Geographic Data Science Studio

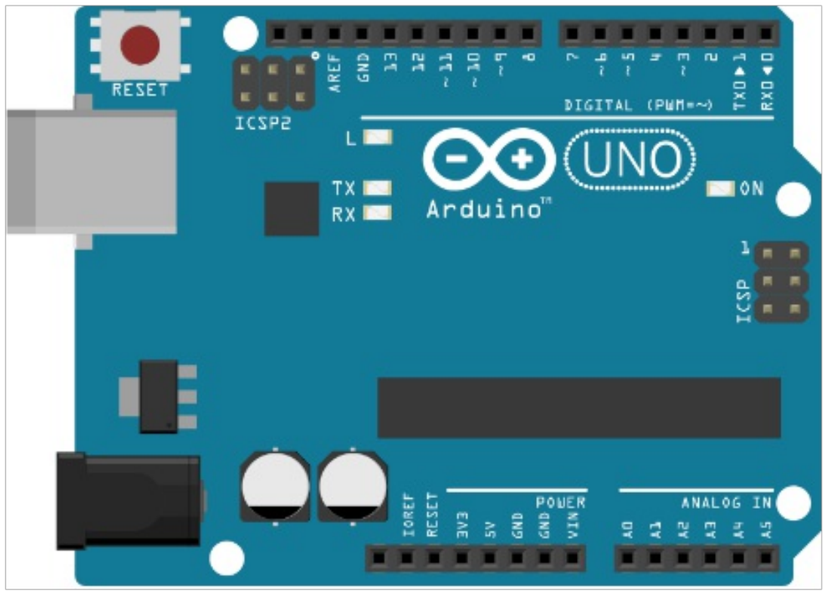
Dani Arribas-Bel

- *Why* Data Science?
- *What* is Data Science?
- This course

Why?

Data, data, data

OPEN DATA


RESET
ICSP2
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2
TX→1
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A5
ANALOG IN


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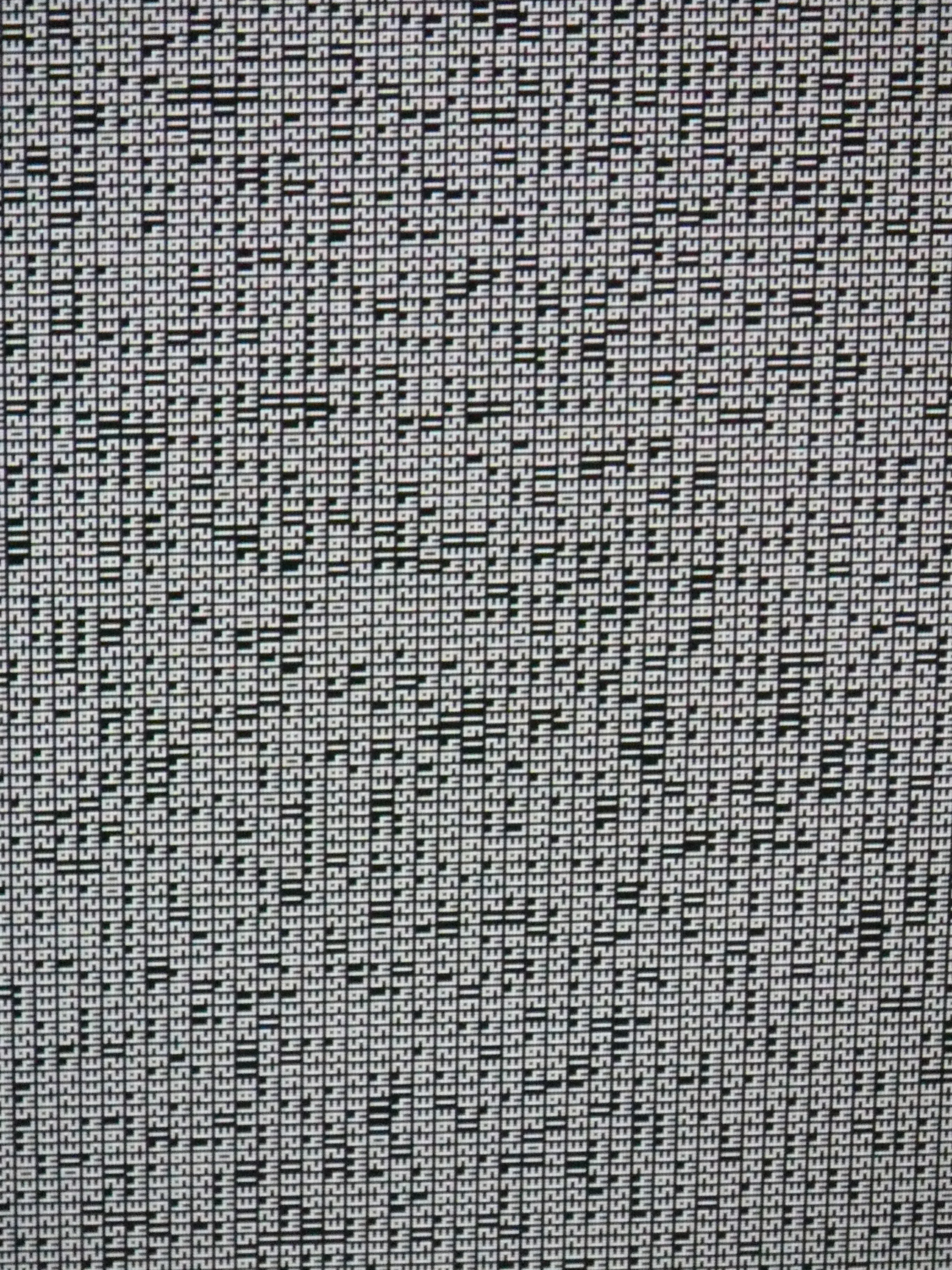


Accidental data (Arribas-Bel, 2014)

- Availability is a *side effect*
- *More* data, *more* often, of *more* places
- Different (shape, form, nature, quality...)

Lazer & Radford (2017)

- Digital life ("the *fraction of life [that is] intrinsically digitally mediated*")
- Digital traces ("*records that chronicle actions taken*")
- Digitalized life ("*nonintrinsically digital life [...] in digital form*")

But...

Data, in itself, is not very useful...

But...

Data, in itself, is not very useful... *insights* are

But...

Data, in itself, is not very useful... *insights* are

Data Science

What?

Peter Naur: Concise Survey of Computer Methods, 397 p - Mozilla Firefox

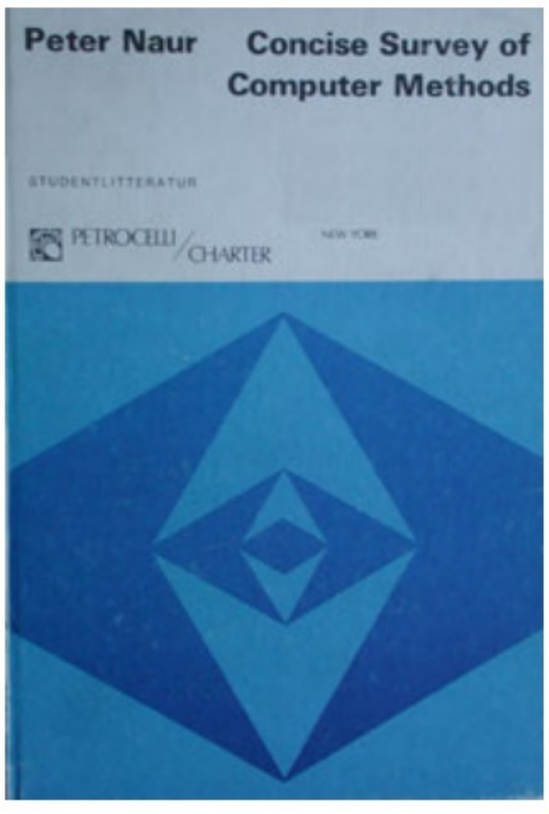
Peter Naur: Concise Survey of

www.naur.com/Conc.Surv.html

Peter Naur: Concise Survey of Computer Methods, 397 p.

Studentlitteratur, Lund, Sweden, ISBN 91-44-07881-1, 1974

ISBN/Petrocelli 0-88405-314-8, 1975



Part 1 - Basic Concepts, Tools and Methods

1. Data and their Applications (Reprinted as section 1.2 of Peter Naur: Computing, a Human Activity, 1992, ACM Press, ISBN 0-201-58069-1)

1.1. Data and What They Represent; 1.2. Data Processes and Models; 1.3. Data Recognition and Context; 1.4. Data Representations; 1.5. Numbers and Numerals; 1.6. Data Conversions; 1.7. Data Processing; 1.8. A Basic Principle of Data Science; 1.9. Limitations of Data Processing; 1.10. Summary of the Chapter; 1.11. Exercises.

Tukey

Four major influences act on data analysis today:

1. *The formal theories of statistics*
2. *Accelerating developments in computers and display devices*
3. *The challenge, in many fields, of more and ever larger bodies of data*
4. *The emphasis on quantification in an ever wider variety of disciplines*

Tukey (1962)

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Harvard Business Review

DATA

Data Scientist: The Sexiest Job of the 21st Century

by Thomas H. Davenport and D.J. Patil

FROM THE OCTOBER 2012 ISSUE

JOURNAL OF COMPUTATIONAL AND GRAPHICAL STATISTICS
2017, VOL. 26, NO. 4, 745–766
https://doi.org/10.1080/10618600.2017.1384734

Taylor & Francis
Taylor & Francis Group

50 Years of Data Science

David Donoho

Department of Statistics, Stanford University, Standford, CA

ABSTRACT

More than 50 years ago, John Tukey called for a reformation of academic statistics. In "The Future of Data Analysis," he pointed to the existence of an as-yet unrecognized *science*, whose subject of interest was learning from data, or "data analysis." Ten to 20 years ago, John Chambers, Jeff Wu, Bill Cleveland, and Leo Breiman independently once again urged academic statistics to expand its boundaries beyond the classical domain of theoretical statistics; Chambers called for more emphasis on data preparation and presentation rather than statistical modeling; and Breiman called for emphasis on prediction rather than inference. Cleveland and Wu even suggested the catchy name "data science" for this envisioned field. A recent and growing phenomenon has been the emergence of "data science" programs at major universities, including UC Berkeley, NYU, MIT, and most prominently, the University of Michigan, which in September 2015 announced a $100M "Data Science Initiative" that aims to hire 35 new faculty. Teaching in these new programs has significant overlap in curricular subject matter with traditional statistics courses; yet many academic statisticians perceive the new programs as "cultural appropriation." This article reviews some ingredients of the current "data science moment," including recent commentary about data science in the popular media, and about how/whether data science is really different from statistics. The now-contemplated field of data science amounts to a superset of the fields of statistics and machine learning, which adds some technology for "scaling up" to "big data." This chosen superset is motivated by commercial rather than intellectual developments. Choosing in this way is likely to miss out on the really important intellectual event of the next 50 years. Because all of science itself will soon become data that can be mined, the imminent revolution in data science is not about mere "scaling up," but instead the emergence of scientific studies of data analysis science-wide. In the future, we will be able to predict how a proposal to change data analysis workflows would impact the validity of data analysis across all of science, even predicting the impacts field-by-field. Drawing on work by Tukey, Cleveland, Chambers, and Breiman, I present a vision of data science based on the activities of people who are "learning from data," and I describe an academic field dedicated to improving that activity in an evidence-based manner. This new field is a better academic enlargement of statistics and machine learning than today's data science initiatives, while being able to accommodate the same short-term goals. *Based on a presentation at the Tukey Centennial Workshop, Princeton, NJ, September 18, 2015.*

ARTICLE HISTORY
Received August 2017
Revised August 2017

KEYWORDS
Cross-study analysis; Data analysis; Data science; Meta analysis; Predictive modeling; Quantitative programming environments; Statistics

Greater Data Science (Donoho, 2017)

- `GDS1`: Data Gathering, Preparation, and Exploration
- `GDS2`: Data Representation and Transformation
- `GDS3`: Computing with Data
- `GDS4`: Data Visualisation and Presentation
- `GDS5`: Data Modeling
- `GDS6`: Science about Data Science

This course

Day 1

- Computational environment **[GDS3]**
- Data wrangling **[GDS1 + GDS2]**
  - Gathering data
  - Reading/writing data
  - Types of data
  - Wrangling patterns

Day 2

- Working with APIs **[GDS1]**
- Exploring data visually **[GDS4]**
- Unsupervised learning: clustering **[GDS5]**

Day 3

- Modeling: the "*two cultures*" **[GDS5]**
- Predictive checking **[GDS5]**
- Overfitting & Cross-validation **[GDS5]**
- Model predictive performance **[GDS5]**
- More advanced methods **[GDS5]**
- Discuss datasets for assignment

Day 4

Data Studio

- Use **your own** data
- Explore the skills learnt over the course
- 1-on-1
- Work on assignment

Python

PYTHON!

YOU'RE FLYING! HOW?

I LEARNED IT LAST NIGHT! EVERYTHING IS SO SIMPLE!

HELLO WORLD IS JUST print "Hello, world!"

I DUNNO... DYNAMIC TYPING? *WHITESPACE?*

COME JOIN US! PROGRAMMING IS FUN AGAIN! IT'S A WHOLE NEW WORLD UP HERE!

BUT HOW ARE YOU FLYING?

I JUST TYPED import antigravity

THAT'S IT?

... I ALSO SAMPLED EVERYTHING IN THE MEDICINE CABINET FOR COMPARISON.

BUT I THINK THIS IS THE PYTHON.

Data

Inside Airbnb: London. Adding Data to the Debate. - Mozilla Firefox

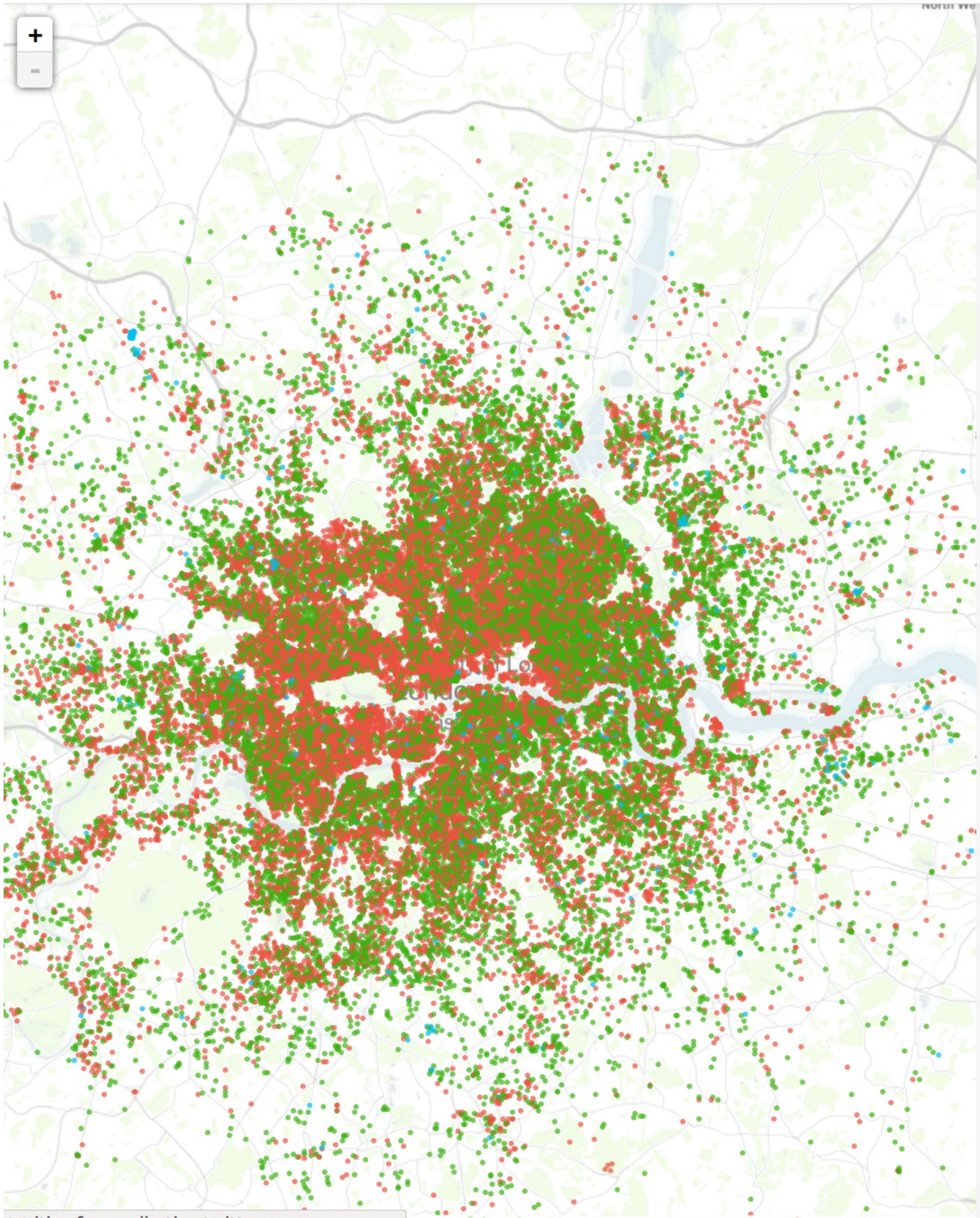
Inside Airbnb: London. Add

insideairbnb.com/london/

Inside Airbnb
Adding data to the debate

About Behind Get the Data

Like 47 Share Tweet



Waiting for syndication.twitter.com...

London

Filter by:
London

49,348
out of **49,348** listings (100%)

About Airbnb in London

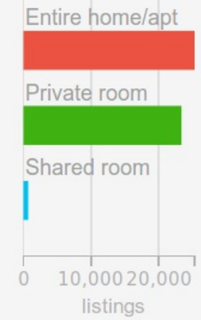
How is Airbnb really being used in and affecting your neighbourhoods?

Room Type

☐ Only entire homes/apartments

Airbnb hosts can list entire homes/apartments, private or shared rooms.

Depending on the room type, availability, and activity, an airbnb listing could be more like a hotel, disruptive for neighbours, taking away housing, and illegal.



51.2%
entire homes/apartments

£98
price/night

25,285 (51.2%)
entire home/apartments

23,357 (47.3%)
private rooms

706 (1.4%)
shared rooms

Activity

☐ Only **recent** and **frequently** booked

Airbnb guests may leave a review after their stay, and these can be used as an indicator of airbnb activity.

The minimum stay, price and number of reviews have been used to estimate the **occupancy rate**, the number of **nights per year** and the **income per month** for each listing.

How does the income from Airbnb compare to a long-term lease?

Do the number of nights booked per year make it impossible for a listing to be used for residential housing?

And what is renting to a tourist full-time rather than a resident doing to our neighbourhoods and cities?

89
estimated nights/year

1
reviews/listing/month

564,297
reviews

£98
price/night

24.5%
estimated occupancy

£661
estimated income/month

Assessment

Assessment (pt. I)

Computational essay

- Find a **dataset** of your interest
  [Discuss with me throughout Day 1-3, confirm on `D3-S3`]
- **Prepare** it for analysis
- Explore the dataset **visually**, identifying the key patterns

Assessment (pt. II)

Computational essay

- Perform a **clustering** exercise & analyse results
- Fit a **regression** model and:
  - Interpret the coefficients
  - Evaluate its predictive performance both with and without cross-validation
  - Reflect on the differences between the two approaches and the reasons for the potential divergences
- Consider potential **predictive improvements** of the model through alternative techniques

Assessment (pt. III)

Computational essay

- HTML of `Jupyter` notebook
- Submit through Turnitin
- Fully document your code
- Max. 2,000 words (Code, comments)
- Deadline: **May 15th**