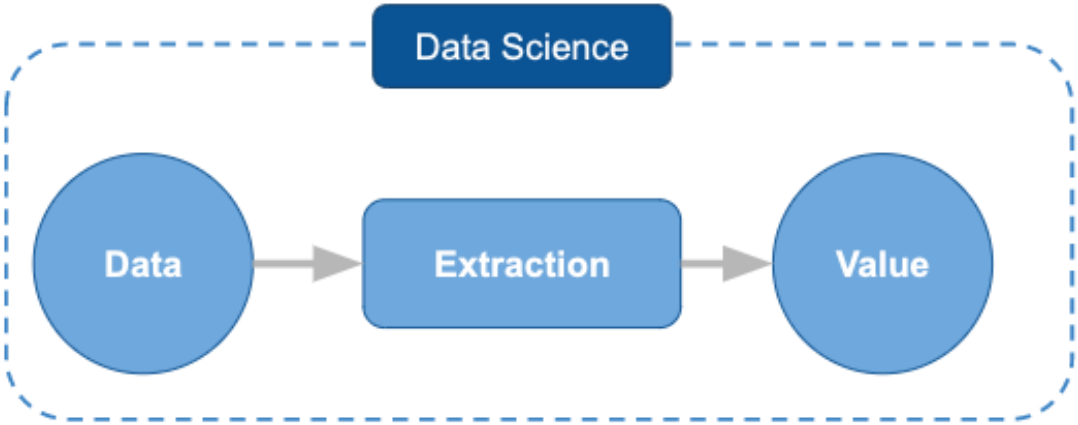
GR 5243/GU 4243
So you want to become a Data Scientist?

Lecture 1

September 5, 2019

What is Data Science?

Data science is the study of extracting value from data.



- Jeannette Wing

(Avanessians Director of the Data Science Institute)

What is data science?

Data Science represents a new approach to

Acquire knowledge,

Collect evidence,

Form decisions,

Make predictions.

The end points are:

knowledge, evidence, decisions and predictions.

Driven by breakthroughs in technologies.

Enabling faster solutions to traditional evidence-based practices.

Creating solutions that would not be otherwise possible.

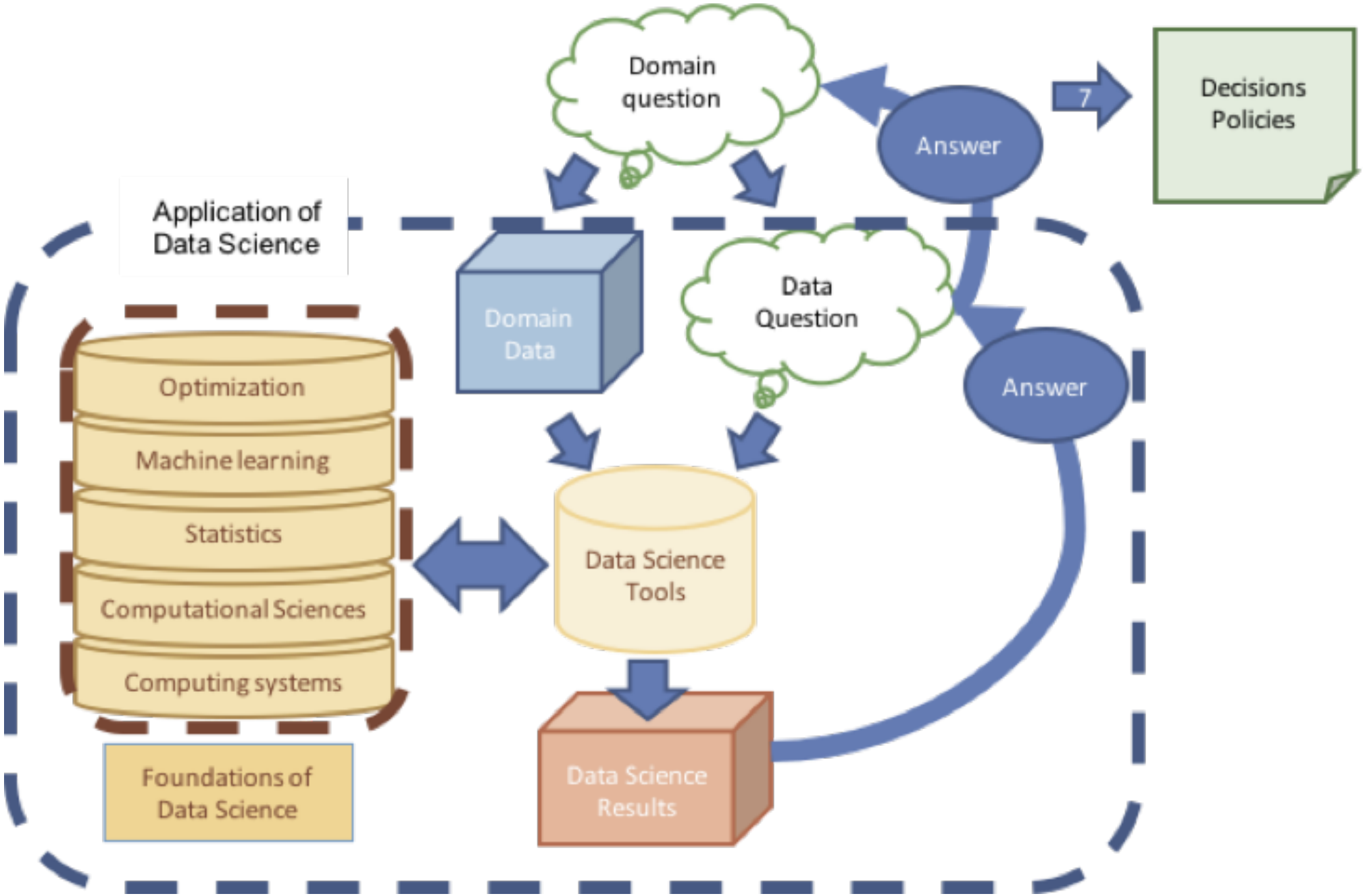
Foundations of data science

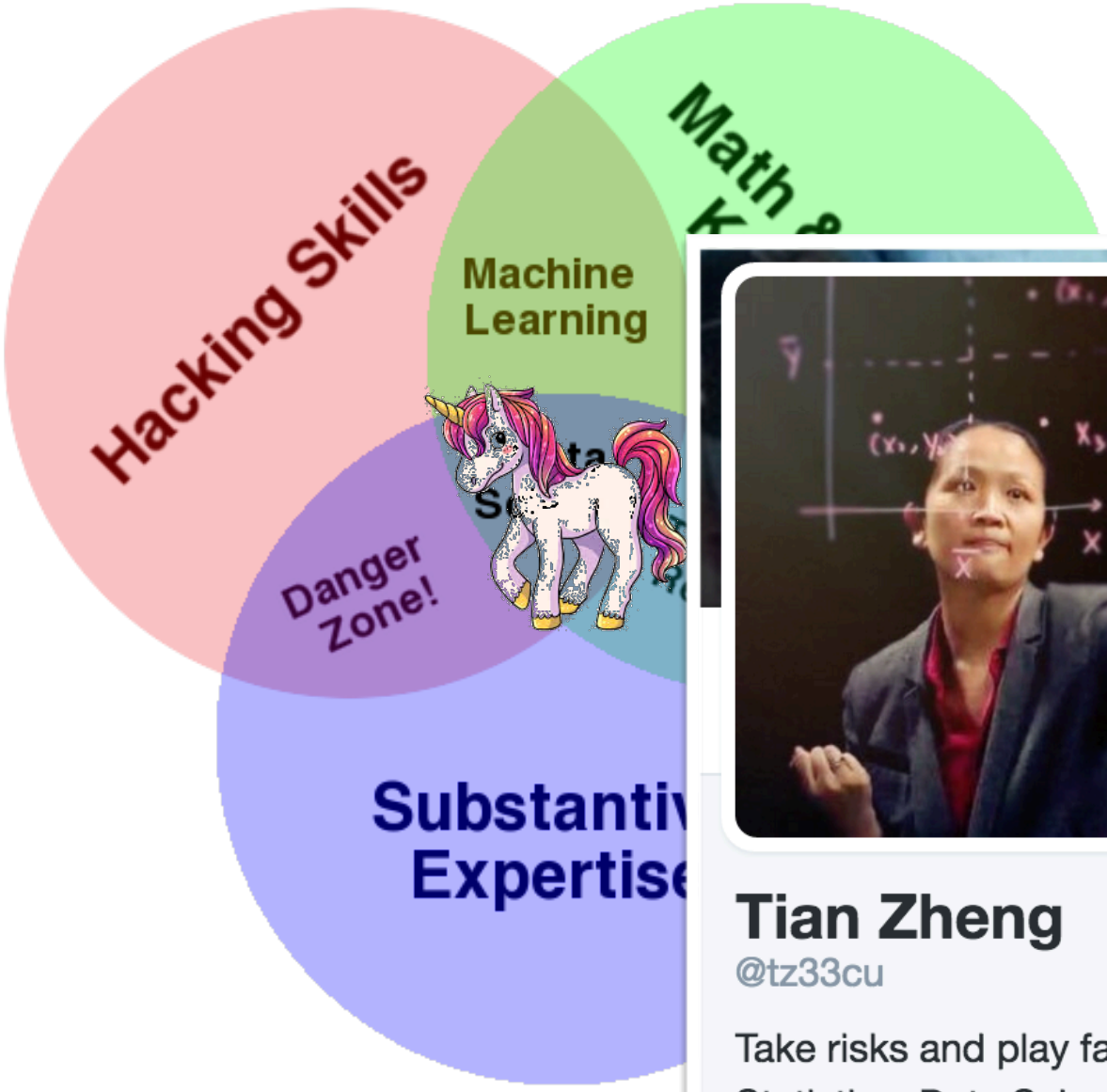
Data engineering - handling data

Software engineering - creating solutions

Machine learning - extracting values

Statistics - dealing with uncertainty, biases; formalize data questions; quantifiable measures of success.


Domain question
Answer
?
Decisions Policies
Application of Data Science
Domain Data
Data Question
Answer
Optimization
Machine learning
Statistics
Computational Sciences
Computing systems
Data Science Tools
Data Science Results
Foundations of Data Science



Tian Zheng

@tz33cu

Take risks and play fair. Professor of Statistics, Data Scientist, Unicorn Trainer, Columbia University. An Asian Mom on us.nyc.uws.

Skills listed in job postings on indeed.com

http://www.kimberlycoffey.com/blog/2016/11/text-analysis

What would be the most useful skill(s)?

Data Science Skill Set

How to **think** about data versus problem:

Mathematics/Statistics/Machine Learning

How to **handle** data

- **Technologies: R/Python, Java, Hadoop, Spark, etc**

Teamwork and collaboration skills - how to **work** with others.

How to turn data into business intelligence:

find **value** in your data

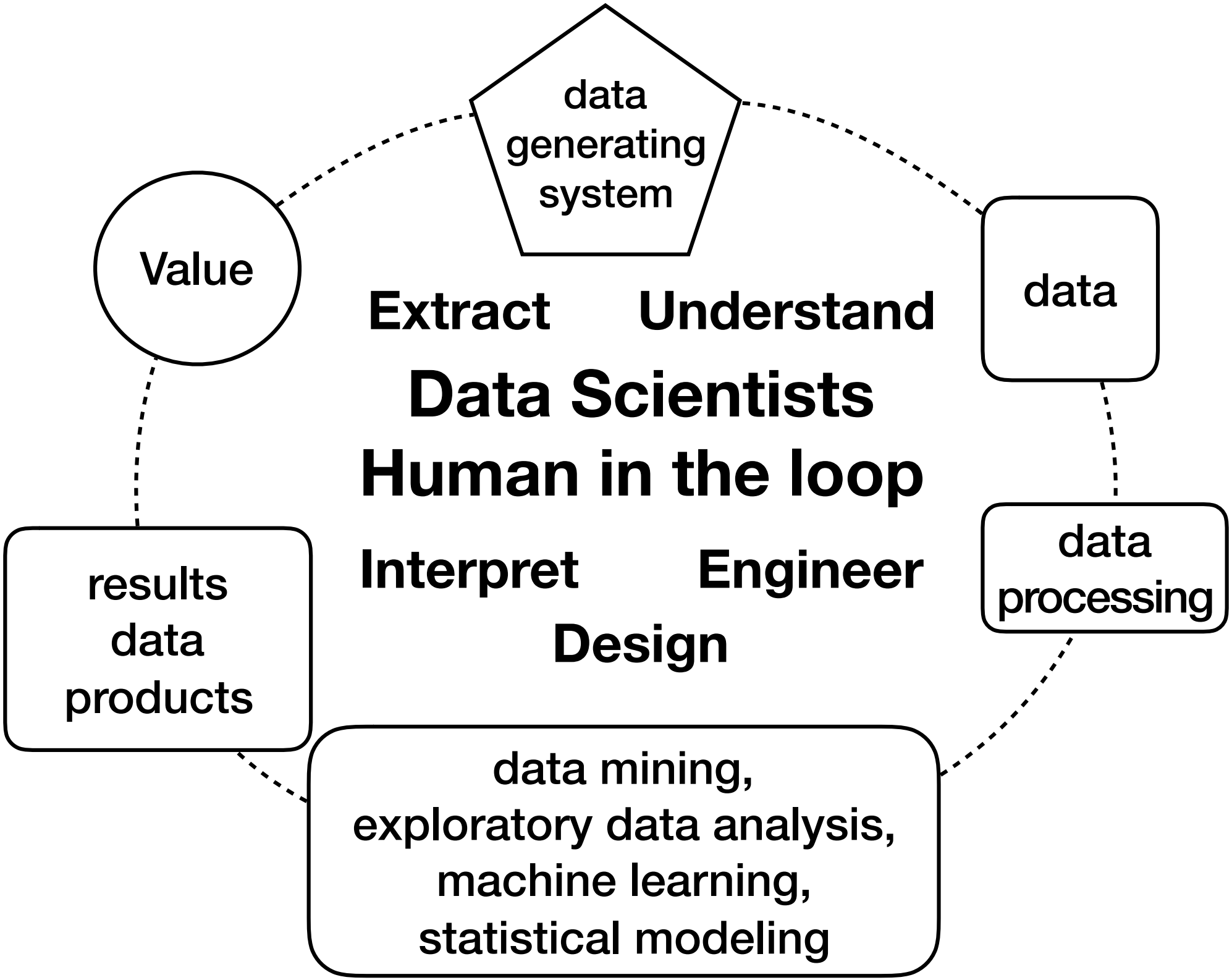
Innovation, intellectual curiosity

Problem-solving skills

How to convince others about your data science results

Visualization, story telling

Communication skills


data generating system
Value
data
Extract
Understand
Data Scientists
Human in the loop
Interpret
Engineer
Design
results data products
data processing
data mining, exploratory data analysis, machine learning, statistical modeling

How this course can help

No formal instruction on statistics/machine learning topics.

Not intended to be a comprehensive data science bootcamp.

Project-based course. Learning by doing.

Project-based learning

- **Problem identification via teamwork and discussion.**
- **Problem solving by using existing skills or new skills, learn new things “on the job”, and learn from your peers.**
- **Present your codes, your results and your story (try to sell them).**
- **There will be things I cannot answer but let’s learn together.**

Stay Hungry. Stay Foolish.

-Steve Jobs

Project-Based Learning

Project-Based Learning Integrating 21st Century Skills

Learning Objectives

Become self-directed learners

Develop problem-solving skills

Teamwork skills: collaboration, reasoning and communication

Self-assessment skills

Presentation and critique skills

“Initial stimulus” and experience for more fun in data science.

Student-centered Approach

I am not to lecture here but to facilitate active learning.

I will design open-ended challenges, each of which focuses on a slightly different area in data science.

In each challenge,

- Start with information/knowledge we already have (maybe not you but your teammate) about the problem.
- Identify knowledge/skills we need to solve the problem.
- Articulate the above thinking process in a team and implement an inquiry as a team

I will provide case studies and tutorials to provide guidance on aspects of the above processes.

Communication is everything

Channels of Communication

During class time

- Brainstorm
- Ask questions during tutorial

Before and after classes

On Piazza (*show piazza*)

Office hours

- Mondays, by appointments (Room 1004 SSW)
- Online Q&A (live or not)

The ADS learning system

Courseworks: grading, peer reviews, official announcements

Piazza: discussion, Q&A

GitHub: where the projects are hosted

Group Projects

Working Together

You don't have to be in the same room at the same time to work together.

Here are several ways you will work together in this course

- Face-to-face brainstorm
- Online discussion in group forum
  - **Slack/wechat is good for brainstorm but not good for assign tasks. Keep notes and project updates in Piazza or GitHub**
- Online video chat (say, via Google Hangout, or zoom) with screen share.
  - Have someone take notes and post to Piazza for each of such sessions. The team need to be "on the same page."
- **GitHub collaboration**

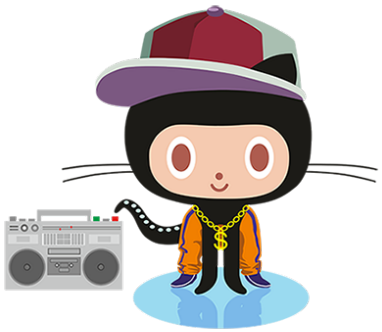
Learning is not a zero-sum game.

Learning on GitHUB

This semester we will use Classroom for GitHub

It allows the instructor to create parallel private repositories for groups to collaborate.

Project Assignment



starter repo → assignment

private

starter repo

private

starter repo

Please **create or join** ‘sec2proj4_grp5'
on GitHub through the link:
https://classroom.github.com/g/IsaeHfSQ

Project Assignment

Teacher creates starter code folder

Teacher creates groups with group numbers (off GitHub)

Teacher shares the group info with students (especially group nubmer) on Piazza

Teacher create assignments (private) and set the option for “new set of groups”

Send invitation link to students with instruction

> First, check whether your teammate already created a team for your group from the “Join an existing group”.
>
> If you cannot find your group’s name (as assigned in the Excel name), please create the team using precisely the name specified in the Excel file.

The Project name and membership can be managed later but the most important part is we get all the teams/groups set up automatically.

Everyone from your team should install Git, GitHub Desktop and use Git with Rstudio.

Let’s take a quick look at the syllabus

Applied Data Science

Tutorial 1: reproducible data analysis

Improve Reproducibility

Setup project folder

Documentation

Project history and source control

Project Setup

Rstudio really makes it easy to keep track of a project.

First, identify a working folder.

Inside the working folder, create the following subfolders.

data: data used in the analysis. Read only

doc: the report or presentation files

figs: contains the figures. only contains generated files. Images used for report should be put in a separate image folder under doc.

lib: various files with function definitions (but only function definitions - no code that actually runs).

output: analysis output, processed datasets, logs, or other processed things. only contains generated files.

Use Git for version control

Use knitr for reproducible data analysis

knitr is an R package that processes R markdown files.

An R markdown file follows the markdown syntax and contains R code blocks.

An R markdown file can be “knitted” into either a html page or PDF document that reproduces a data analysis.

It shows both the code *chunk*s and the results produced.

One can also include seamlessly project discussion, method section (with LaTeX support) and results discussion.

It should be viewed as a data analysis documentation, rather than a report though, as the analysis needs to presented in a chronological order.

DPLYR

Data manipulation using five key verbs

- filter
- select
- mutate
- arrange
- summarise

along with "by group" adverb.

Now lets look at Project 1

Project description
- *what you need to do*

Coursework assignment
- *how you will be evaluated*

Project starter codes
- *how you can get started*