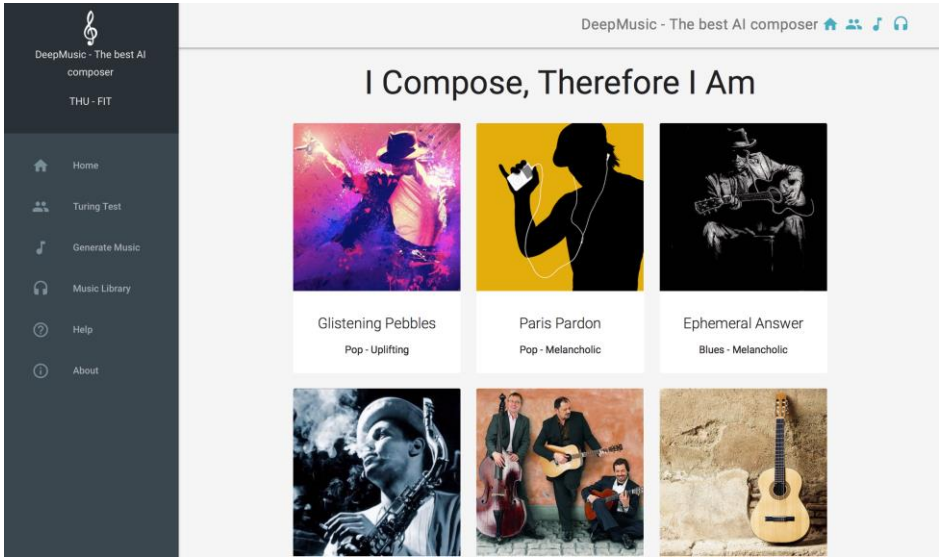
***Index Terms*— Image style recognition, neural network.**

I. Introduction

THE style in a painting or photograph plays a significant role in people's perception of the image. Take Figure 1 as an example: the lower picture conveys a nostalgia feeling compared to the upper one, notwithstanding the same scene depicted in the pictures. Human beings can sense this subtle difference easily, but it is still a difficult task for computers. In this study, our focus is to design an efficient algorithm to recognize the style of an image

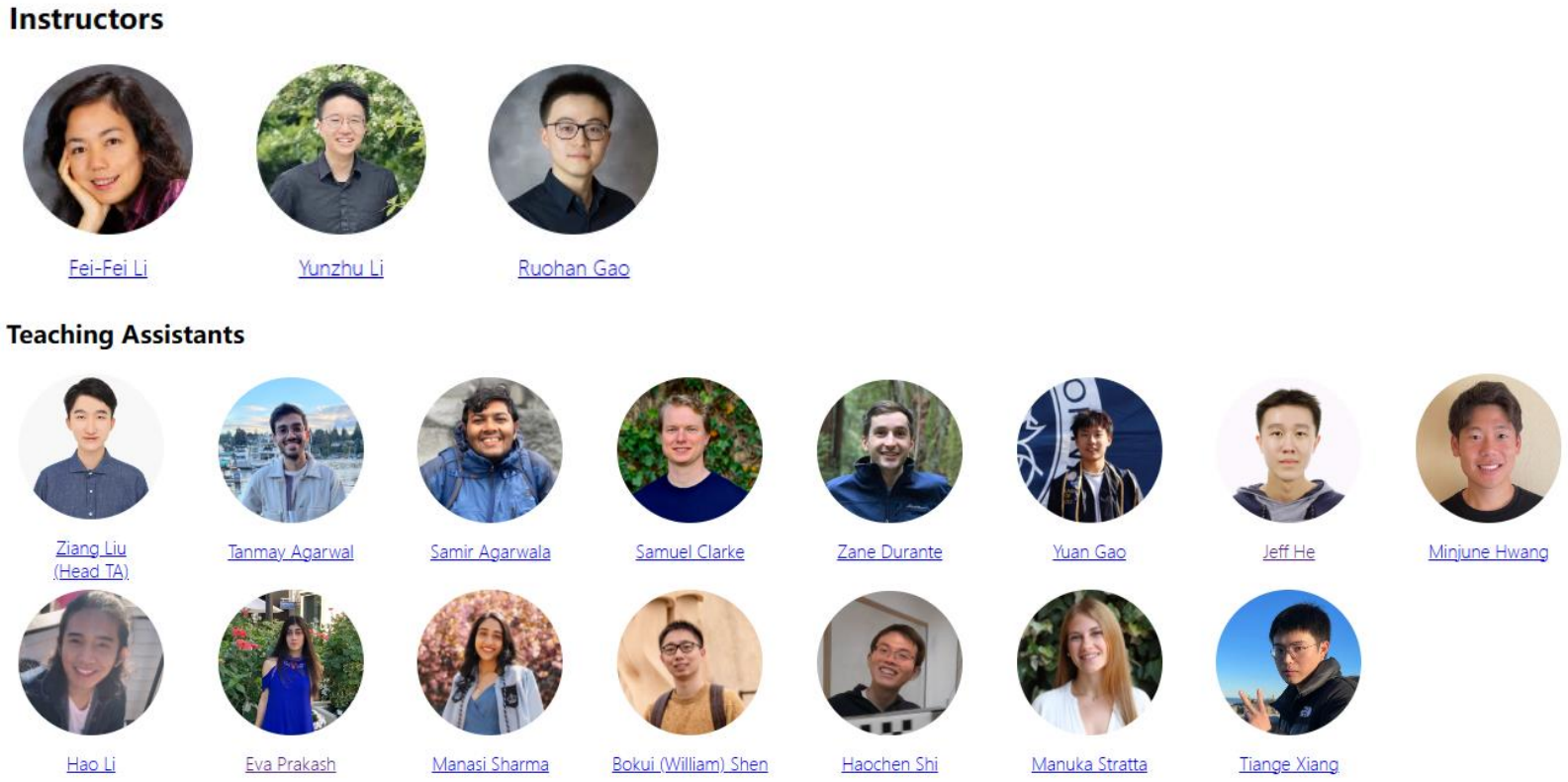
Fig. 1. Two images with similar content but different styles.

Selected projects in previous course



Related Courses on Internet

- Stanford CS231n: Convolutional Neural Networks for Visual Recognition



Related Courses on Internet

- Coursera Deep Learning