First Year Project, Spring 2021

Lecture 1: Introduction, Logistics, Project 1

Instructor: Michael Szell
Feb 5, 2021

Today I introduce you to the course and to Project 1

Course Logistics

Project 1 Motivation

Project 1 Data set first exploration

```
Accident_Index,Location_Easting_OSGR,Location_Northing_OSGR,Longitude,Latitude,Police_Force,Accident_Severity,Number_of_Vehicles,
Number_of_Casualties,Date,Day_of_Week,Time,Local_Authority_(District),Local_Authority_(Highway),1st_Road_Class,1st_Road_Number,Road_Type,
Speed_limit,Junction_Detail,Junction_Control,2nd_Road_Class,2nd_Road_Number,Pedestrian_Crossing-Human_Control,Pedestrian_Crossing-
Physical_Facilities,Light_Conditions,Weather_Conditions,Road_Surface_Conditions,Special_Conditions_at_Site,Carriageway_Hazards,
Urban_or_Rural_Area,Did_Police_Officer_Attend_Scene_of_Accident,LSOA_of_Accident_Location
2019010128300,526210,180407,-0.153842,51.508057,1,3,2,3,18/02/2019,2,17:50,1,E09000033,3,4202,1,30,1,2,3,4202,0,5,1,1,1,0,0,1,3,E01004762
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```
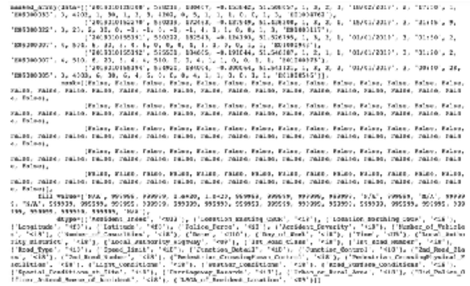
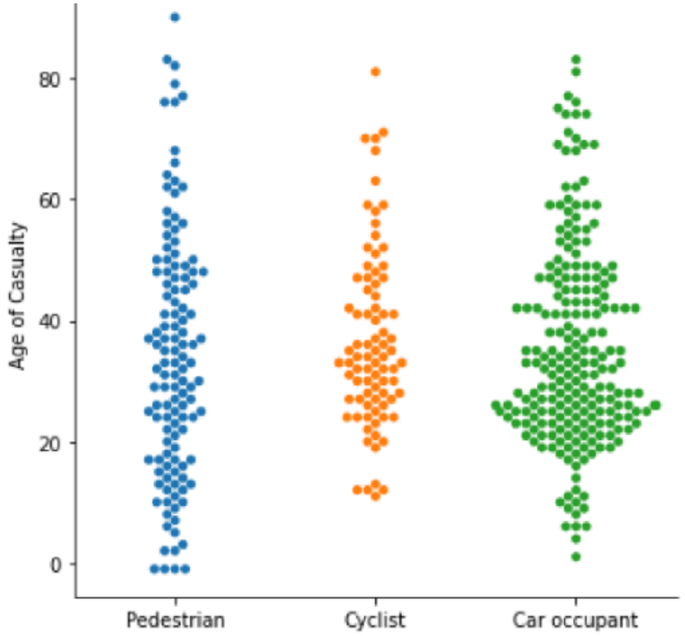

Example of new skills/tools you will learn in Project 1

`MaskedArray`
for data cleaning



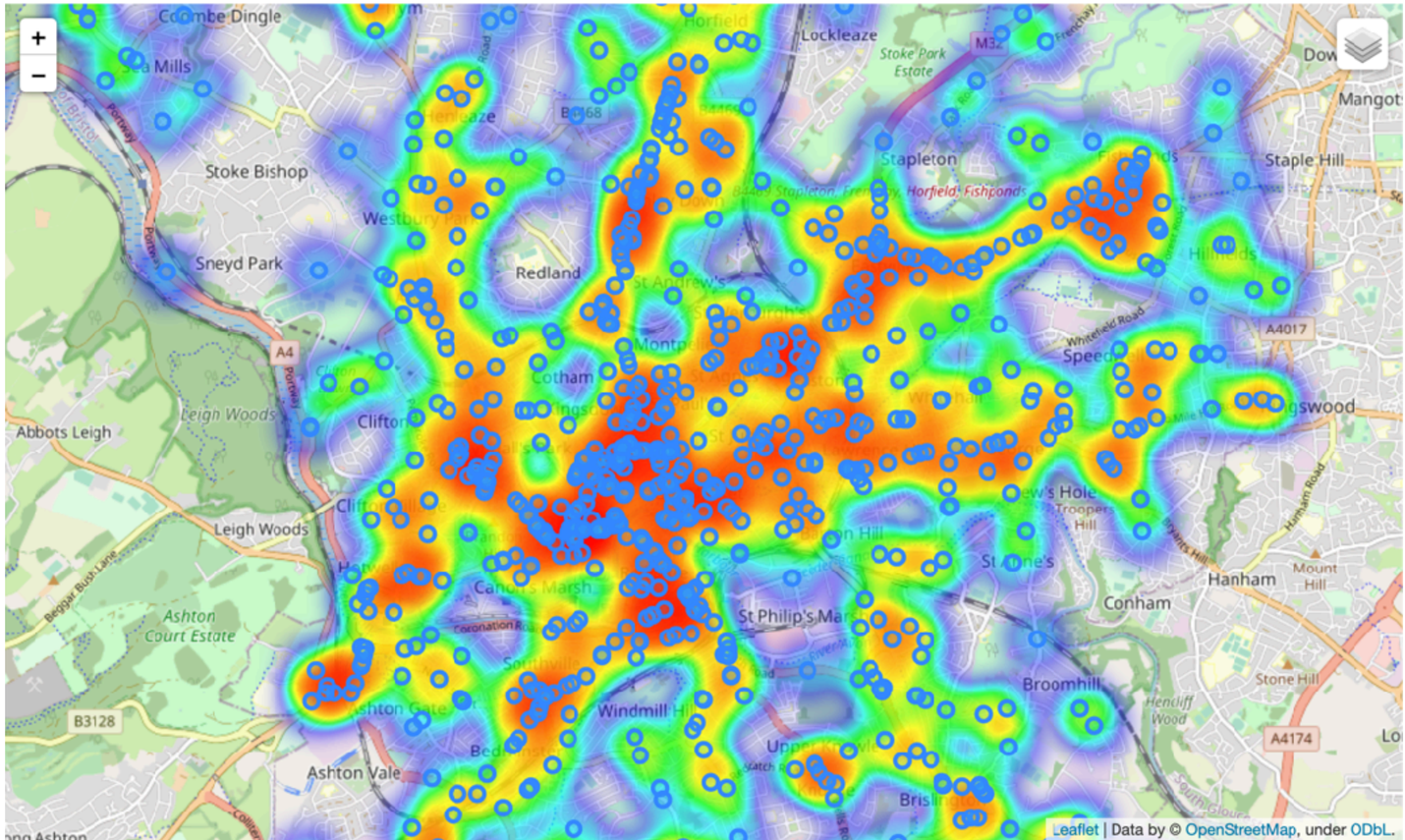
Pearson's test
of independence

$$\chi^2$$



Categorical scatterplots

`shapely` + `folium`
for spatial filtering and map visualization



Why this course?

You need hands-on experience (lectures and tutorials are not enough)

You need to work on *real-world* problems with *real-world* data

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Data sets
in tutorials

Data sets in
the wild

Why this course?

You need hands-on experience (lectures and tutorials are not enough)

You need to work on *real-world* problems with *real-world* data

You need to experience the whole data science pipeline:
- Problem formulation
- Data analysis
- Communication of results

Prepare you for group work with RANDOM people

After you have taken this course, you will be able to:

Develop code with a professional version control system (git)

Identify and discuss issues in a real data science project

After you have taken this course, you will be able to:

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Implement the whole data science pipeline:
- Problem formulation
- Data analysis
- Communication of results

Work with RANDOM people, be able to handle teamwork issues

What is going to happen?

You work on 4 data science projects from 4 diverse fields in groups of 5 over 4 months

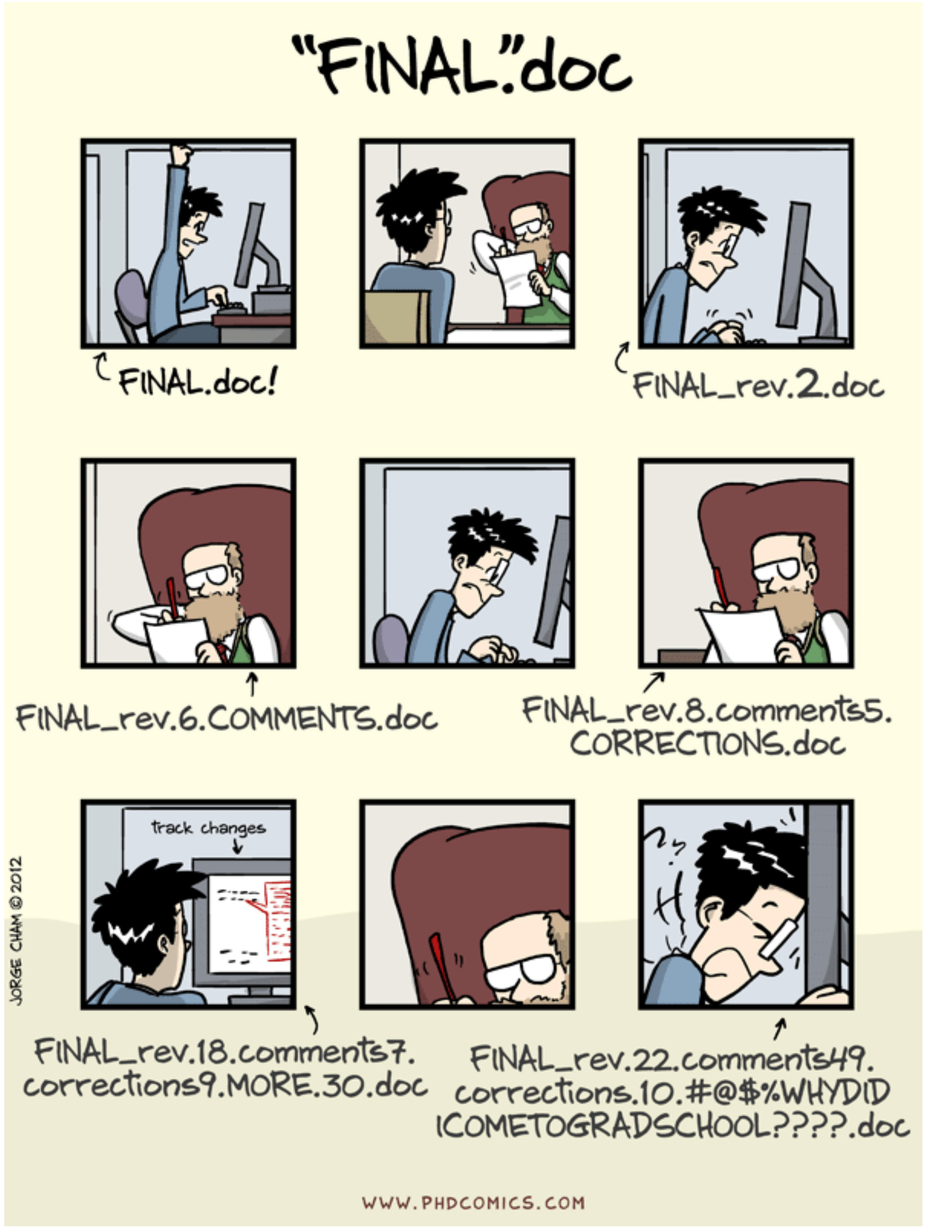
4 instructors, 4 TAs, 4 hand-ins, 2 exams

Questions

Get acquainted with git / GitHub

Git is a distributed version-control system for tracking changes in any set of files, originally designed to coordinate group work.

Similar systems: CSV, SVN, Mercurial



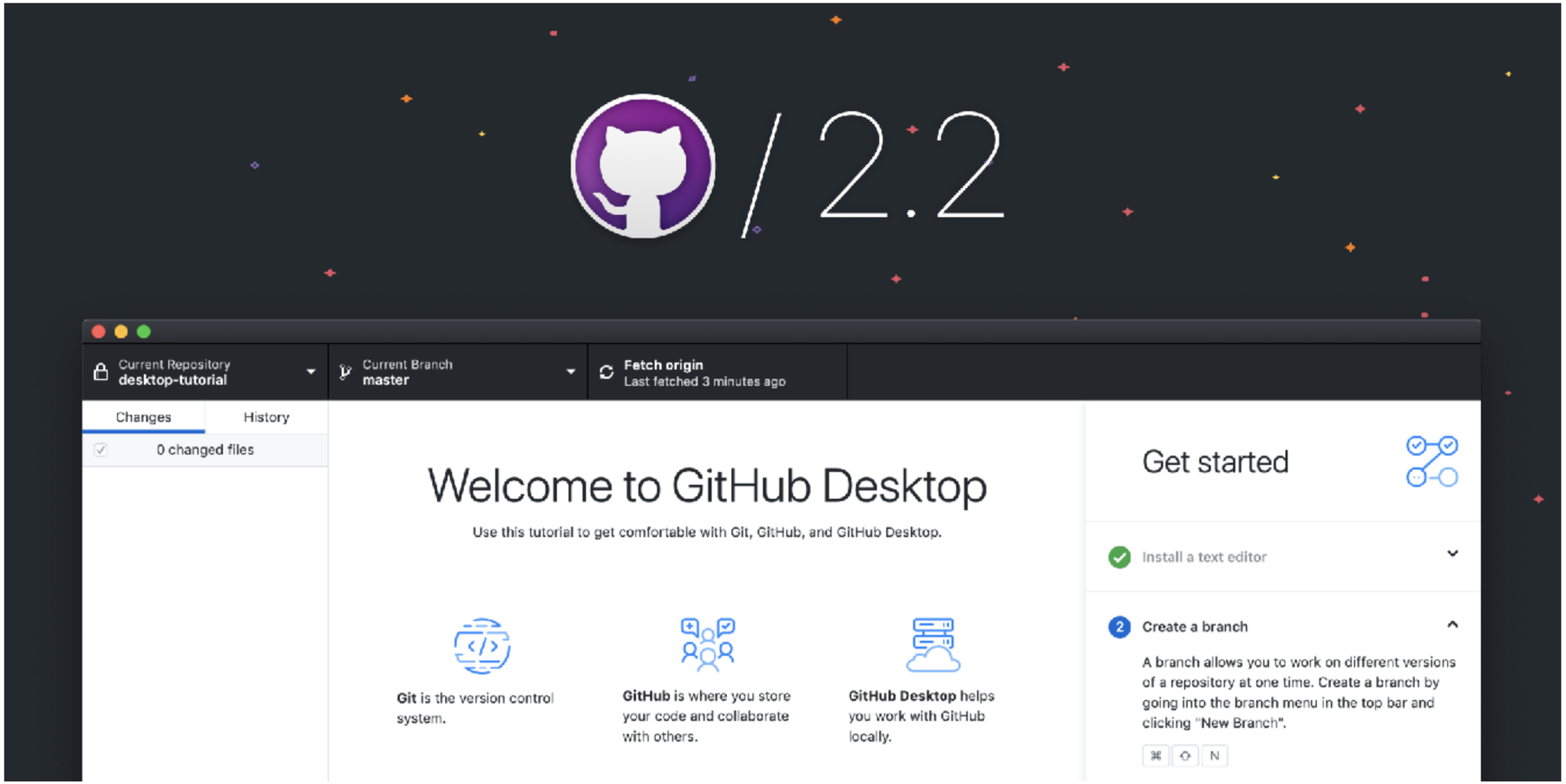
Get acquainted with git / GitHub

GitHub, Inc. is a subsidiary of Microsoft which provides hosting for software development and version control using Git

GitLab is a good alternative

Get acquainted with git / GitHub

GitHub Desktop is a Graphical User Interface (GUI) for Github



desktop.github.com

Let's get started with the project!

Before we delve into the project, you MUST get organized!

```
├── LICENSE
├── Makefile           <- Makefile with commands like `make data` or `make train`
├── README.md          <- The top-level README for developers using this project.
├── data
│   ├── external       <- Data from third party sources.
│   ├── interim        <- Intermediate data that has been transformed.
│   ├── processed      <- The final, canonical data sets for modeling.
│   └── raw            <- The original, immutable data dump.
│
├── docs               <- A default Sphinx project; see sphinx-doc.org for details
│
├── models             <- Trained and serialized models, model predictions, or model summaries
│
├── notebooks          <- Jupyter notebooks. Naming convention is a number (for ordering),
│                         the creator's initials, and a short `-` delimited description, e.g.
│                         `1.0-jqp-initial-data-exploration`.
│
├── references         <- Data dictionaries, manuals, and all other explanatory materials.
│
├── reports            <- Generated analysis as HTML, PDF, LaTeX, etc.
│   └── figures        <- Generated graphics and figures to be used in reporting
│
├── requirements.txt   <- The requirements file for reproducing the analysis environment, e.g.
│                         generated with `pip freeze > requirements.txt`
│
├── src                <- Source code for use in this project.
│   ├── __init__.py    <- Makes src a Python module
│   │
│   ├── data           <- Scripts to download or generate data
│   │   └── make_dataset.py
│   │
│   ├── features       <- Scripts to turn raw data into features for modeling
│   │   └── build_features.py
│   │
│   ├── models         <- Scripts to train models and then use trained models to make
│   │   │                 predictions
│   │   ├── predict_model.py
│   │   └── train_model.py
│   │
│   └── visualization  <- Scripts to create exploratory and results oriented visualizations
│       └── visualize.py
│
└── tox.ini            <- tox file with settings for running tox; see tox.readthedocs.io
```

Folder structure is not a science, but based on years of experience

Cookiecutter Data Science

https://github.com/drivendata/cookiecutter-data-science

Before we delve into the project, you MUST get organized!

```
├── LICENSE
├── Makefile           <- Makefile with commands like `make data` or `make train`
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├── docs               <- A default Sphinx project; see sphinx-doc.org for details
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│
├── references         <- Data dictionaries, manuals, and all other explanatory materials.
│
├── reports            <- Generated analysis as HTML, PDF, LaTeX, etc.
│   └── figures        <- Generated graphics and figures to be used in reporting
│
├── requirements.txt   <- The requirements file for reproducing the analysis environment, e.g.
│                         generated with `pip freeze > requirements.txt`
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│       └── visualize.py
│
└── tox.ini            <- tox file with settings for running tox; see tox.readthedocs.io
```

MUST haves:

- README.md
- Data: raw, interim, processed

- Notebooks / Code
- References
- Reports / Figures

Cookiecutter Data Science

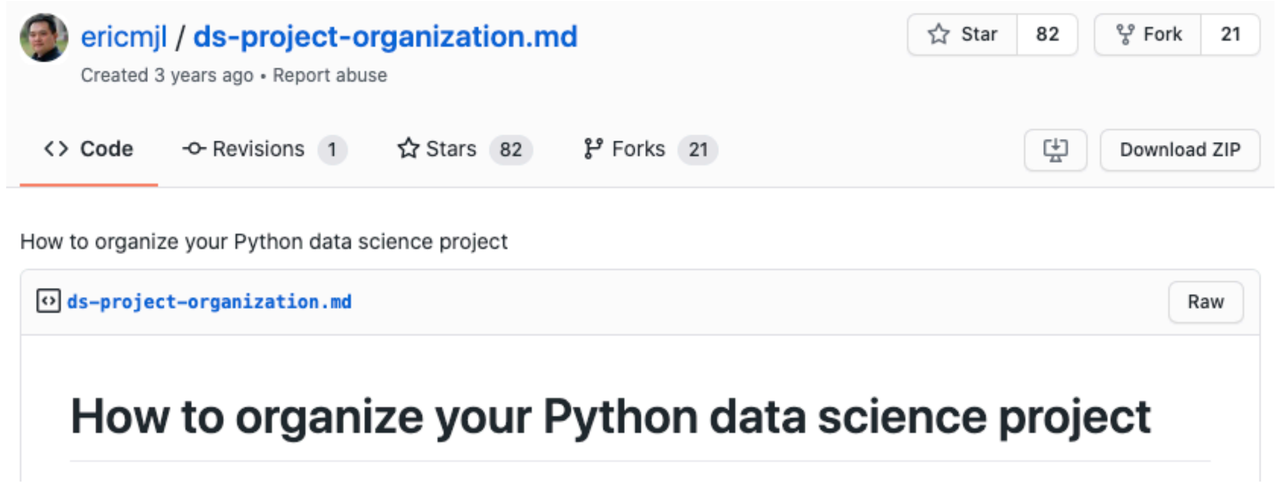
https://github.com/drivendata/cookiecutter-data-science

Before we delve into the project, you MUST get organized!

How to Create a Professional Github Data Science Repository

Good practices in repository structure, documenting jupyter notebooks, and writing an informative README

Ahilan Srivishnumohan Jul 25, 2020 · 7 min read ★



https://gist.github.com/ericmjl/27e50331f24db3e8f957d1fe7bbbe510

https://towardsdatascience.com/how-to-create-a-professional-github-data-science-repository-84e9607644a2

Data is usually NOT stored on Github

Github is for code and work documents, not data.

There are hard limitations: 100 MB files, 2 GB push, ~5 GB repo

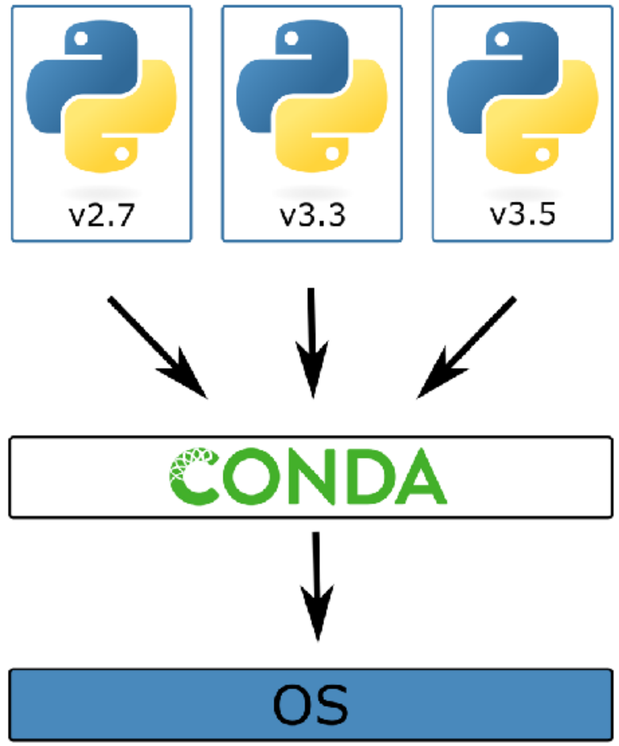
If you have hundreds of MB data, add the data folder to .gitignore

https://stackoverflow.com/questions/38768454/repository-size-limits-for-github-com

Advanced organization (not for this course)

In Data Sci, we use a virtual environment (venv) for each project

Why?



https://deparkes.co.uk/2016/10/21/anaconda-python-environments/

Advanced organization (not for this course)

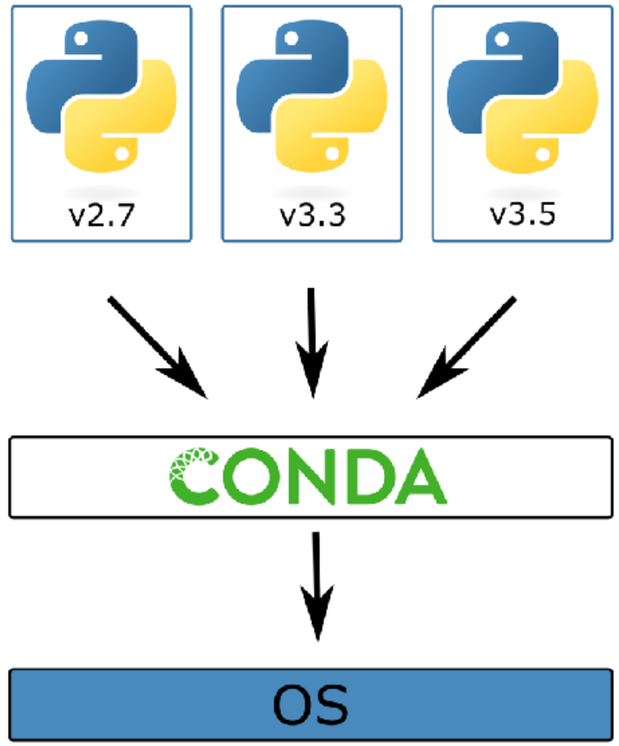
In Data Sci, we use a virtual environment (venv) for each project

Why?

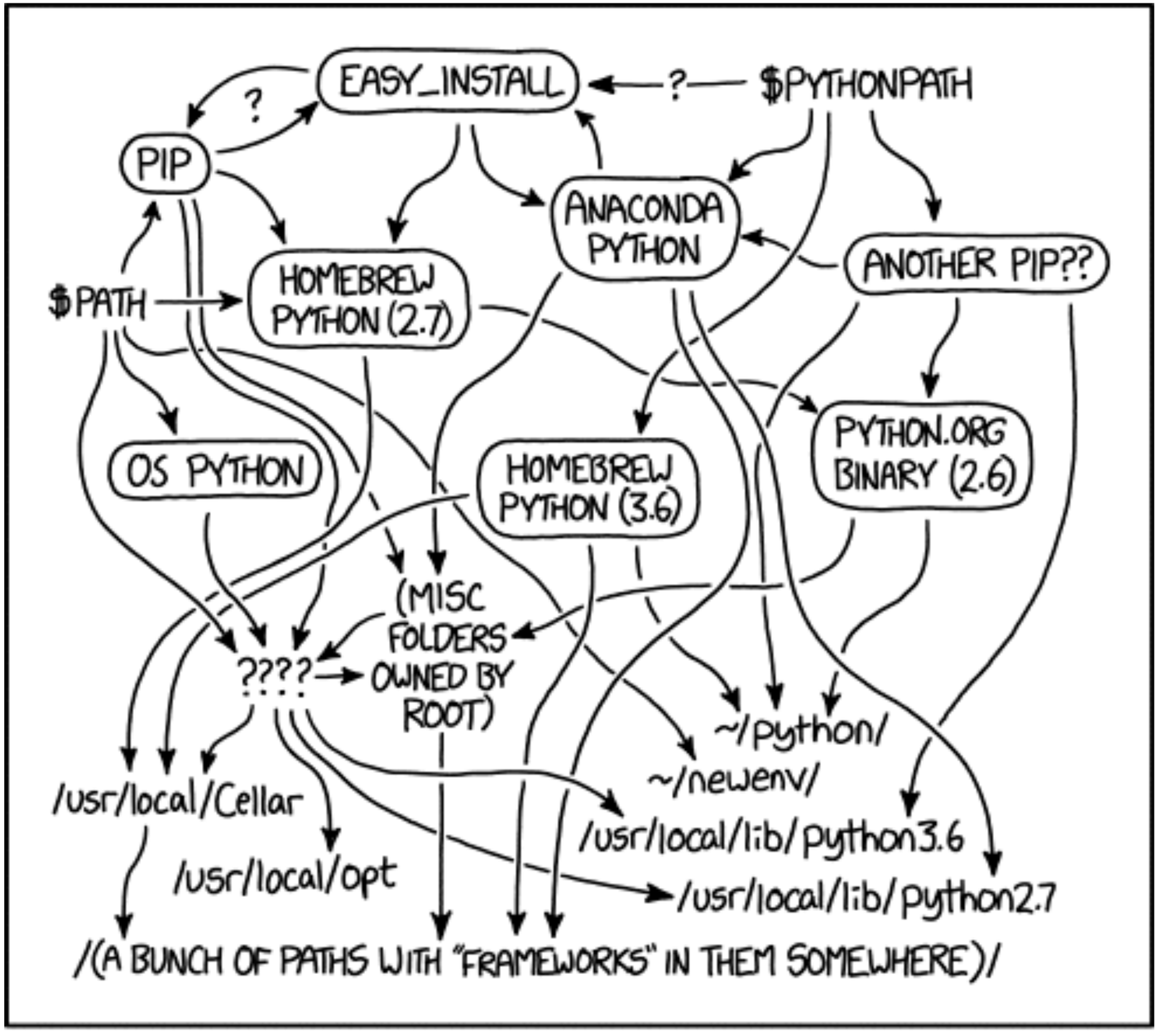
1) Reproducibility:

- Python changes all the time
- Python packages change all the time
- requirements.txt differ between projects

2) To not mess up your Python install



https://deparkes.co.uk/2016/10/21/anaconda-python-environments/



MY PYTHON ENVIRONMENT HAS BECOME SO DEGRADED
THAT MY LAPTOP HAS BEEN DECLARED A SUPERFUND SITE.

Advanced organization (not for this course)

requirements.txt

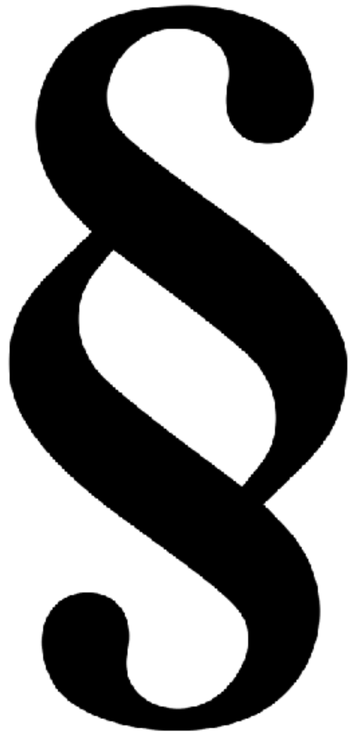
```
matplotlib>=3.3.3
numpy>=1.19.4
pandas>=1.0.3
pyproj>=2.6.1.post1
geojson>=2.5.0
shapely>=1.7.0
csv>=1.0
networkx>=2.5
igraph>=0.8.3
fiona>=1.8.18
osmnx==0.16.2
geopandas>=0.8.1
tqdm>=4.55.0
haversine>=2.3.0
```

```
pip freeze > requirements.txt
```

Advanced organization (not for this course)

LICENSE

If you publish your project, the license is the legal document telling others how they can use it.



No serious company will ever risk building on your code if you don't have a license.

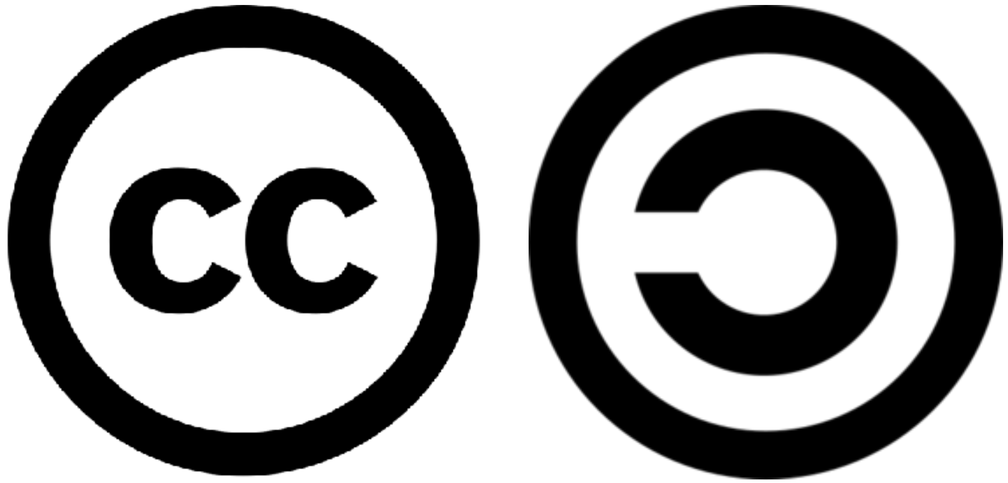
Advanced organization (not for this course)

LICENSE

If you publish your project, the license is the legal document telling others how they can use it.

Choose an established license, don't write it yourself.

Consider copyleft and creative commons to protect freedoms.



https://creativecommons.org/

https://www.gnu.org/philosophy/free-sw.en.html

https://softwareengineering.stackexchange.com/questions/47028/how-could-we-rewrite-the-no-evil-license-to-make-it-free

Advanced organization (not for this course)

DOCS

If you want others to use and build on your code, you need excellent documentation. It makes or breaks its success.

Expect investing >20% of the whole project time on docs.

Let's get started with the project! (for real)

Data set: Road collisions in the UK in 2019

data.gov.uk | Find open data

BETA This is a new service – your feedback will help us to improve it

Home > Department for Transport > Road Safety Data

Road Safety Data

Published by:	Department for Transport
Last updated:	08 January 2021
Topic:	Transport
Licence:	Open Government Licence

Summary

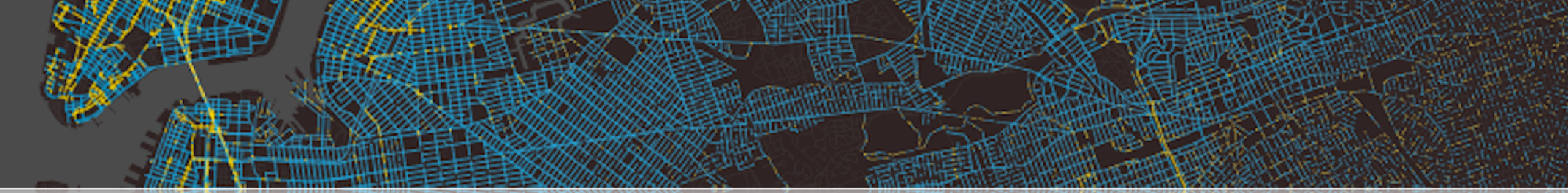
Road Safety Statistics releases

3 Data Tables

Metadata

https://data.gov.uk/dataset/road-accidents-safety-data

How many road deaths since 2000?



Overview: Urban / Spatial Data Science

In this project, you will complete tasks similar to data scientists working for a department of transportation or a city government, to inform city leaders about traffic fatalities and injuries, and give insights for urban/transport planning. You will explore a data set of all recorded road collisions in Great Britain in the year 2019 from the UK Department of Transport with details about the circumstances of personal injury.

The major parts of the project are:

- Exploring and transforming the data, making numerical and visual reports
- Connecting data tables (accidents, vehicles, casualties)
- Reporting possible statistical associations by filtering for a variety of attributes
- Visualizing the data on a map
- Involving self-downloaded/scraped external data sets in the analysis

Project Tasks

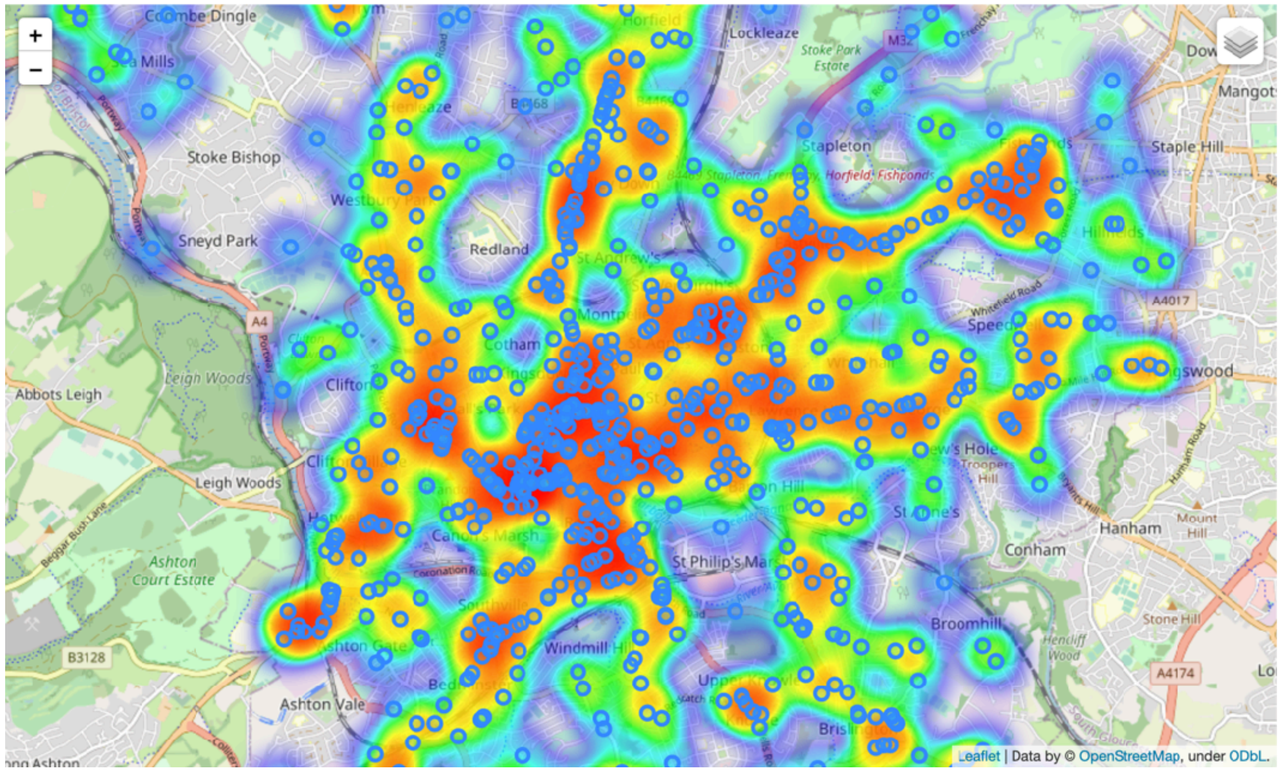
0) **Data filtering and cleaning**

1) **Single variable analysis**

2) **Associations**

3) **Map visualization**

4) **Open question**



Details: project01_description.pdf

Project Hand-in

Hand-in 1) a report, 2) your code (Jupyter), 3) the git log.
In your report you analyze the data set answering specific research questions.

Your group's **github repo** `fyp2021p01gXX` must document your whole process.

All Python packages allowed, including pandas. **Comment** your code assuming the reader has no knowledge of such extra packages.

Details: project01_description.pdf

Hand-ins: What is important

Argue for your choices of data/analysis, **explain** your decisions/results

is much more important than:

Size of data set, number of results/analyses/methods

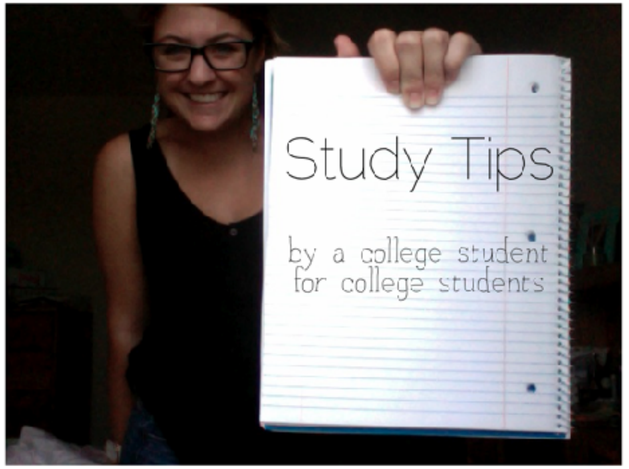
10 min: Explore the data (in any way you like)

Then: give first impressions

Jupyter

Tips that past students give you

- “Don’t spend too long on literature in the beginning”
- “Make a plan, especially for time away from campus”
- “Start coding early”
- “Don’t be afraid to try things out”
- “You can do it even if nobody has programmed before!”



Tips I give you

- “Group meet 2+ times / week, starting this week”
- “Work on the project every week (1-2 tasks/week)”
- “Start with a "shitty first draft" report >1w before deadline”
- “Google/Stackoverflow is your friend”
- “Ask on LearnIT! There are no stupid questions”

Sources and further materials for today's class

https://creativecommons.org/

https://www.gnu.org/philosophy/free-sw.en.html

https://softwareengineering.stackexchange.com/questions/47028/how-could-we-rewrite-the-no-evil-license-to-make-it-free

https://data.gov.uk/dataset/road-accidents-safety-data

https://gist.github.com/ericmjl/27e50331f24db3e8f957d1fe7bbbe510

https://towardsdatascience.com/how-to-create-a-professional-github-data-science-repository-84e9607644a2

https://github.com/drivendata/cookiecutter-data-science

https://deparkes.co.uk/2016/10/21/anaconda-python-environments/

https://www.oreilly.com/library/view/python-for-data/9781449323592/ch04.html