

# Introduction

Lecture 0

Hyung-Sin Kim



Seoul National University  
Graduate School of Data Science







# Instructor – Hyung-Sin Kim



- Assistant Professor in Data Science, SNU 
- Software Engineer at 
- Postdoctoral Scholar in Computer Science, UC Berkeley 
- BS/MS/PhD in Electrical and Computer Science, SNU 
- 69 academic papers
- 4 Postdoc/PhD Fellowships, 3 Best paper finalists, 2 Paper awards





# Ambient AI



# Data Science

## - GSDS View -

Lecture 0

Hyung-Sin Kim



Seoul National University  
Graduate School of Data Science





# We Want Insight



Useful insight!





# Data Science – From Data to Insight

Big, Diverse Data

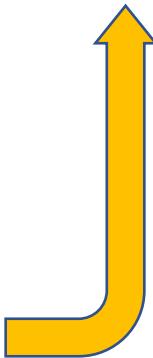


A	B	C	D	
1	Date	Apples	Oranges	Total Fruit
2	6/1/2012	125	75	200
3	6/2/2012	118	84	202
4	6/3/2012	164	72	236
5	6/4/2012	114	65	179
6	6/5/2012	98	96	194
7	6/6/2012	172	82	254

Useful insight!



Data Science





# Data Science – From Data to Insight

Big, Diverse, **Dirty** Data



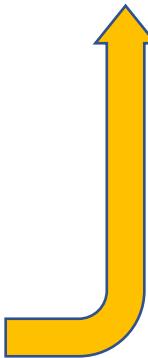
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Useful insight!



Data Science





# Data Science – From Data to Insight

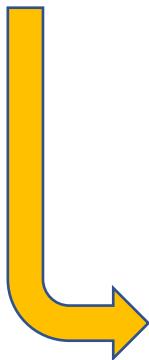
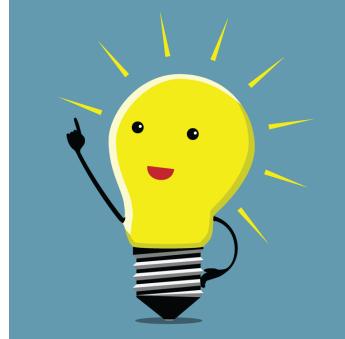
Big, Diverse, **Dirty** Data



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Useful insight!



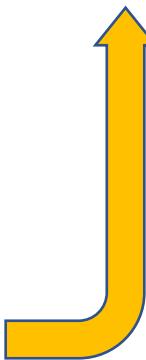
Storing and Managing  
– Data Lake



Cleansing and Pre-processing



Analysis



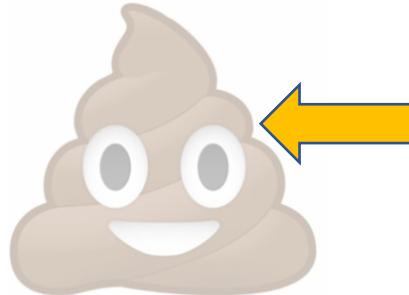


# Data Science – Four Pillars (ABC+D)

Big, Diverse, **Dirty** Data



A	B	C	D
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6/6/2012	172	82	254



Domain (application)

Where data comes from...  
Where insights are applied to...



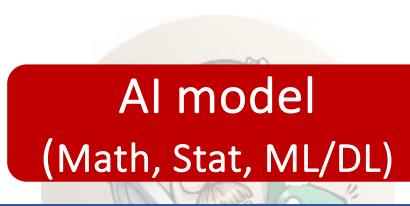
Useful insight!



Big Data



Computing

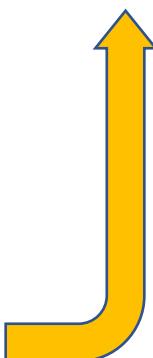


AI model  
(Math, Stat, ML/DL)

Storing and Managing  
– Data Lake

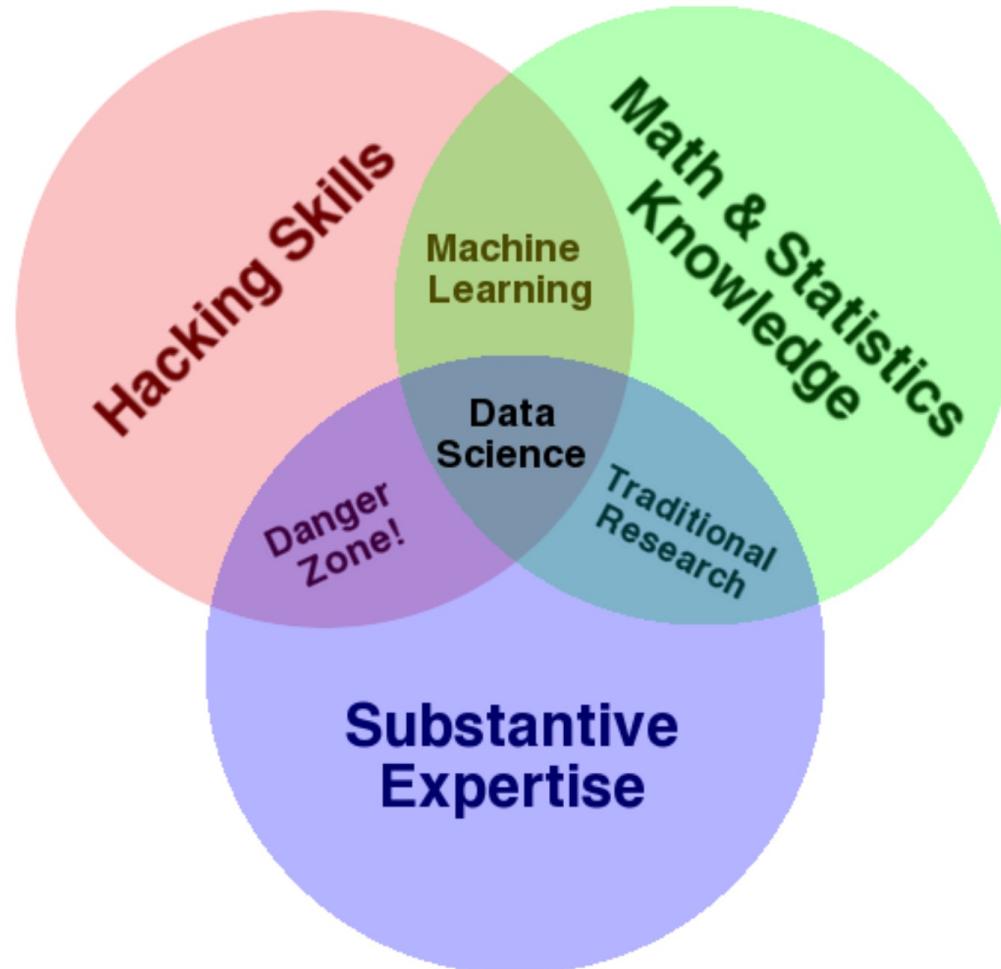
Cleansing and Pre-processing

Analysis





# Drew Conway's Venn Diagram (2010)





# Ullman's Venn Diagram (2021)

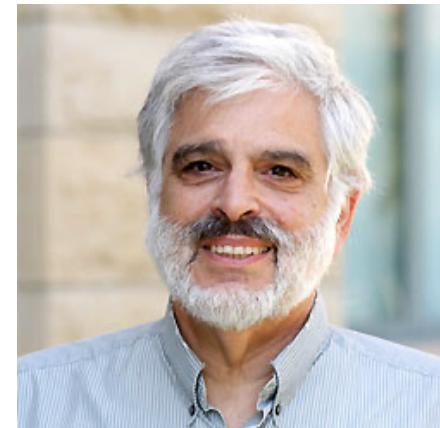
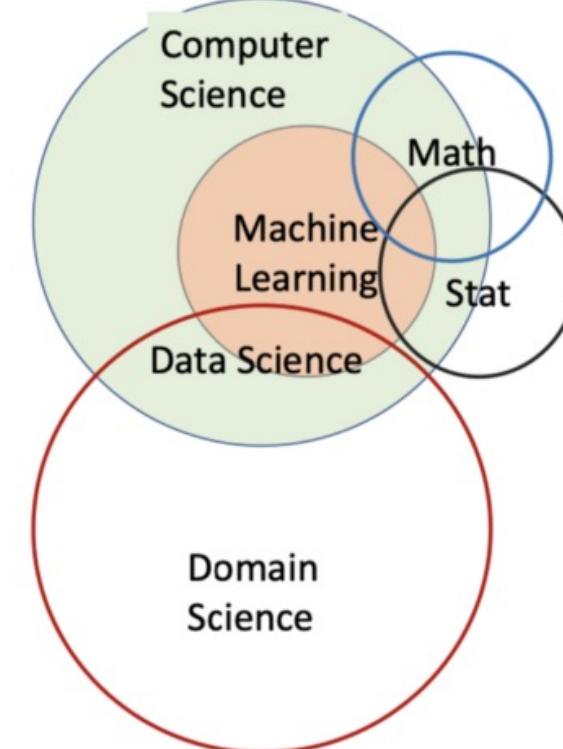
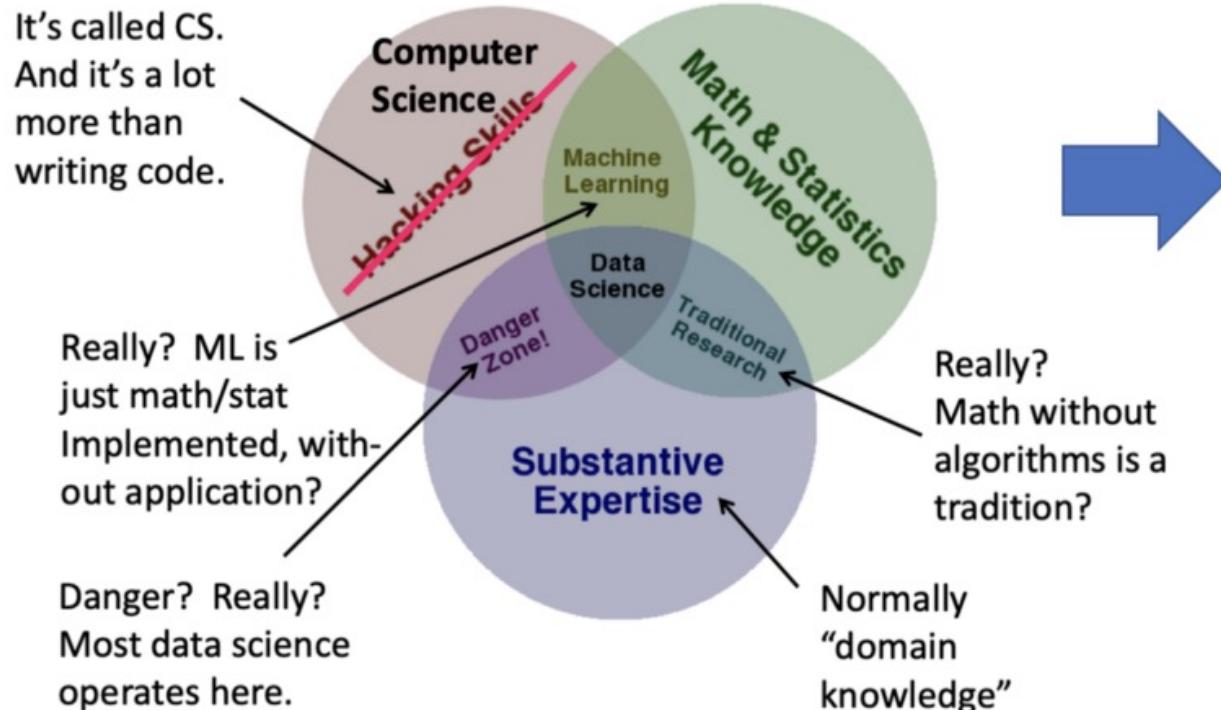


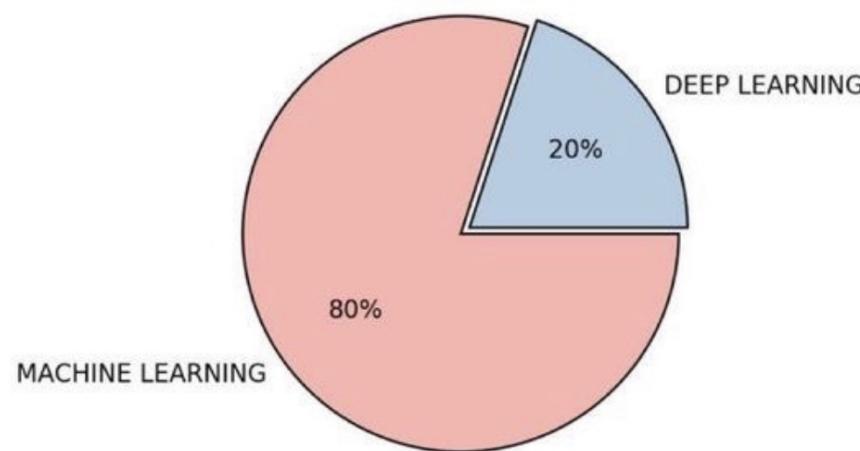
Figure 1: The Conway Venn diagram for data science



# Data Scientist Job ...

## DATA SCIENTIST JOB - EXPECTATION

@drangshu



Follow: Dr. Angshuman Ghosh

## DATA SCIENTIST JOB - REALITY

MACHINE/DEEP LEARNING  
FEATURE ENGINEERING  
DATA CLEANING

DATA GATHERING

10%  
10%

20%

MAINTENANCE

10%

20%

UNDERSTANDING PROBLEM

MACHINE/DEEP LEARNING  
FEATURE ENGINEERING  
DATA CLEANING  
DATA GATHERING  
MAINTENANCE  
UNDERSTANDING PROBLEM

bit.ly/drangshu

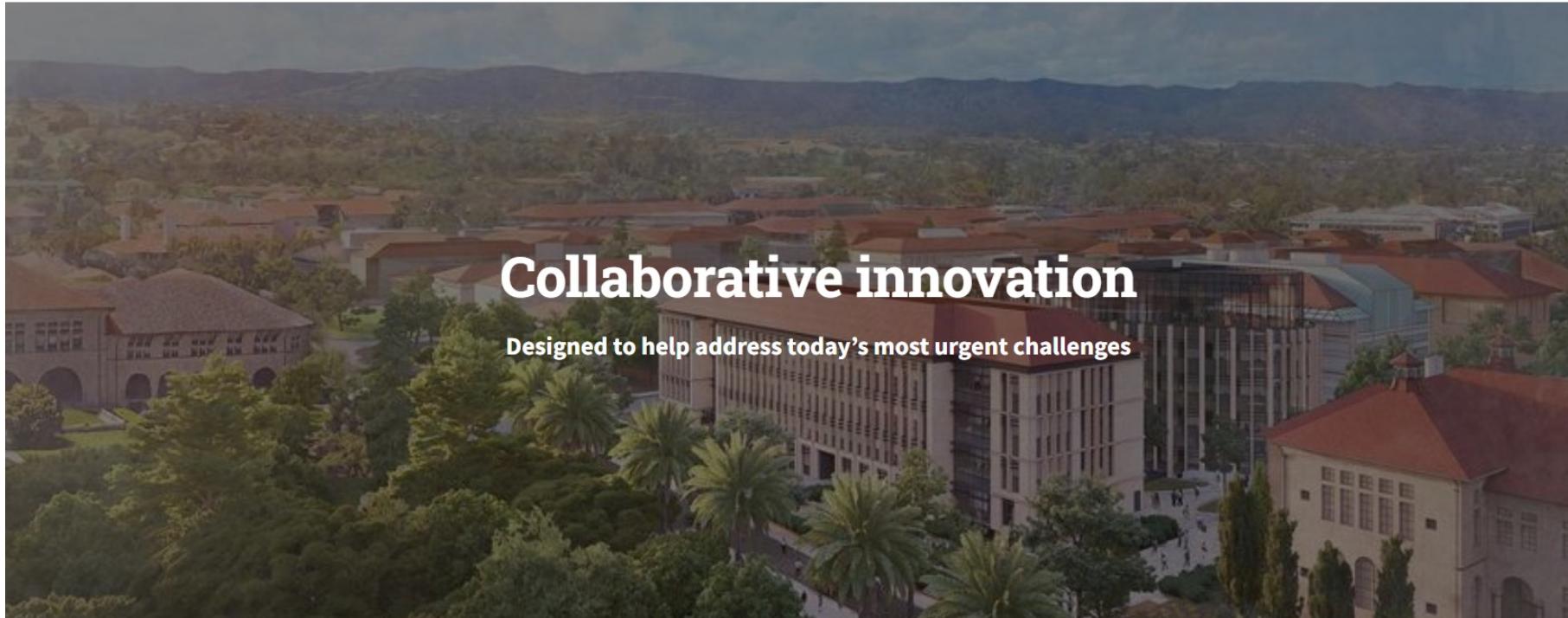




# Data Science, a Global Megatrend

- <https://www.youtube.com/watch?v=2ZopVhw6t3Y>

## Stanford Data Science & Computation Complex





# Data Science, a Global Megatrend

- <https://www.youtube.com/watch?v=9Hx5FppPVso>

The screenshot shows the UC Berkeley homepage. At the top, there is a navigation bar with links for 'For Students', 'For Faculty/Staff', 'For Our Partners', 'Give', and a search bar. Below the navigation bar, the text 'Berkeley Computing, Data Science, and Society' is displayed, with 'Computing, Data Science, and Society' highlighted by a red rectangular box. Underneath this, there is a horizontal menu with dropdowns for 'About', 'Academics', 'Research', 'News', 'Events', and 'Support Us'. The main content area features a large photograph of a woman wearing glasses, looking thoughtfully at a computer screen displaying code. To the right of the photo, there is a dark blue sidebar with white text. The sidebar reads: 'UC Berkeley and UCSF Launch Joint Computational Precision Health Program. Program aims to improve quality and equity of health care'. The background of the sidebar has a subtle geometric pattern.





# Data Science, a Global Megatrend

- In UC Berkeley
  - 6,000 undergraduate students take DS courses per year
  - ~2,000 students and 76 TAs for a single course (Data 8, Spring 2022)



Teaching Assistants ((u)GSIs)

	Aarushi Karandikar ( <a href="#">bio</a> ) aarushi.k@berkeley.edu OH: 581 SOCS, Wed 3-4 PM		Alice Chen ( <a href="#">bio</a> ) alicechen295@berkeley.edu OH: 581 SOCS, Wed 2-3 PM		Angela Guan ( <a href="#">bio</a> ) guangangel@berkeley.edu OH: B6 Evans, Tue 7-8 PM		Ashika Raghavan ( <a href="#">bio</a> ) ashika-raghavan@berkeley.edu OH: 581 SOCS, Wed 2-3 PM
	Carlos Ortiz ( <a href="#">bio</a> ) carlosortiz@berkeley.edu OH: 581 SOCS, Tue 12-1 PM		Carter Junhao Sun ( <a href="#">bio</a> ) caius45@berkeley.edu OH: 581 SOCS, Fri 2-3 PM		Ciara Acosta ( <a href="#">bio</a> ) ciara.acosta@berkeley.edu OH: 581 SOCS, Tue 2-3 PM		Devarsh Dhanuka ( <a href="#">bio</a> ) devarshdhanuka@berkeley.edu OH: 210 South Hall, Thu 2-3 PM
	Ellen Kwock ( <a href="#">bio</a> ) ellenkwock862@berkeley.edu OH: 581 SOCS, Tue 4-5 PM		Ellen Persson ( <a href="#">bio</a> ) ellenepersson@berkeley.edu OH: 581 SOCS, Tue 1-2 PM		Emily Guo ( <a href="#">bio</a> ) lingjunguo@berkeley.edu OH: B6 Evans, Thu 6-7 PM		James Weichert ( <a href="#">bio</a> ) jweichert@berkeley.edu OH: 581 SOCS, Tue 4-5 PM
	Jessica Qian ( <a href="#">bio</a> ) jaqian@berkeley.edu OH: 210 South Hall, Thu 1-2 PM		Joshua Alvarez ( <a href="#">bio</a> ) cayanan.joshua@berkeley.edu OH: 581 SOCS, Wed 2-3 PM		Joyce Zheng ( <a href="#">bio</a> ) joycezheng@berkeley.edu OH: 381 SOCS, Wed 3-4 PM		Kanchnaa Samala ( <a href="#">bio</a> ) kanchnaa@berkeley.edu OH: 581 SOCS, Wed 4-5 PM





# *Graduate School of Data Science*





# GSDS – Vision and Mission

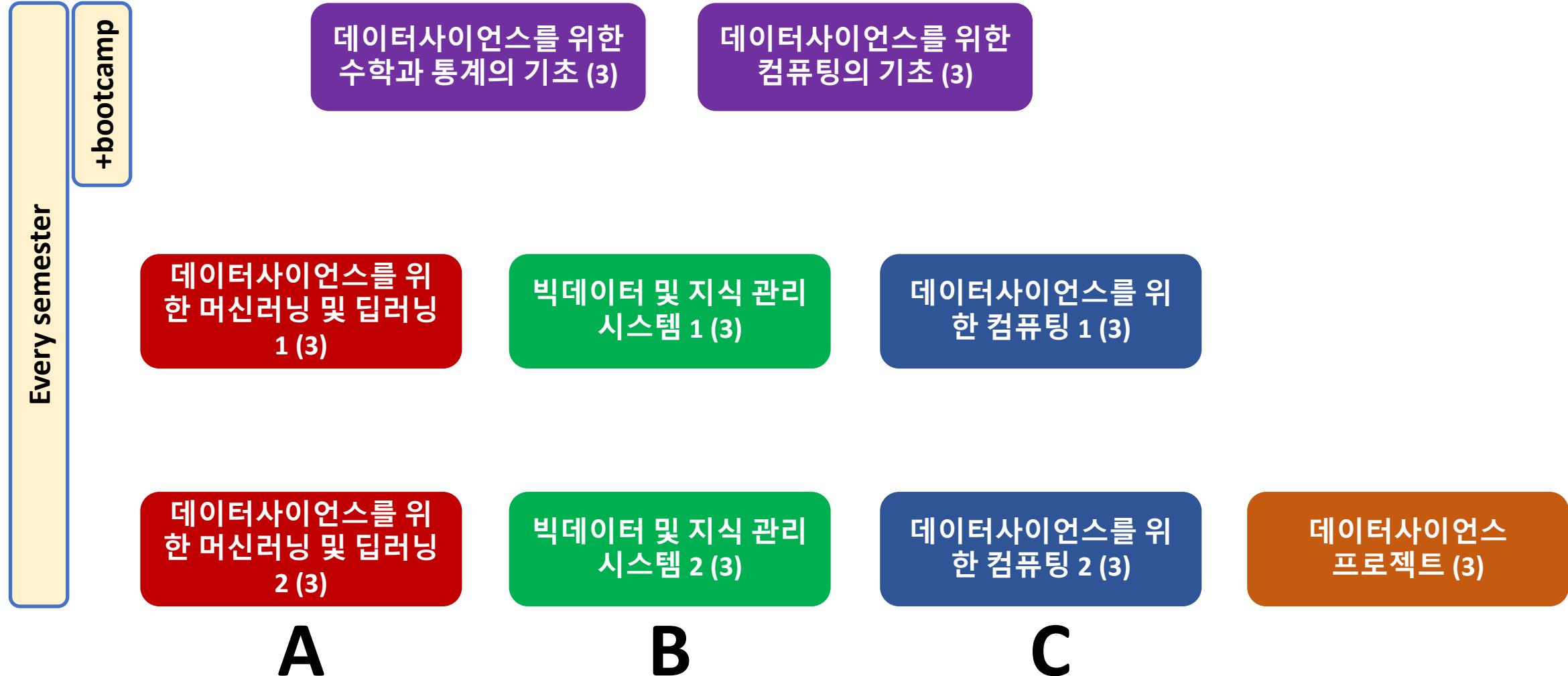
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- Make students from **various backgrounds (D)** dive into **core principles (ABC)** of data science and let these **ambidexters** lead data-driven **innovation** in various fields
  - Globally unique mission... challenging of course...
- Methodologies
  - Not an undergraduate department as a silo but a **graduate** school as a **hub**
  - Not an MBA-ish but a **hardcore** program to change students' DNA
  - Not only advanced but also **basic** courses that are open to all students outside of GSDS (no number limit)





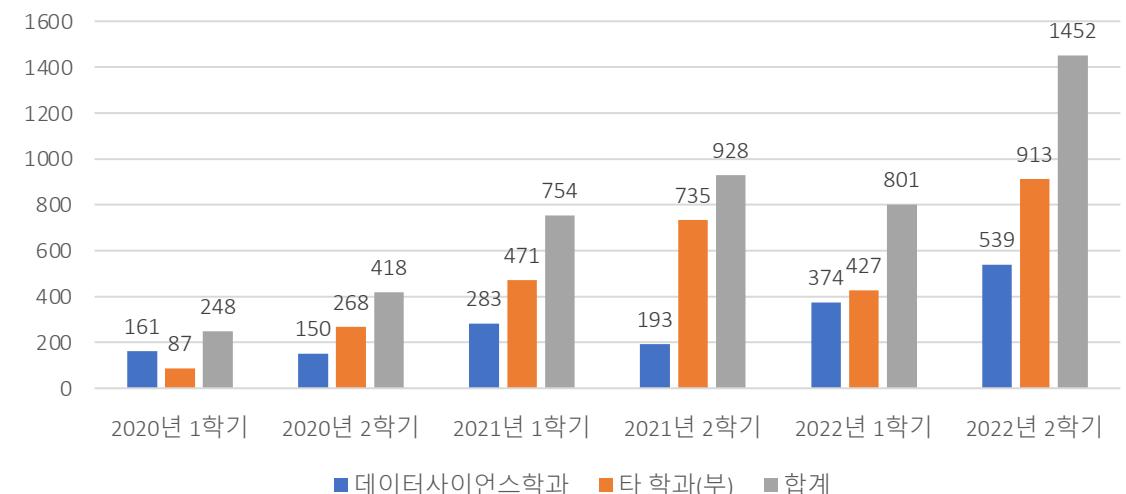
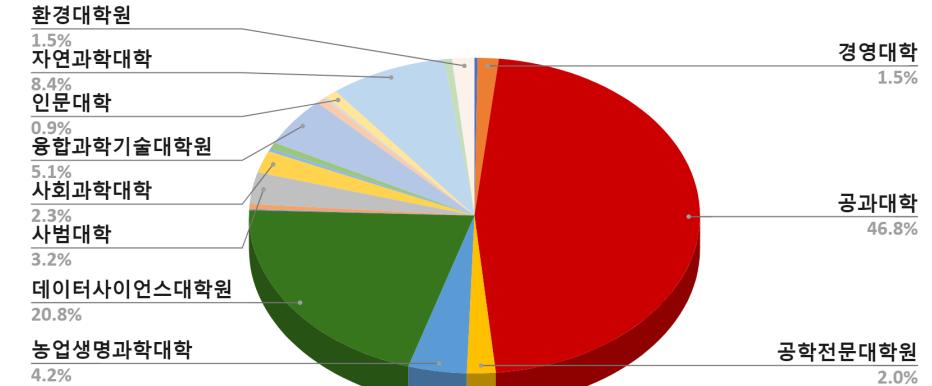
# GSDS – Curriculum





# GSDS – Growth

- 10 new faculty members have joined
  - Google, Amazon, US faculty...
- 40 MS/15 PhD to 80 MS/30 PhD per year
- Being recognized gradually...





# GSDS – Outreach

- Summer/Winter GSDS Bootcamp
  - 4-week quick and intense program for beginners
  - Flipped learning
  - Computing for DS
  - Math and Statistics for DS

서울대학교  
데이터사이언스대학원

## 데이터사이언스 Bootcamp 안내 및 참가자 모집

📅 강의 일정  
2023. 1. 16.(월) ~ 2. 10.(금) 총 4주 코스

🔔 평가(시험)일  
2023. 2. 11.(토)

🌐 수강신청 방법  
SNUON 사이트에서 부트캠프 강좌 검색 후  
수강신청(두 과목 모두 신청 가능)  
<https://etl.snu.ac.kr/snuon>

📅 수강신청 기간  
2023. 1. 9.(월) 10:00 ~ 1. 11.(수) 16:00 까지  
(정원 초과 및 신청기간 이후 추가 등록 없음)

📝 수강료 무료  
성공적으로 교과목을 이수한 학생에 한해  
수료증 발급 예정

데이터사이언스 대학원은 학내 다양한 전공의 학생들의 요구를 수용하기 위하여 2023년 1월 16일부터 2월 10일까지 데이터사이언스 Boot Camp를 개설하여 데이터사이언스 기초 지식에 대한 교육을 진행합니다. Boot Camp에서는 데이터사이언스에 필요한 프로그래밍/컴퓨팅부터 수학/통계에 대한 균형 잡힌 기초 강의를 제공하며 이를 초심 학생들에게 다른 단과대학(원) 및 학과와 협력하여 다양한 교육 및 연구 기회를 마련하고자 합니다.

**Boot Camp 과목**

	데이터사이언스 부트캠프 수학/통계
	데이터사이언스 부트캠프 컴퓨팅

Boot Camp 과목들은 플립 러닝(Flipped Learning)방식으로 진행됩니다. 각 과목당 1일 12강좌(주 5일)로 구성된 온라인 강의 수강 후 실습 및 질의응답 세션에 참여하게 됩니다. 데이터사이언스분야에 관심있는 학부·대학원생 분들의 많은 지원바랍니다.





# GSDS – Outreach

## • Google ExploreCSR

- Workshops to explore various research fields
- Mentoring for CS/DS carrier and research
- Will do it again in the upcoming Summer



데이터사이언스대학원

# Explore CSR Workshops

신청기간  
22년 12월 14일 수요일까지 22년 12월 20일 화요일 오후

첫 워크샵 시간  
신청대상자  
데이터사이언스 연구 및 학습에 관심있는 서울대 학부생 전체

선정인원  
40명 내외

신청방법  
링크  
설문지 작성 (<https://url.kr/m2jxdw>)  
웹사이트  
<https://sites.google.com/view/datacareer2022>

신청서  
홈페이지

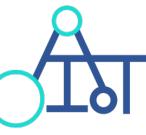
**소개 글**

서울대학교 데이터사이언스 대학원은 Google과 손잡고 겨울방학기간 ExploreCSR 프로그램을 운영합니다. Google ExploreCSR은 Computer/Data Science 관련 연구 및 교육 기회가 상대적으로 제한적이었던 우수한 학부생들을 집중적으로 선발하여 교육, 연구, 커리어 멘토 등의 기회를 제공하는 outreach 프로그램입니다 (<https://research.google/outreach/explore-csr>). 선발된 학생들은 2번의 대면 워크샵을 통해 커리어 톤을 듣고 네트워킹 기회를 가지며, 그 외 기간 동안 매칭된 교수님 및 대학원생의 멘토링을 통해 교육, 프로젝트 및 연구를 수행하며 Computer/Data Science 역량을 증진시키고 커리어를 탐색할 수 있습니다.

**문 의** 김영신 교수 [hyungkim@snu.ac.kr](mailto:hyungkim@snu.ac.kr), 이준석 교수 [joonseok@snu.ac.kr](mailto:joonseok@snu.ac.kr)

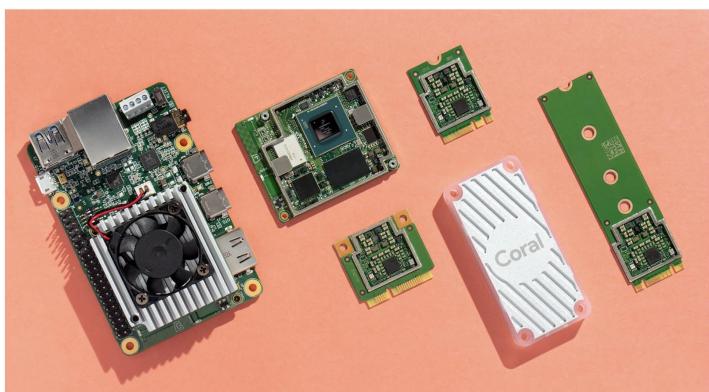
서울대학교 데이터사이언스대학원  
BK21 FOUR BK21 데이터사이언스혁신인재양성사업단  
Google Research





# GSDS – Outreach

- Ambient AI Bootcamp & Competition
  - Google donation and funding
  - 3-week education
  - 1-month project with mentoring



**데이터사이언스 대학원**

## 앰비언트 AI Bootcamp & Competition

**부트캠프 강의 및 실습**

수강 기간 | 2023. 1. 9. ~ 1. 30. (Flipped Learning 중심, 총 27시간)

**컴피티션**

- 프로젝트 수행 기간 | 2023. 2. 1 ~ 3.1
- 상 금 | 대상 200만원 / 최우수상 100만원 / 우수상 50만원

<b>수강 대상자</b>	서울대 구성원 전체
<b>수강신청 방법</b>	eTL(SNUON)사이트에서 '앰비언트 AI 부트캠프' 검색 및 수강 신청 <a href="https://etl.snu.ac.kr/snuon">https://etl.snu.ac.kr/snuon</a>
<b>수강신청 기간</b>	2023. 1. 2. (월) ~ 1. 6. (금) 선착순 마감이며 수강 신청 기간 종료 후 일괄 승인 예정
<b>관련 문의</b>	<ul style="list-style-type: none"> <li>▪ eTL등록 관련: 오승철 seungchul91@snu.ac.kr</li> <li>▪ 강의 문의: 김형신 교수 hyungkim@snu.ac.kr</li> </ul>

**소개글**

앰비언트 인공지능(Ambient AI)은 사용자 주변의 저비용 사물인터넷 기기에서 직접, 협력적으로 인공지능 연산을 수행함으로써 인간과 환경 간의 상호 작용을 강화하고 인터넷에 대한 의존도를 낮추어 개인정보를 보호할 수 있는 새로운 인공지능 트렌드입니다. 앰비언트 인공지능은 AI 반도체의 발전에 힘입어 사물인터넷과 인공지능을 결합한 최신 기술로서 웨어러블, 스마트팜, 제조 등 다양한 분야에 혁신을 일으킬 수 있는 잠재력을 가지고 있습니다.

서울대학교 데이터사이언스 대학원은 세계 최초로 구글 Coral AI팀과 협력하여 앰비언트 인공지능 플랫폼 및 실습 등 새로운 커리큘럼과 프로젝트에서 구글 Coral Dev Board와 센서를 사용하고 있습니다.

이번 거울, 데이터사이언스 대학원이 Google과 협력하여 앰비언트 인공지능의 잠재력을 다양한 분야의 서울대 구성원들과 공유하기 위해 "앰비언트 인공지능 Bootcamp & Competition"을 개최합니다. 부트캠프는 앰비언트 인공지능 및 딥러닝의 기초지식과 TensorFlow 플랫폼 및 구글이 기증한 Coral Dev Board 7판 실습 경험을 제공합니다. 부트캠프 종료 후 1달 동안 자유 팀프로젝트를 수행하게 되며, 우수한 결과를 도출한 팀에게는 소정의 상금이 주어집니다.

앰비언트 인공지능에 관심있는 분들이 많은 지원 부탁드립니다.

**서울대학교 데이터사이언스대학원**  
 Seoul National University Graduate School of Data Science

**BK21**  
 데이터사이언스혁신IZE 양성사업단

**Google coral.ai**  
 Google Research



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데이터사이언스 대학원

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강의링크

QR 코드

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수강 대상자

서울대 구성원 전체

수강신청 방법

eTL(SNUON)사이트에서 '앰비언트 AI 부트캠프' 검색 및 수강 신청  
<https://etl.snu.ac.kr/snuon>

수강신청 기간

2023. 1. 2. (월) ~ 1. 6. (금) 선착순 마감이며 수강 신청 기간 종료 후 일괄 승인 예정

관련 문의

- eTL등록 관련: 오승철 seungchul91@snu.ac.kr
- 강의 문의: 김형신 교수 hyungkim@snu.ac.kr

소개글

앰비언트 인공지능(Ambient AI)은 사용자 주변의 저비용 사물인터넷 기기에서 직접, 협력적으로 인공지능 연산을 수행함으로써 인간과 환경 간의 상호 작용을 강화하고 인터넷에 대한 의존도를 낮추어 개인정보를 보호할 수 있는 새로운 인공지능 트렌드입니다. 앰비언트 인공지능은 AI 반도체의 발전에 힘입어 사물인터넷과 인공지능을 결합한 최신 기술로서 헬스케어, 스마트팜, 제조 등 다양한 분야에 혁신을 일으킬 수 있는 잠재력을 가지고 있습니다.

서울대학교 데이터사이언스 대학원은 세계 최초로 구글 Coral AI팀과 협력하여 앰비언트 인공지능 플랫폼 및 실습 등 새로운 커리큘럼과 프로젝트에서 구글 Coral Dev Board와 센서를 사용하고 있습니다.

이번 거울, 데이터사이언스 대학원이 Google과 협력하여 앰비언트 인공지능의 잠재력을 다양한 분야의 서울대 구성원들과 공유하기 위해 "앰비언트 인공지능 Bootcamp & Competition"을 개최합니다. 부트캠프는 앰비언트 인공지능 및 딥러닝의 기초지식과 TensorFlow 플랫폼 및 구글이 기증한 Coral Dev Board 7기반 실습 경험을 제공합니다. 부트캠프 종료 후 1달 동안 자유 팀프로젝트를 수행하게 되며, 우수한 결과를 도출한 팀에게는 소정의 상금이 주어집니다.

앰비언트 인공지능에 관심있는 분들이 많은 지원 부탁드립니다.

서울대학교 데이터사이언스 대학원 | BK21 데이터사이언스 혁신 인재 양성 사업단 | Google coral.ai | Google Research



# About This Course

Lecture 0-2

Hyung-Sin Kim



Seoul National University  
Graduate School of Data Science





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# *Computing Foundations for Data Science*





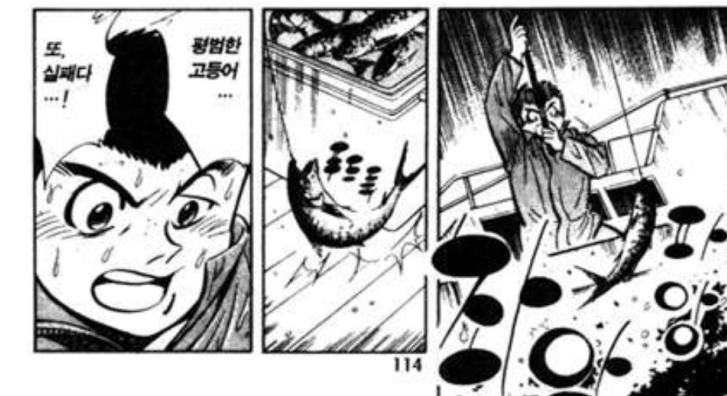
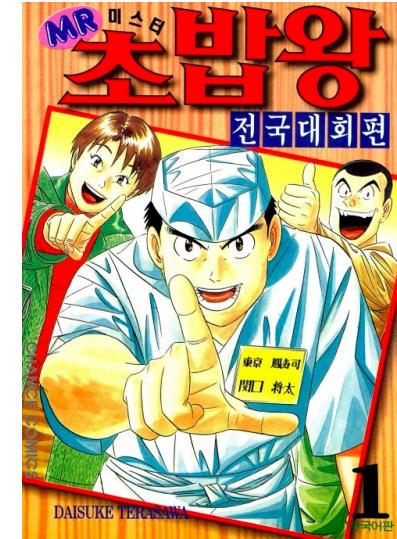
# Chef or Farmer?





# What Chefs Do...

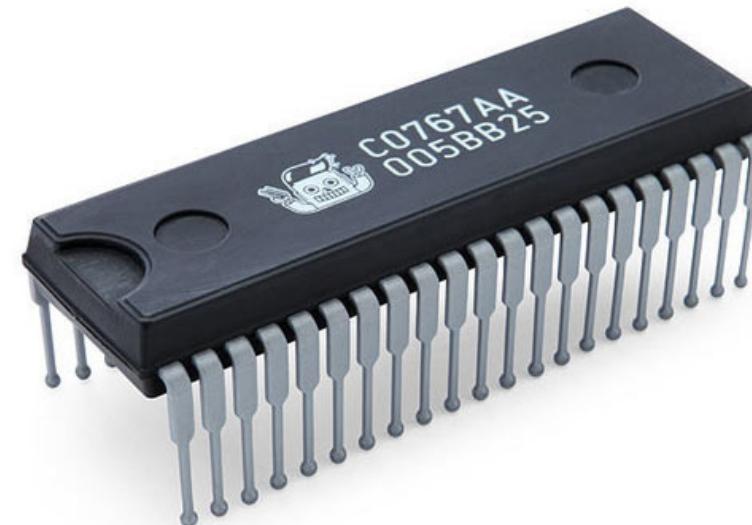
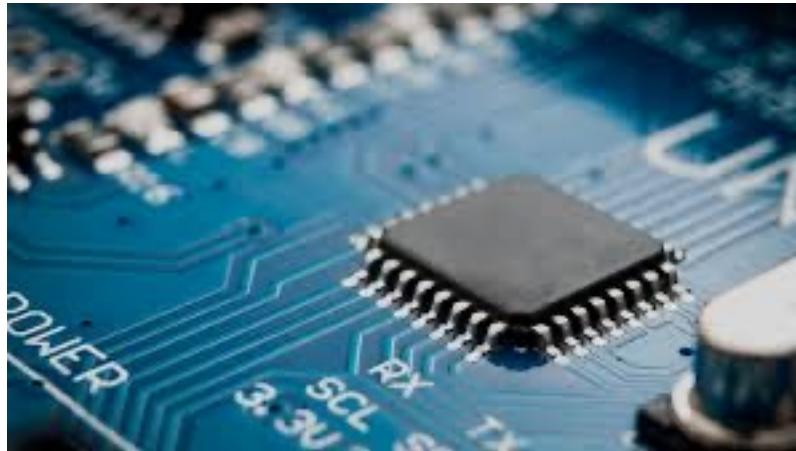
- Making a unique **recipe**
  - What ingredient to use
  - What utensils to use
  - Sequence of cooking
  - Time duration of each step
- Cooking fluently according to the recipe
- They are not required to farm, fish, or feed livestock
- But if you are a **top-level chef**, you do take care of so many things
  - Ingredient, chemistry, climate, history, culture...





# Computer Science

- Computer Science is not mainly about computer hardware
  - Semiconductor (Moore's law), Integrated circuit – Electrical engineering!
  - Like chefs' main job is neither farming nor fishing





# Computer Science

- Computer Science is more about what computers can do (software)
  - How to make computers do what we want them to do?
  - We should provide a nice **recipe** for computers to follow
  - **Algorithm:** A recipe for computers to follow (logical steps)
  - **Program:** An instruction set for a computer to understand put an algorithm to practice
  - <https://www.youtube.com/watch?v=9otrE0SyrFE>
- But if you want to be an **exceptional** programmer, you do need more!
  - Hardware characteristics (not to design it but use it efficiently)
  - Application (may be your current major)
- This is what GSDS is heading toward!

# Computing, as Part of Data Science

Manager



How to make my workers most productive?

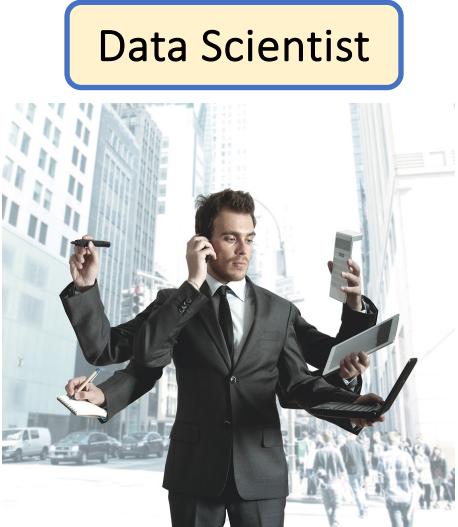


Various workers





# Computing, as Part of Data Science



Data Scientist

All data are electronically stored and processed...

How to make my computers most productive?





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# *Computing Foundations for Data Science: A Pathway toward...*





# Power of Programming

- **Defining new operations**
  - “Go to work” Program
    - (1) check time (2) if it is 9:00, go to the office (3) otherwise, stay at home
  - "Go home" Program
    - (1) check time (2) if it is 18:00, go home (3) otherwise, stay at the office
- **Combining (Reusing) already-defined operations to do more complex things**
  - “Commute” Program
    - Repeat the steps (1) and (2) infinitely
    - (1) If you are at home, do “Go to work”
    - (2) Otherwise, do “Go home”
- Repeating the two steps enables computers to do incredibly many things!





# Programming Language

- **Human(natural) languages** are based on common sense of mankind
  - Computers do not have that common sense
  - Human languages are difficult for computers to understand
- **Programming languages** have accurate structure and accurate meaning for computers to understand (zero ambiguity)
  - **Programming:** Writing an algorithm in a programming language
  - It is also called “**coding**,” since it was actually like a **secret code** (011010101110111...)
- Programming languages have evolved so that human can also easily understand
  - Less like a secret code these days ☺



# This Course is About ...

- You will learn fundamental programming concepts to handle data
  - How to (**efficiently**) process data to draw conclusions: **Algorithms**
  - How to store/organize data for its (**efficient**) processing: **Data types/structures**
  - How to make computers (**efficiently**) execute your algorithms: **Programming in Python**
  - Yes, now that we are talking about **big data**, efficiency is important!
- **Clarification:** Although this course does cover Python, it is NOT mainly about Python, but more about **fundamental concepts** by using Python as a tool
- You will get a glimpse of how Silicon Valley companies do technical interviews to recruit software engineers ☺





# This Course is About ...

- You will learn how a computer system works
  - How to process and store data at the hardware level: **Logic gates**
  - Why/How all the information is represented in bits (010101): **Data representation**
  - Several **great ideas** in computer architecture
- You will learn another language called **C**
  - Why it is important and how it is distinguished from Python
  - If you can implement an algorithm using Python, you should be able to do it using C!



# This Course is **NOT** About...

- This course does not cover computer systems nor machine-friendly programming, which is important for high-performance big data computing
  - Please check out
    - Computing for Data Science 1, 2
    - Big data and knowledge management systems 1, 2
- This course does not cover machine/deep learning programming, which needs (some) mathematical background as well
  - Please check out
    - Computing for Data Science 1
    - Machine learning and deep learning for Data Science 1, 2





# This Course is **NOT** About...

- This course does not cover various libraries and frameworks for data analysis, such as pandas, numpy, Tensorflow, and Pytorch
- This course is **not easy!** It will require **devotion**
  - You will learn **a lot** (three in one) and there will be **a lot** of assignments
  - If you don't have that much time, I recommend other slow-paced courses



# Course Logistics

Lecture 0-3

Hyung-Sin Kim



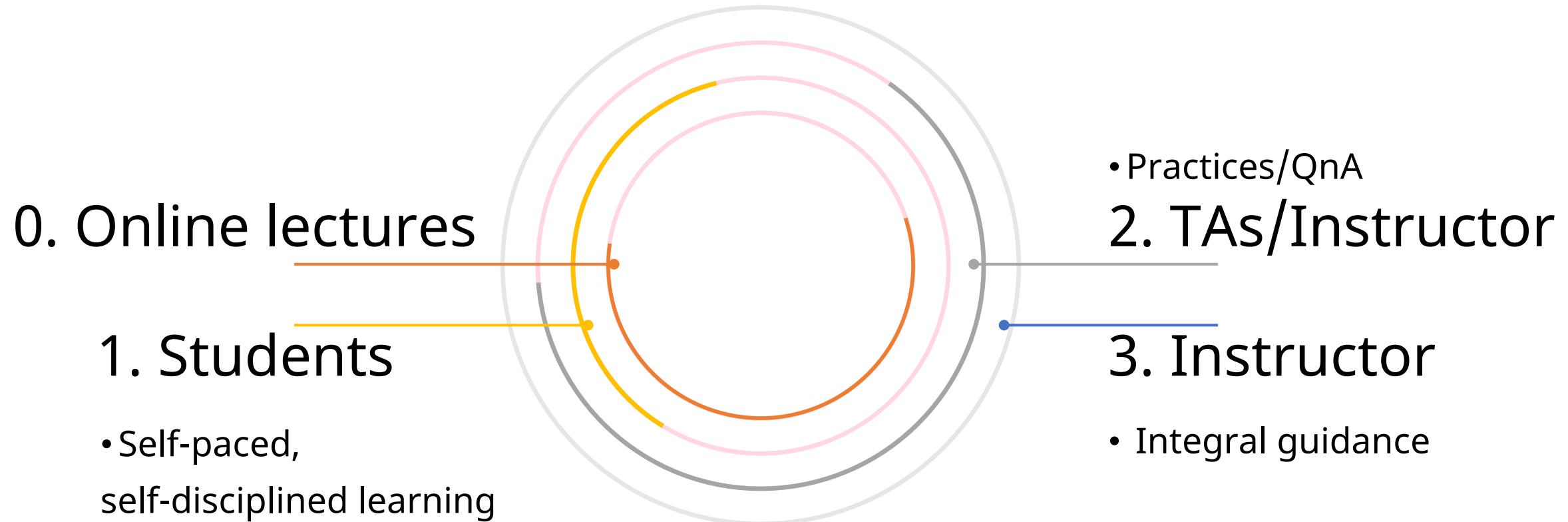
Seoul National University  
Graduate School of Data Science





# Hybrid Learning

- Q&A, assignments, grading ... (feel free to poke them 😊)





# Learning Methodology

- Out of the darkness (**competition**) into the light (**collaboration**)
  - This is not an undergraduate course, but a grad-level course!
  - If you don't know something, do not just shed tears but **ask questions** to your peers!
    - There is no stupid question
    - Your question might save other peers too
  - If you know the answer, share your ideas (**NOT codes**) with your peers!
    - It is **important** to describe your coding ideas without actually showing your codes
- Collaboration is at the heart of Data Science
- Collaboration is for **understanding** something clearly, not submitting HW



# Learning Methodology

- When/How to ask questions?
  - During lectures (zoom chat or offline)
  - Q&A session after each lecture – For shy ladies and gentlemen
  - Using **Slack** between lectures
    - [https://join.slack.com/t/cfds2023-2/shared\\_invite/zt-22u2uf45c-CXoUOnZtrQfSF9I5vUaHBg](https://join.slack.com/t/cfds2023-2/shared_invite/zt-22u2uf45c-CXoUOnZtrQfSF9I5vUaHBg)
- I really encourage students to **try** to answer any question
  - Remember! You know something only when you can explain it clearly to others
  - By organizing your thought, you will be the one who has the most benefit

저도 수업에 기여하고 싶어 튜터에 자원하긴 했는데, 개념정리가 잘 되어있지 않다보니  
튜터님들께 깔끔히 설명드리고 도움드리지 못했던 것 같아 아쉽습니다.  
(설명 할 수 없으면 모르는 것이라는 교수님 말씀에 많이 공감이 되었습니다)





# Learning Methodology

- Study group (mandatory for GSDS students, optional for others)
  - Will be organized later this week (4~5 members/group)
    - Please answer the **google form**
  - Small group discussion during lectures
  - Study **together** and do assignments **together** (but **don't share codes** at all!)

서로 토론하고 그룹별로 학습했던게 재밌고 좋았습니다.

저는 교육에 관심이 많은데, 교수님께서 수업을 하시는 방식에서도 좋다고 느껴지는 부분들이 있었습니다. 소회의실이라는 기능이 인상깊었고, 또 그 토론 주제로 주로 복습내용을 다뤄서, 자칫 (이미) 잘 하는 학생 위주로 이루어질 수 있는 토론에서 누구든 말을 할 수 있게끔 하면서 복습도 겸했던 것이 좋았던것 같습니다. 그리고 스터디그룹을 운영하신 부분이 아주 인상깊었습니다.

스터디 그룹을 만들어 운영한 점이 좋았습니다.

디스커션이 생각보다 유익한거 같습니다. 토론 중, 제가 생각하지 못했던 관점에서 생각한 답을 말씀해주시는 팀원분들 덕분에 많은 것을 배우게 됩니다. 또한 복습 용도로 매우 좋습니다.





# So... for Each Lecture...

- Before the lecture
  - You should watch the videos in advance
  - While doing this, you should **turn on** Jupyter or Visual studio and **type** the codes
  - Ask questions on Slack
- During the lecture
  - Change your zoom name like 스터디그룹명-김형신
  - **Quiz:** You will take a quiz with your group members
  - **Review:** I will review the content of the videos
  - **Practice:** A TA or I will lead a practice session and you will solve some problems collaboratively
- After the lecture
  - Review and ask questions on Slack





# TAs

- Q&A, assignments, grading ... (feel free to poke them ☺)

[taegyoun88@snu.ac.kr](mailto:taegyoun88@snu.ac.kr)



윤태균

[yegyuhan@snu.ac.kr](mailto:yegyuhan@snu.ac.kr)



한예규

[iamkji@snu.ac.kr](mailto:iamkji@snu.ac.kr)



김지윤

[kjg121@snu.ac.kr](mailto:kjg121@snu.ac.kr)



김정국

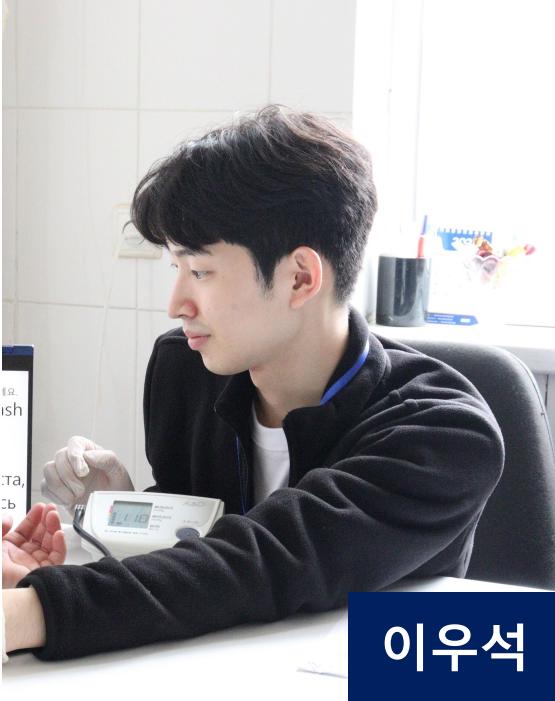




# TAs

- Q&A, assignments, grading ... (feel free to poke them ☺)

[andylws@snu.ac.kr](mailto:andylws@snu.ac.kr)



이우석

[shodream95@snu.ac.kr](mailto:shodream95@snu.ac.kr)



지서진

[jihaeinina@snu.ac.kr](mailto:jihaeinina@snu.ac.kr)



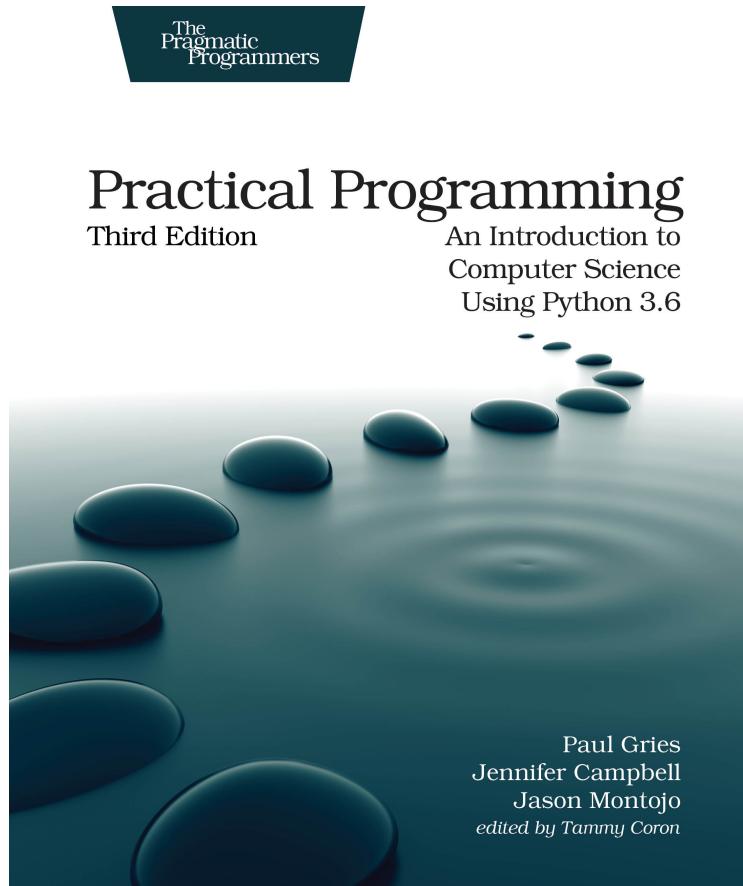
정지혜



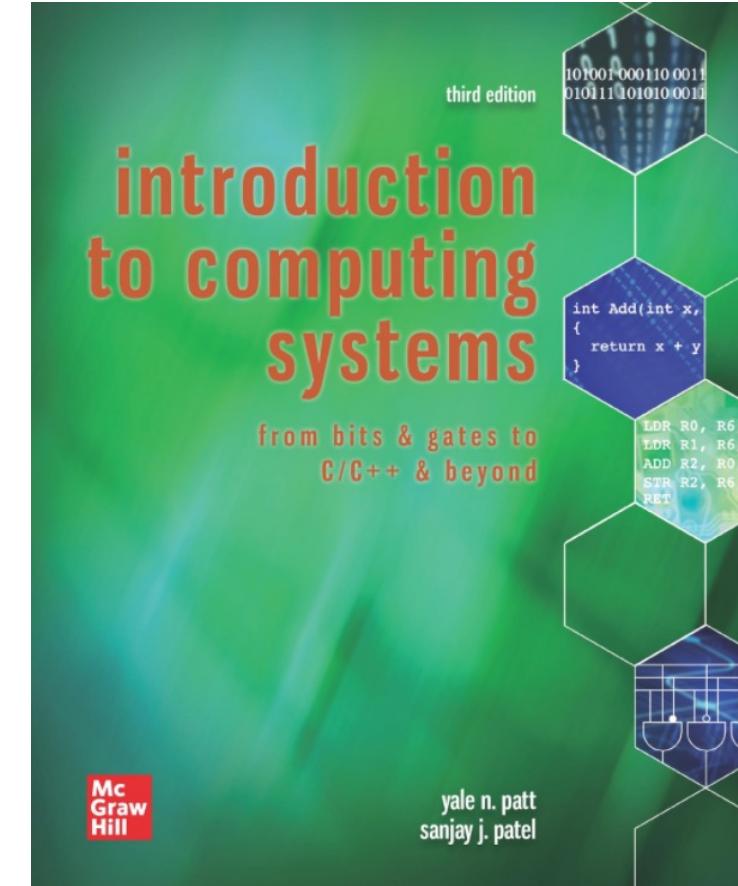


# Textbook

- Practical programming (pdf is provided!)
  - Used for the first half of this course



- Introduction to computing systems
  - Used for the second half of this course





# Grading

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- Assignments 20%
  - 6 programming assignments
- Midterm 35% (**10/19**, offline)
- Final 35% (**12/14**, offline)
- Peer review 5%
- Attendance 5%
  - You **must** turn on the camera





# Warning

- Lots of students take this course, meaning that we have little flexibility
  - Exam schedule
  - No late submission
  - Strict instruction for assignments and exams

- You **must** fall in love with



- Cheating = zero credit and then... **FFFFFFFFFF**





# Overcoming Psychological Barrier

- <https://www.youtube.com/watch?v=r7onWtuD92U>



Dr. Jordan Peterson





# Thanks!

hyungkim@snu.ac.kr

