
# So you want to become a Data Scientist?

Lecture 1

September 20, 2018

# 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
- Software engineering
- Machine learning
- Statistics

Domain question

Answer

7

Decisions Policies

Application of Data Science

Domain Data

Data Question

Answer

Optimization

Machine learning

Statistics

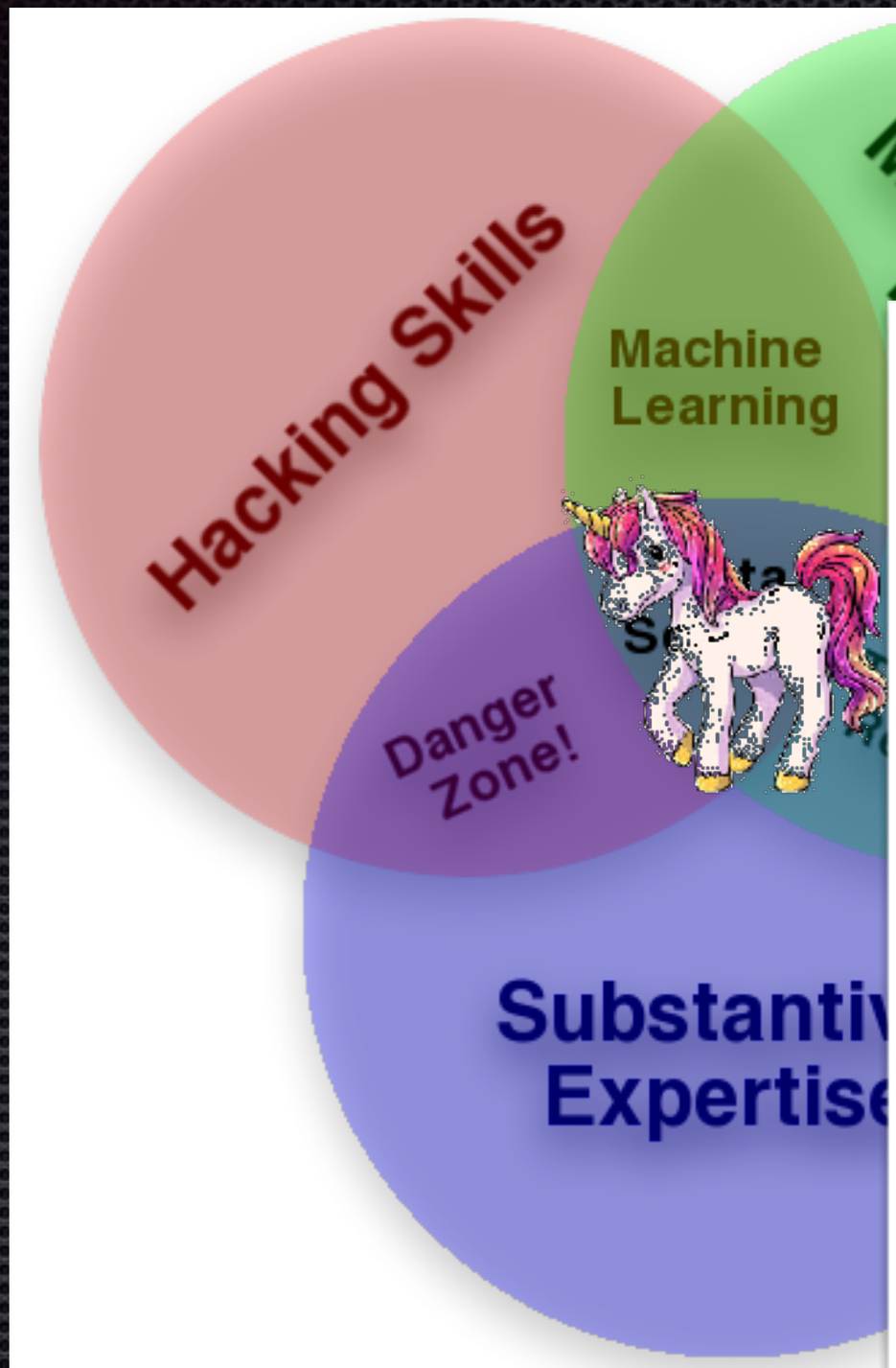
Computational Sciences

Computing systems

Data Science Tools

Foundations of Data Science

Data Science Results

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

# Data Science Skill Set

- How to **think** about data versus problem:
  - Mathematics/Statistics/Machine Learning
- How to **handle** data
  - **Technologies: 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

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

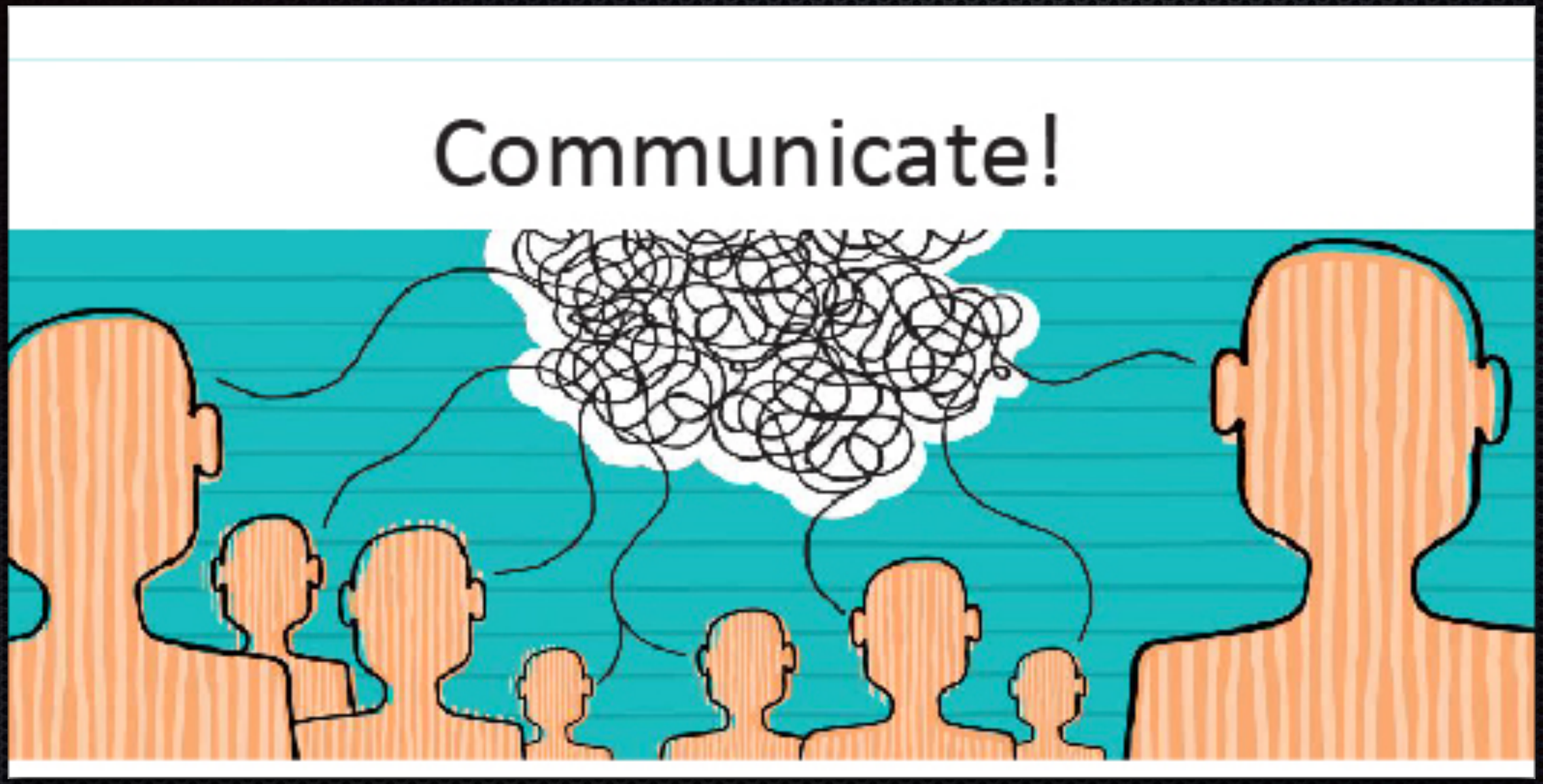
# Project-Based Learning Integrating 21st Century Skills

# 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
  - In person: Mondays 1-2pm (Room 1007 SSW)
  - Online Q&A (live or not)
  - By appointments (cannot afford to do it too often)

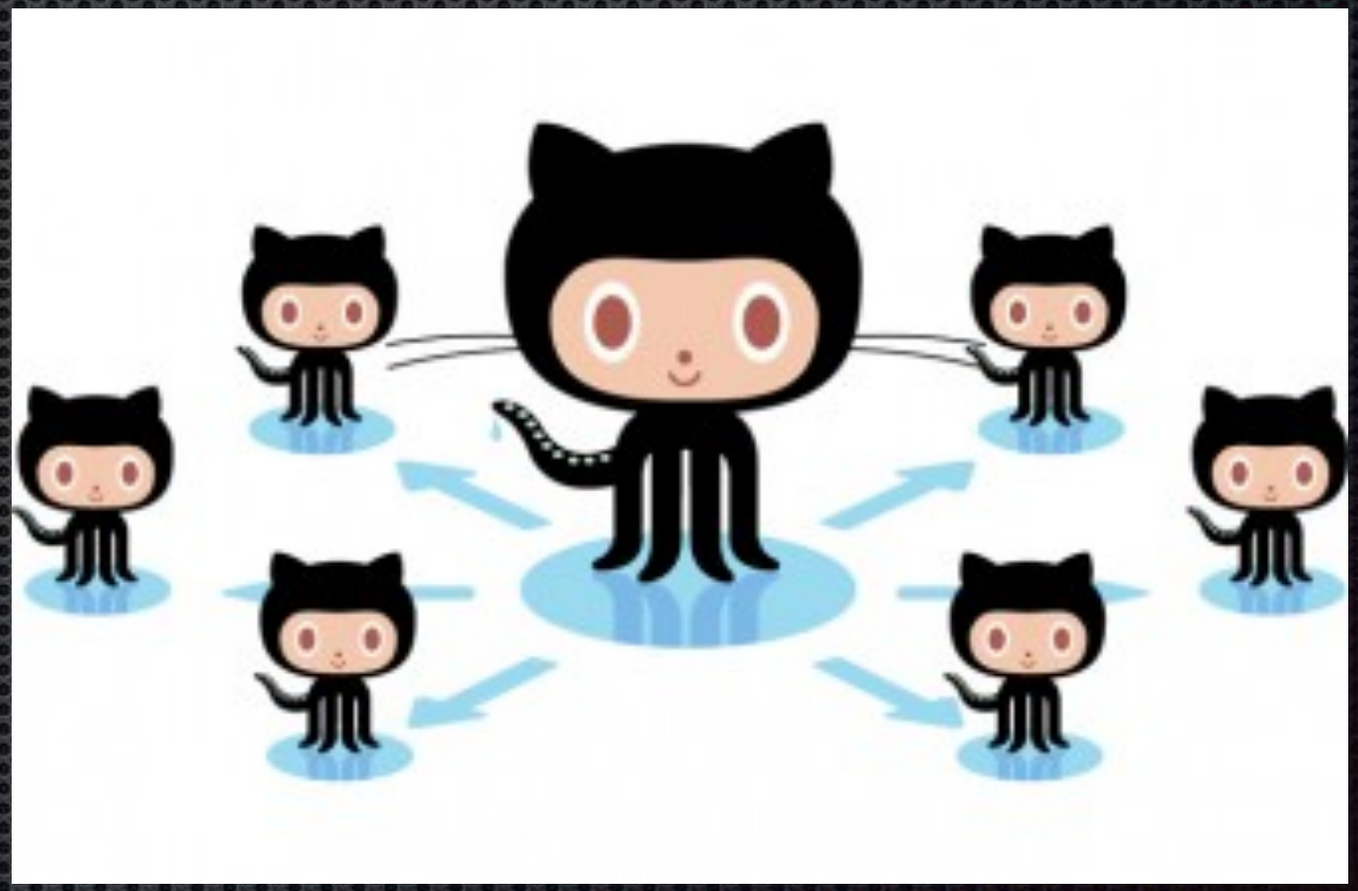
# Group Projects

# 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) with screen share.
  - **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 → Invitation

**private**

starter repo

**private**

starter repo

# 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.

# 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