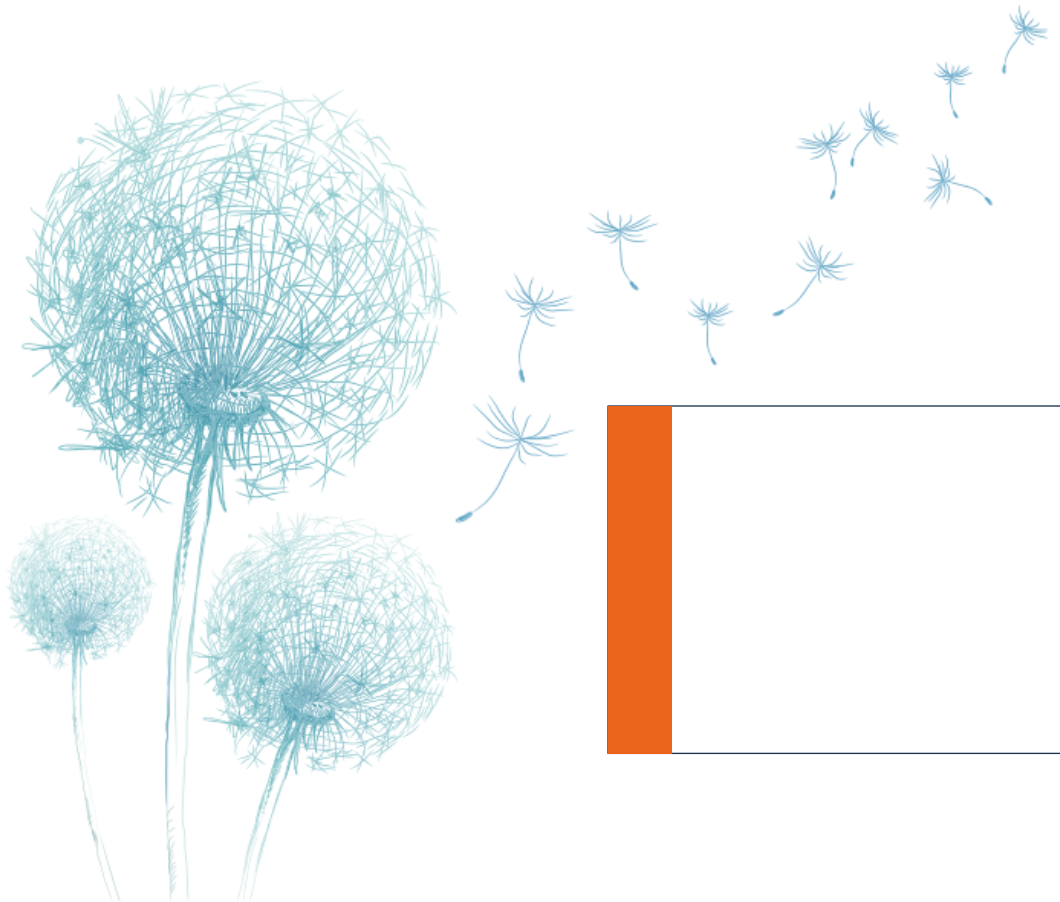
Neural networks and deep learning



Overview

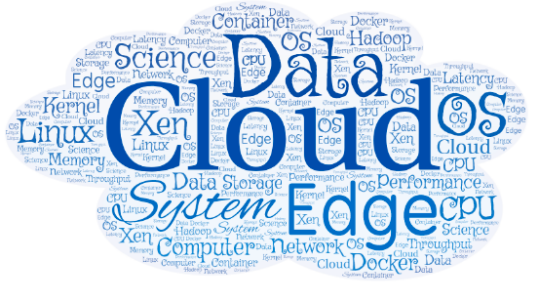
Kun Suo
Computer Science, Kennesaw State University
https://kevinsuo.github.io/

Self Introduction

- ## Kun Suo, Ph.D.
  - Homepage, https://kevinsuo.github.io/

- ## Research interests:
  - Cloud computing and virtualization;
  - Operating systems, containers and kubernetes;
  - Software defined network (SDN) and network function virtualization (NFV)
  - Big data systems and machine learning systems

- ## Projects you may be interested in:
  - Several projects in Cloud & Data & Edge
  - https://kevinsuo.github.io/code-lab.html



Now it's your turn

- Name, program/year, where from
- Your interests in Computer Science
- What do you expect in the Neural networks and deep learning?

https://www2.eecs.berkeley.edu/Research/Areas/CS/

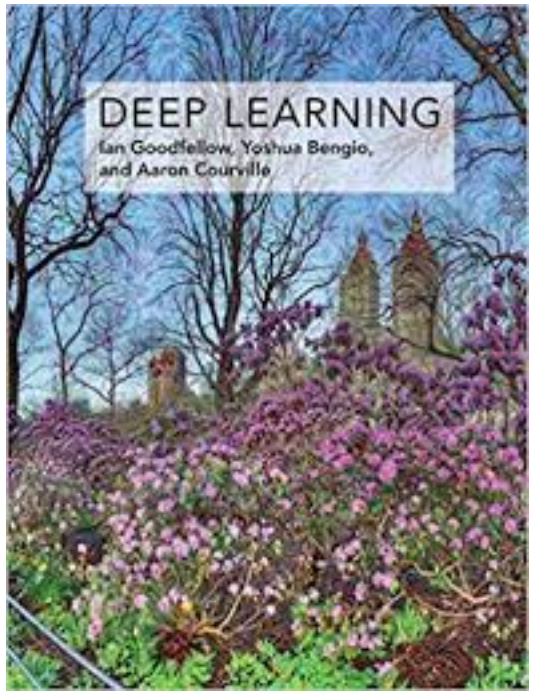
If you are in the online course, introduce yourself in D2L,
Discussions → Self-Introduction

Course Information

- Instructor: Dr. Kun Suo
- Office: J-318
- Email: ksuo@kennesaw.edu
  - Only reply to e-mails that are sent from KSU student email accounts and title the course number [CS7357]
- Office Hours:
  - T/Th, 2pm-3pm
  - By appointment
- Course Materials
  - Homework assignments, lecture slides, and other materials will be posted in the webpage (https://kevinsuo.github.io/teaching/2021Spring/7357/class.html) and D2L.

Reference Book

- Deep Learning (Adaptive Computation and Machine Learning series) :
  - Ian Goodfellow
  - The MIT Press, 2016
  - ISBN-13: 978-0262035613



Prerequisites

- Computer basics that are supposed to covered in *CS 5040 - Data Structures & Algorithms or equivalent*

- Python programming (code reading, development and debugging). (Famous projects in python: https://hackernoon.com/50-popular-python-open-source-projects-on-github-in-2018-c750f9bf56a0)

- Linux command line environment (debugging, simple shell programming).

For Python and Linux beginners

- Python tutorial
  - https://docs.python.org/3/tutorial/
  - https://www.w3schools.com/python/
  - https://www.tutorialspoint.com/python/index.htm
  - https://www.learnpython.org/

- Linux tutorial
  - https://ryanstutorials.net/linuxtutorial/
  - http://www.ee.surrey.ac.uk/Teaching/Unix/
  - https://www.tutorialspoint.com/unix/

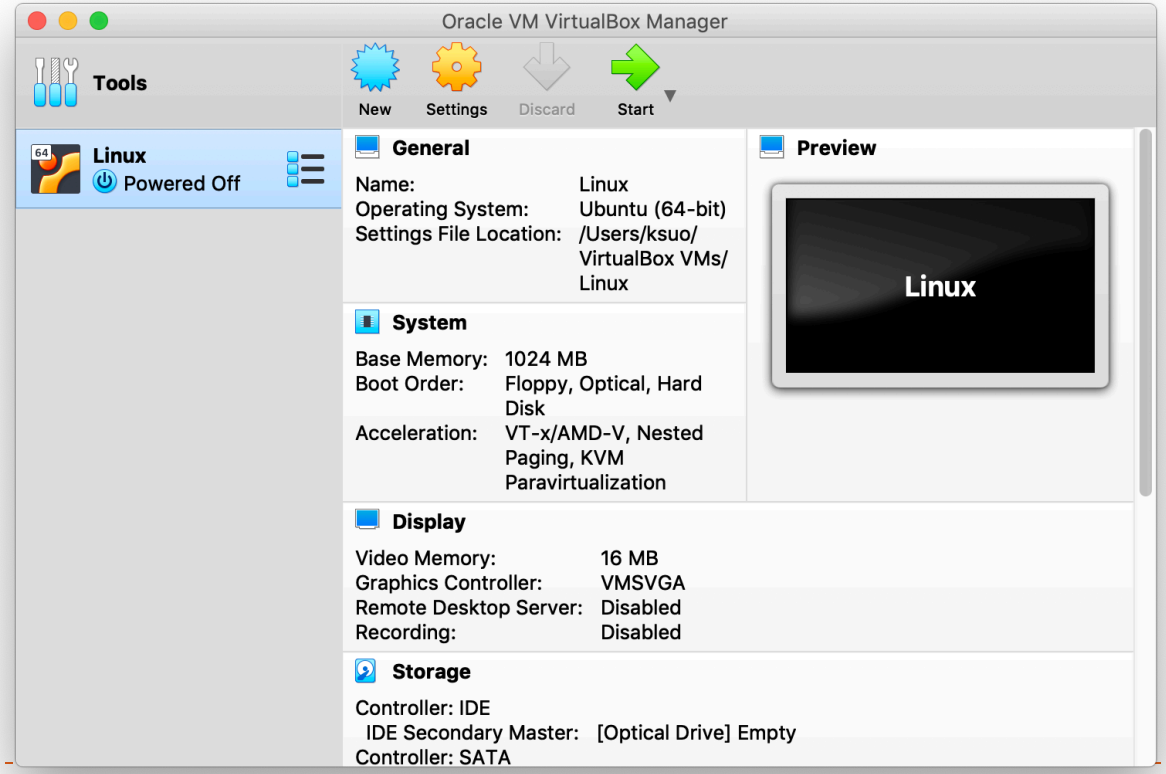
Project Environment

- Recommend project environment
  - VirtualBox + Ubuntu + Linux + Python

Virtual machine VM OS VM OS Kernel

https://www.virtualbox.org/

https://ubuntu.com/download/desktop



Project Environment

- Recommend project environment
  - VirtualBox + Ubuntu + Linux + Python

https://www.virtualbox.org/

https://ubuntu.com/download/desktop

- New to VirtualBox?
  - https://oracle-base.com/articles/vm/virtualbox-creating-a-new-vm
  - https://www.youtube.com/watch?v=sB_5fqiysi4

Project Environment

- If you like
  - Windows / Mac + Python

Course Structure

- Lectures
  - M/W 8:00 PM – 9:15 PM
  - Online
- Paper presentation
  - Second half term
- Projects
  - 3 programming assignments
- Exams (open books)
  - 3X : online, TBA.

Course Policy

- Grading scale

Percentage	Grade
90 - 100	A
80 - 89	B
70 - 79	C
60 - 69	D
Below 60	F

Grading Policy (cont.)

- Grading percentage
  - In-class discussion, attendance & paper presentation: 10%
  - Projects (x3): 30%
  - Exam 1: 20%
  - Exam 2: 20%
  - Final exam: 20%

Late submission policy: late submission will **not be accepted** and **no credits**

Academic Integrity

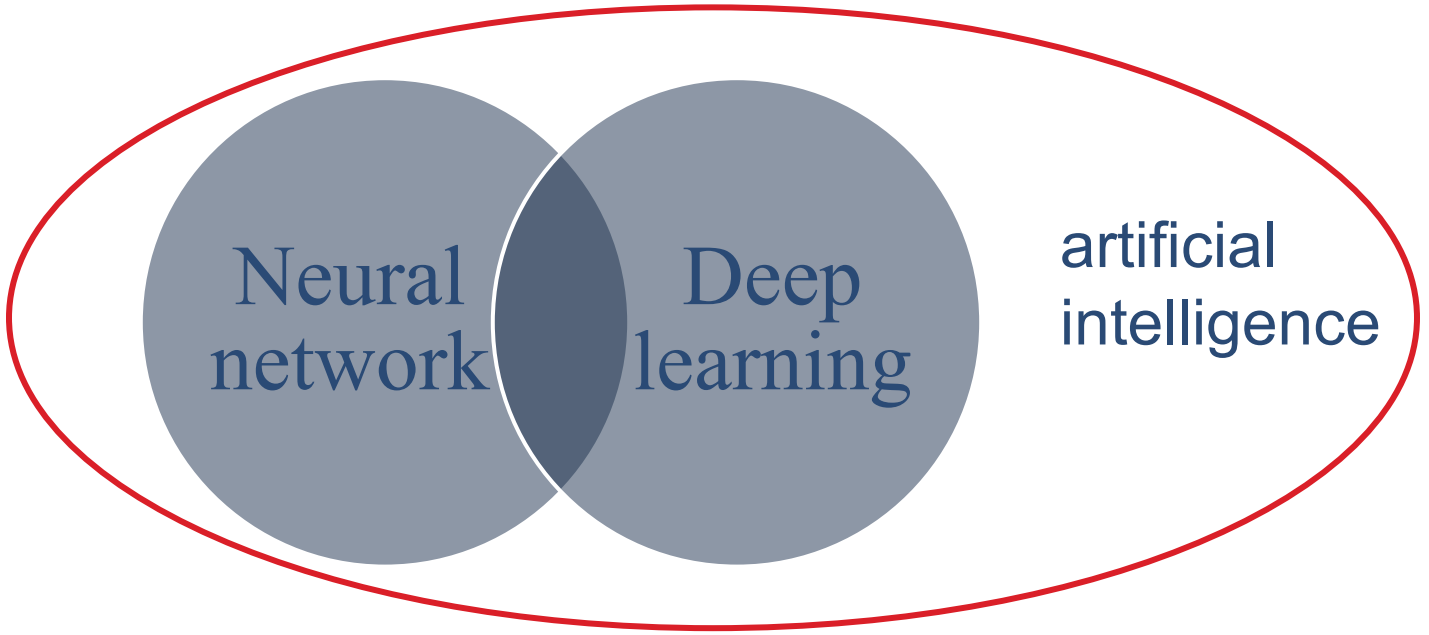
- Academic dishonesty
  - Cheating
  - Plagiarism
  - Collusion
  - The submission for credit of any work or materials that are attributable in whole or in part to another person
  - Taking an examination for another person
  - Any act designed to give unfair advantage to a student or the attempt to commit

Where to go for help ?

- Ask questions in class
- Ask questions outside class
  - Classmates and friends
- Attend office hours
  - Dr. Kun Suo: Tuesday/Thursday 2:00PM – 3:00PM, J-318
- Search on the web
  - Stand on the shoulder of giants

About this lecture

- A subfield of artificial intelligence
  - Neural network: a model with (artificial) neurons as the basic unit
  - Deep learning: a type of machine learning problem that mainly solves the problem of contribution allocation.



Prerequisite knowledge

- Linear algebra
- Calculus
- Mathematical optimization
- Probability theory
- Information theory

Recommended online courses

- CS224n: Deep Learning for Natural Language Processing
  - https://web.stanford.edu/class/archive/cs/cs224n/cs224n.1194/
  - Chris Manning, mainly explain various deep learning models in the field of natural language processing
- CS231n: Convolutional Neural Networks for Visual Recognition
  - http://cs231n.stanford.edu/
  - Fei-Fei Li and Rej Karpathy, mainly explain the application of CNN and RNN in the image field
- CS 294: Deep Reinforcement Learning
  - http://rail.eecs.berkeley.edu/deeprlcourse/

Recommended top conferences

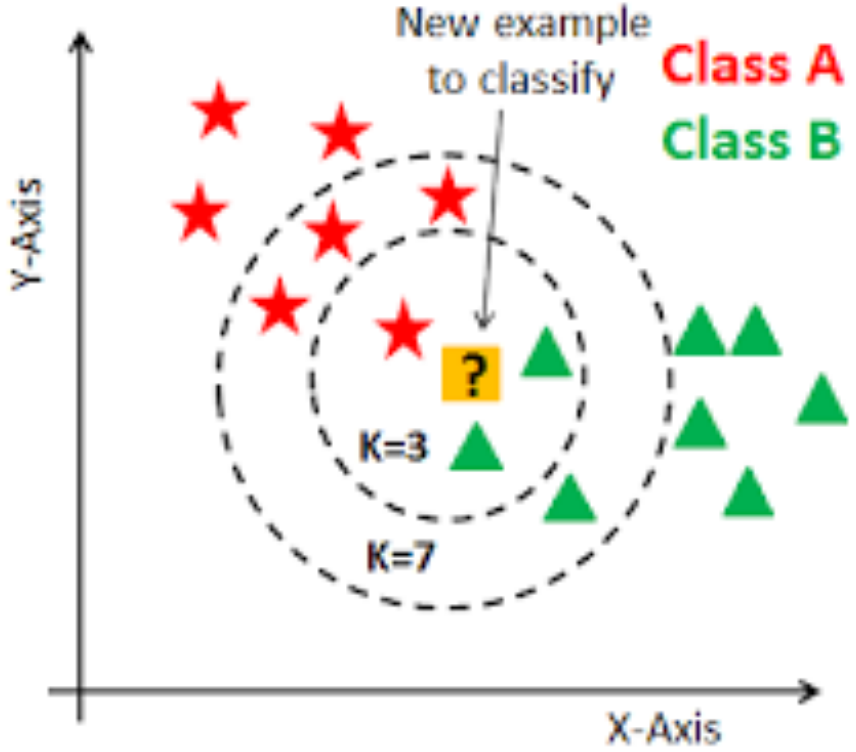
- NeurIPS、ICLR、ICML、AAAI、IJCAI
- ACL、EMNLP
- CVPR、ICCV
- …

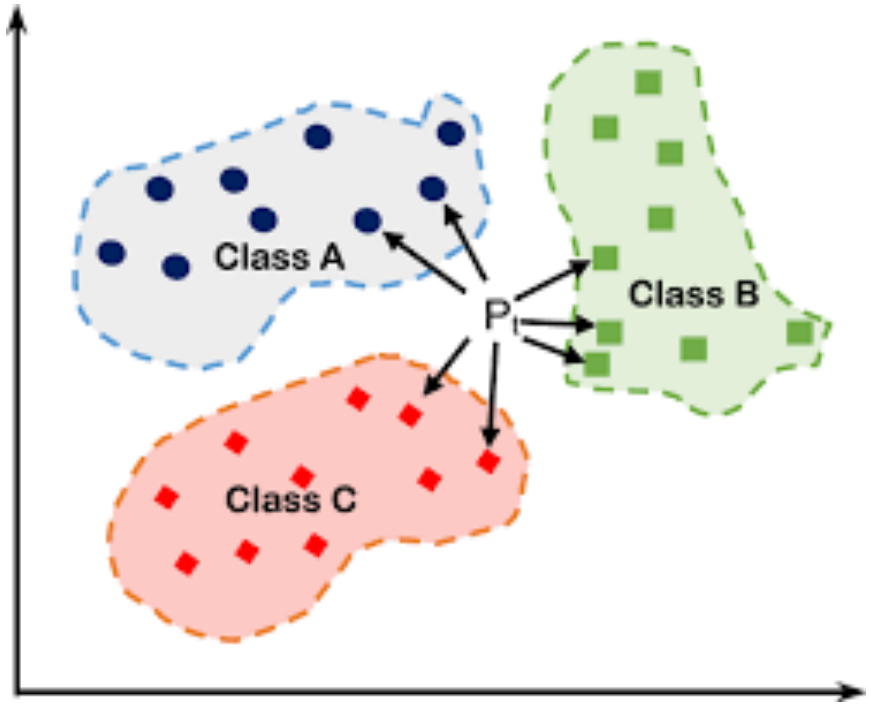
Course outline

Week	Topics	Homework
Week 1	Overview	
Week 2	No class, Machine learning	
Week 3	KNN	HW1
Week 4	Linear Regression	
Week 5	Exam 1	
Week 6	Logistic Regression	HW2
Week 7	Feedforward neural network	
Week 8	CNN	
Week 9	No class, Spring break	
Week 10	Exam 2	
Week 11	RNN	HW3
Week 12	Unsupervised learning	
Week 13	GAN	
Week 14	Resarch paper presentation	
Week 15	Resarch paper presentation	
Week 16	Resarch paper presentation	
Week 17	Final exam	

Project 1

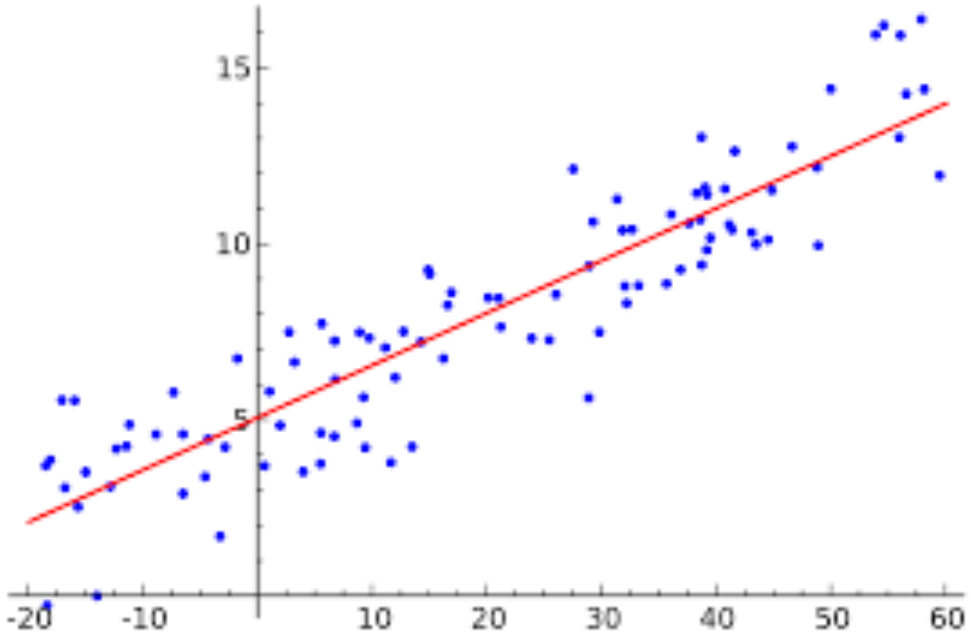
- KNN

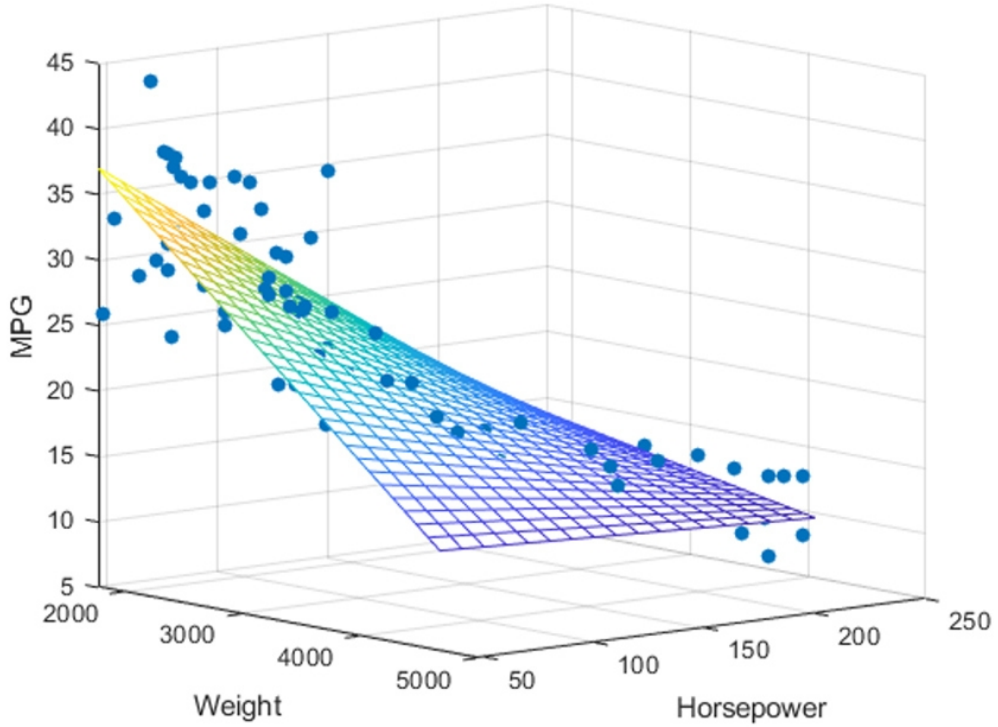




Project 2

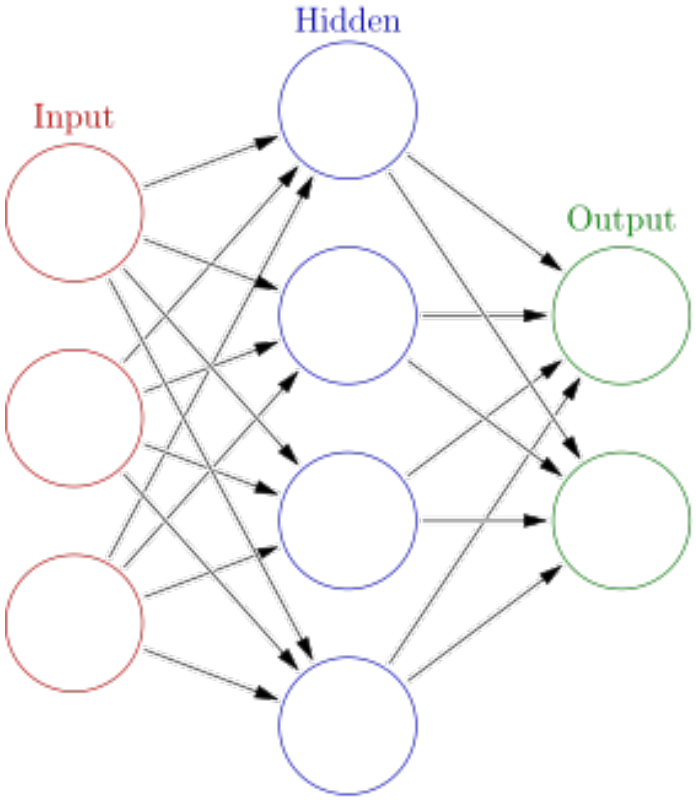
- Linear regression

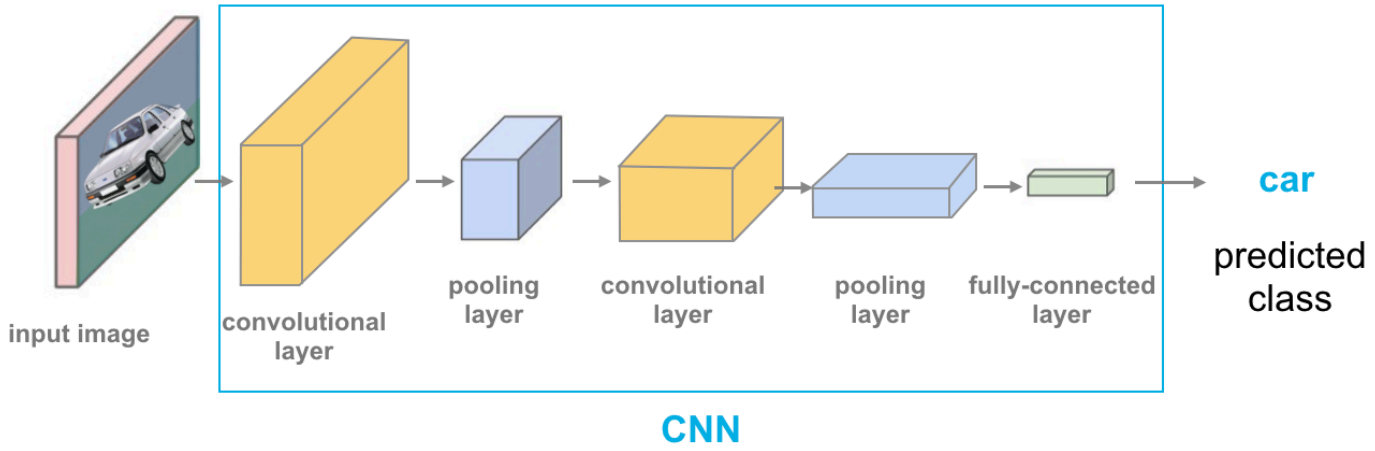




Project 3

- neural networks and convolutional neural network





Paper presentation

- https://docs.google.com/spreadsheets/d/1kGszd_RWYSKGaXkznMFz3mBWH17bPJvnzU8haclL_Co/edit?usp=sharing

Name	Neural Network	Paper
	MobileNet v1	https://arxiv.org/pdf/1704.04861.pdf
	Inception v1	https://arxiv.org/pdf/1409.4842.pdf
	ResNet-50 v2	https://arxiv.org/pdf/1603.05027.pdf).
	VGG-16	https://arxiv.org/pdf/1409.1556.pdf%20http://arxiv.org/abs/1409.1556.pdf
	ResNet-SRGAN	https://openaccess.thecvf.com/content_cvpr_2017/papers/Ledig_Photo-Realistic_Single_
	SRCNN 9-5-5	https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7115171&casa_token=tysl9rSqf3
	ResNet-DPED	https://openaccess.thecvf.com/content_ICCV_2017/papers/Ignatov_DSLR-Quality_Photo
	U-Net	https://arxiv.org/pdf/1505.04597.pdf)%e5%92%8c%5bTiramisu%5d(https://arxiv.org/abs/
	Nvidia-SPADE	https://openaccess.thecvf.com/content_CVPR_2019/papers/Park_Semantic_Image_Synt
	ICNet	https://openaccess.thecvf.com/content_ECCV_2018/papers/Hengshuang_Zhao_ICNet_f
	PSPNet	https://openaccess.thecvf.com/content_cvpr_2017/papers/Zhao_Pyramid_Scene_Parsin
	DeepLab v1	https://arxiv.org/pdf/1412.7062.pdf
	Project 1	https://github.com/kevinsuo/CS7357/tree/master/project/1
	Project 2	https://github.com/kevinsuo/CS7357/tree/master/project/2
	Project 3	https://github.com/kevinsuo/CS7357/tree/master/project/3