Introduction to Data Science

Stat 220 Bastola

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Something about me

- First year at Carleton
- Originally from Nepal
- PhD in Applied Statistics from UC-Riverside
- Diverse education background
- Avid learner and traveler

Figure 1: Me without mask

COVID-19 related policies

- Stay home when sick. (Even if you don't have COVID-19, you should stay home if you aren't feeling well.)
- Follow CDC on testing, quarantine, and isolation.
- Follow the College mask-wearing policy

What is data science?

Data Science:

- the science of extracting meaningful information from data

> *Computer science is more than just programming; it is the creation of appropriate abstractions to express computational structures and the development of algorithms that operate on those abstractions. Similarly, statistics is more than just collections of estimators and tests; it is the interplay of general notions of sampling, models, distributions, and decision-making. [Data science] is based on the idea that these styles of thinking support each other. - Michael Jordan, UC Berkeley*

Data Scientist

The "data scientist" mashup:

- "The definitions of data science are converging around the intersection of mathematics, statistics, and computer science—with some area of application (e.g., finance, biology, political science)."
- "I have heard data scientists referred to equally as
  - 'the computer scientist who was the best of his peers in his statistics courses' and
  - 'the statistician who was the best of his peers in his computer science courses."'
- Jennifer Lewis Priestley Data Science: The Evolution or the Extinction of Statistics?

Data Science Education

- Many schools now offer degrees in some form of data science (data analytics)
- A B.S. (or Masters) in Data Science includes courses like:
  - Intro Stats, Intro Programming, Intro Data Science
  - Regression (modeling)
  - Machine Learning, Data mining
  - Database management
  - Data visualization
  - Big Data
  - Applications (econ, poli sci, bio)
  - Ethics

Stat 220: Data Science

Focus on the "soup to nuts" approach to problem solving

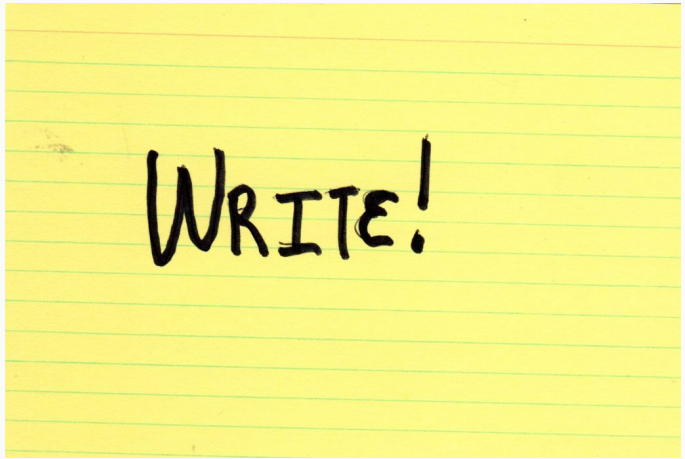
- data wrangling
  - reshaping, cleaning, gathering
- learning from data
  - EDA tools
  - statistical learning methods
  - network data, spatial data
- communication
  - reproducibility
  - effective visualization

How to make friends and succeed in Data Science?

1. *Actively follow along!* RMarkdown documents will be provided for you each week - use these to take notes and run code "live" in class.
2. *Ask questions!* This is new for everyone, no question is a bad question.
3. *When you don't know if something will work, try it!* Experimentation is key in this class.
4. *BRING YOUR LAPTOP.* Charged, everyday.

Tell me something about yourself

- Your name?
- Gender Pronouns?
- Why are you interested in data science?
- Rate your R Skills from 1 to 10.



Class Instruction

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# Main Course Webpage for Instruction
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https://deepbas.io/courses/stat220/

- Bookmark this page
- Should be checked multiple times a day

Collaborative notes

- Each day, two of you will collaborate on notes to share with the class
- Creates a crowd-sourced version of what we do in class
- Helps anyone who needs to miss class
- You'll do this 3x throughout the course
- Sign up here
- Notes are due 24 hours after class, count as a HW assignment

Necessary skills to be mastered

- programming with data
- statistical modeling
- domain knowledge
- communication

Why aren't we learning Python?

When Hadley Wickham was asked "Why R?"

> *And the second reason, which is both a huge strength of R and a bit of a weakness, is that R is* ***not just a programming language****. It was designed from day 1 to be an* ***environment that can do data analysis****. So, compared to the other options like Python, you can get up and running in R doing data science, learning much, much less about programming to get started. And that generally makes it like* ***easier to get up and running if you don't have formal training in computer science or software engineering****.*
> *-Hadley Wickham, Advice to Young (and Old) Programmers: A Conversation with Hadley Wickham*

Using R Markdown for data science

- You will use R Markdown for all work in this class
- A Markdown (`.Rmd`) file contains
  - R code
  - written answers, description of results, report, etc.
- The Markdown file is `knit` to generate an output document
  - pdf, html, word
  - presentations (html, beamer pdf)
  - dashboards, interactive graphics (html)
- Markdown is designed for **reproducibility**!
- The slides I produce for this class are R Markdown's `beamer`

Data Science in a nutshell

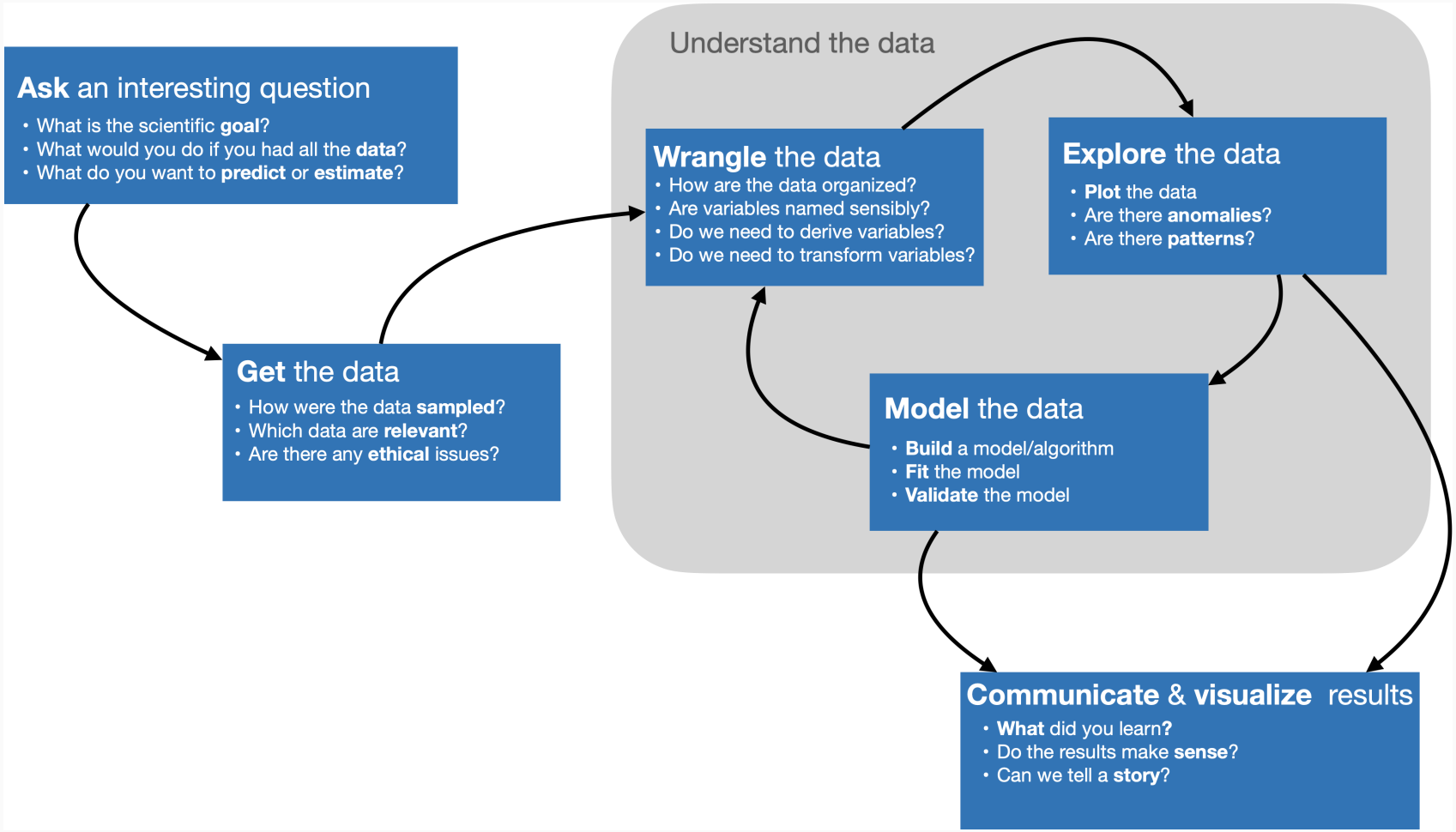
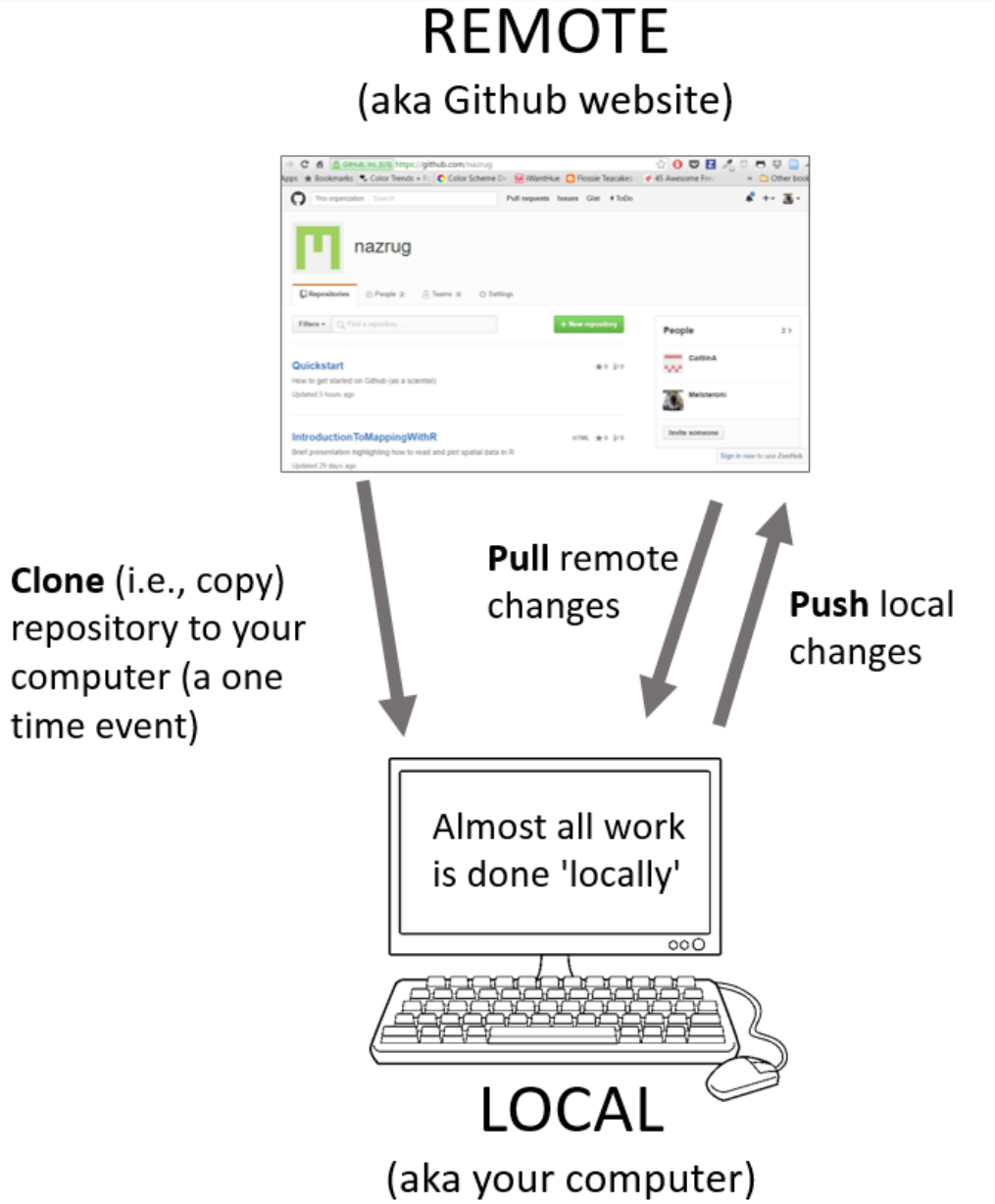


Image adapted from work of Joe Blitzstein, Hanspeter Pfister, and Hadley Wickham

Version Control using Git and GitHub

- Git doesn't automatically track changes the way a tool like Google Docs does
- Starting with GitHub and going to Rstudio is easier for beginner
- Do commit, push, pull until you get used to it!
- Commit: Telling Git that you made changes
  - can be done from within RStudio

The Git cycle



Source:
http://ohi-science.org/data-science-training/

Using GitHub and Rstudio for data science

- Rstudio lets you create git controlled projects
  - create a GitHub repo
  - make a Rstudio project using your cloned repo
  - edit/create files (.rmd, .r, .csv, . . .)
  - **commit** changes to your local computer using git
  - **push** changes to the GitHub repo (online)
  - **pull** changes made by others to your computer

What will a typical day/week look like?

Before class:

- Some reading/video to introduce some topics
- Work on homework/projects, come with questions

During class:

- Mini lectures
- Hands-on programming

Setup Guides

- What you need to do
  - read the Rstudio for Stat220 page
  - read the GitHub for Stat220 page
  - read the Software for Stat220 page

For rest of the class

- In Maize or on your laptop: make sure you have a `test-assignment` R project and a `course-content` R project.
- Work on the `test-assignment.Rmd` file in the `test-assignment` repo
  - Ask me questions
  - By class time Friday, push your completed `test-assignment.Rmd` and `test-assignment.md` files to GitHub.
  - Worth 10 points toward homework score. (5/10 for successful push to GitHub!)