SO YOU WANT TO BECOME A DATA SCIENTIST?

Lecture 1

January 20, 2016

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 turn data into business intelligence
  - Innovation, intellectual curiosity
  - Problem-solving skills
- How to convince others about your data science results
  - Visualization, story telling
  - Communication skills

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.

Communicate!

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 12-1pm (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
  - 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

PROJECT ASSIGNMENT

- Teacher creates starter code folder
- Teacher creates groups with group names (off GitHub)
- Teacher shares the group info with students (especially group names) 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

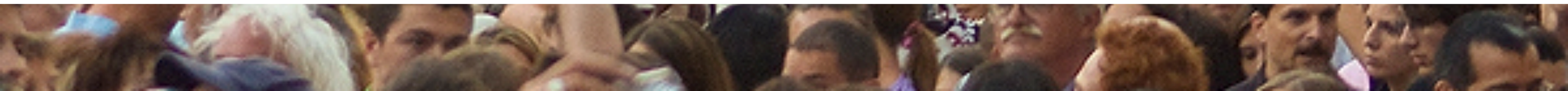
- knitr is an R package that processes R markdown files.
- An R markdown file follows the markdown syntax and contains R code blocks.
- An R markdown file can be "knitted" into either a html page or PDF document that reproduces a data analysis.
- It shows both the code *chunks* and the results produced.
- 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.

2013 AMERICAN COMMUNITY SURVEY

A Kaggle Script Learning Experience



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The American Community Survey (ACS) is an ongoing survey that provides vital information on a yearly basis about our nation and its people.

- *censur.com*

KAGGLE DATASET ON ACS 2013

- Hosted on kaggle
- Can be directly analyzed using Kaggle Scripts
- 700+ scripts posted.
- Data can be downloaded or can be analyzed online

UNDERSTAND THE DATA

- ACS Guide, especially on
  - data collection
  - data subjects
- ACS Data dictionary
- Kaggle dataset description