Data sciences as essential job skill!

A social science, economics, and public policy training perspective

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JPSM – Uni Mannheim – IAB

Paderborn 11/12/17

AAPOR

AMERICAN ASSOCIATION FOR PUBLIC OPINION RESEARCH

AAPOR Report on Big Data

AAPOR Big Data Task Force

February 12, 2015

Prepared for AAPOR Council by the Task Force, with Task Force members including:

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Paul Biemer, RTI International
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Cliff Lampe, School of Information at the University of Michigan
Julia Lane, American Institutes for Research
Cathy O'Neil, Johnson Research Labs
Abe Usher, HumanGeo Group

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The National Academies of
SCIENCES · ENGINEERING · MEDICINE

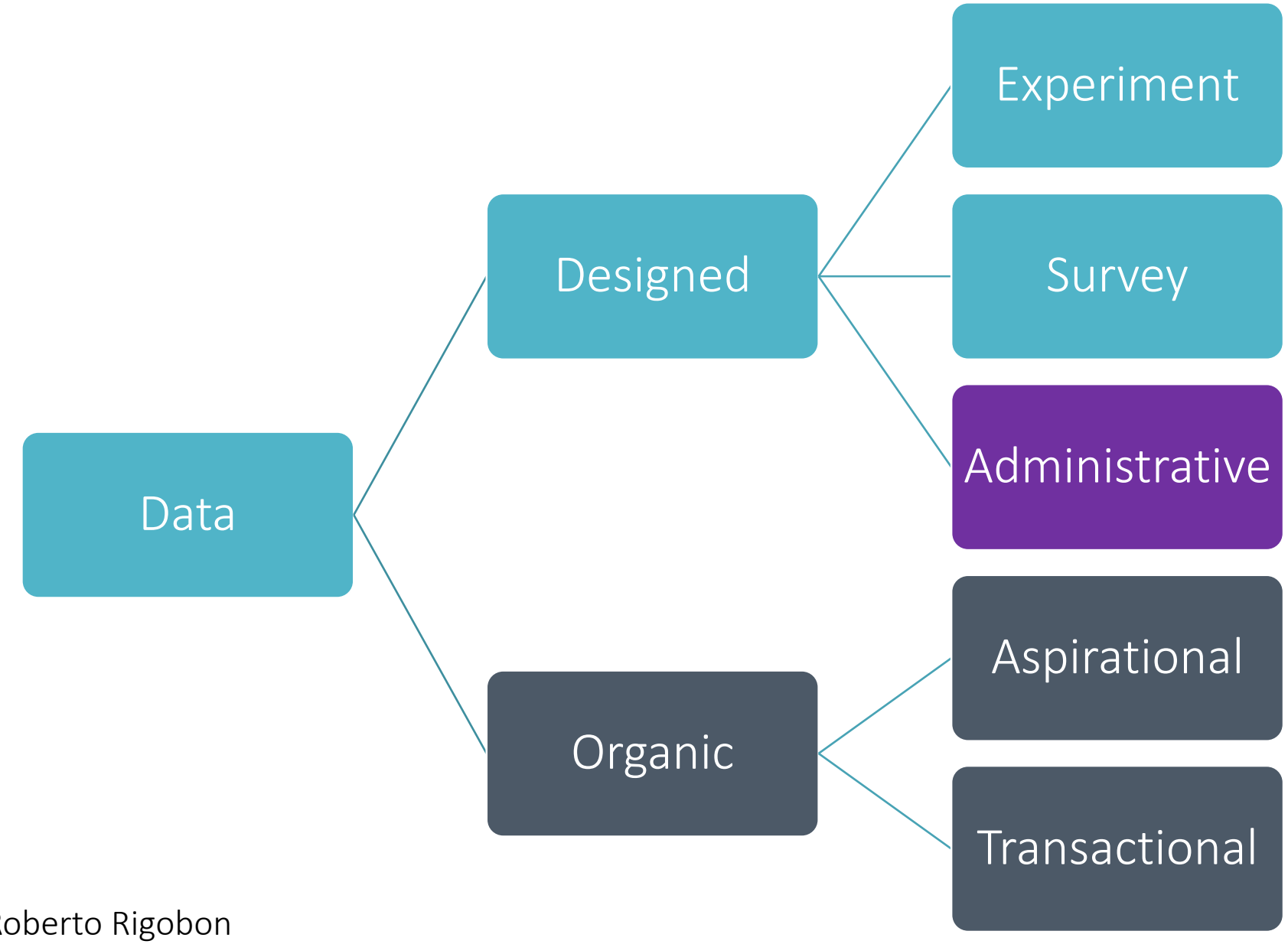
REPORT

INNOVATIONS IN FEDERAL STATISTICS

Combining Data Sources While Protecting Privacy

THE PROMISE OF EVIDENCE-BASED POLICYMAKING

Report of the Commission on Evidence-Based Policymaking



Source: Roberto Rigobon

Social Science

Marienthal study:
•social inclusion,
•coping behavior,
•day structure of the unemployed

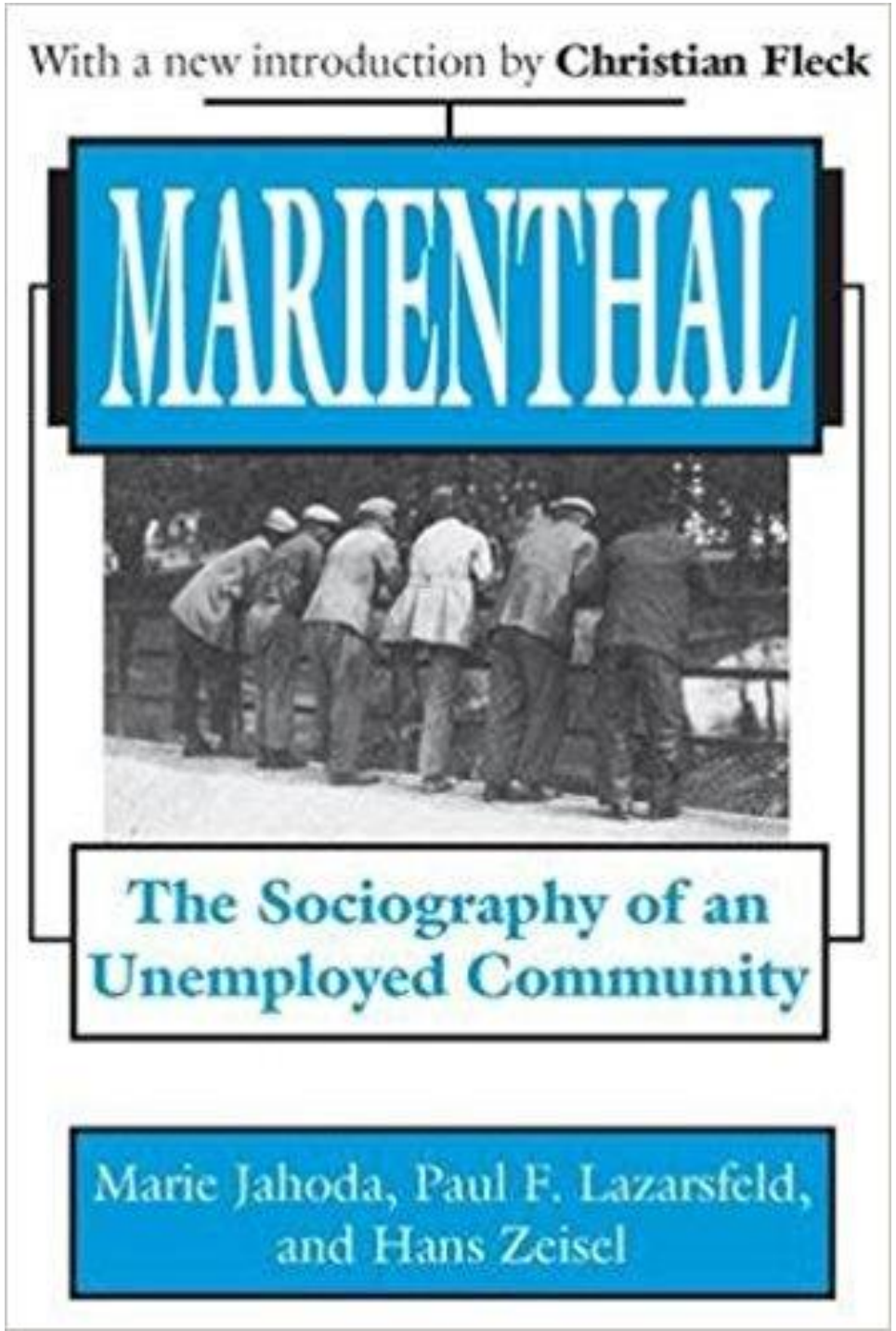
MoDeM @ IAB

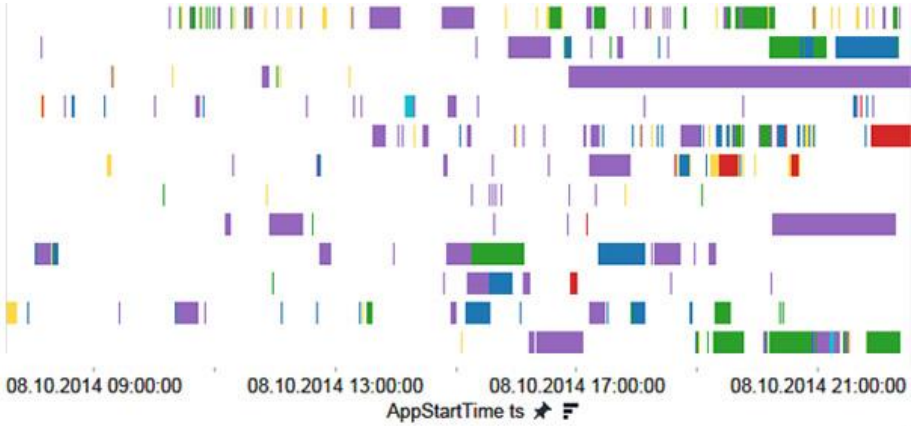
Sensor data replace time intensive observations in original study

- Radius of action
- Walking speed, sports activities
- Social networks
- Media use

…

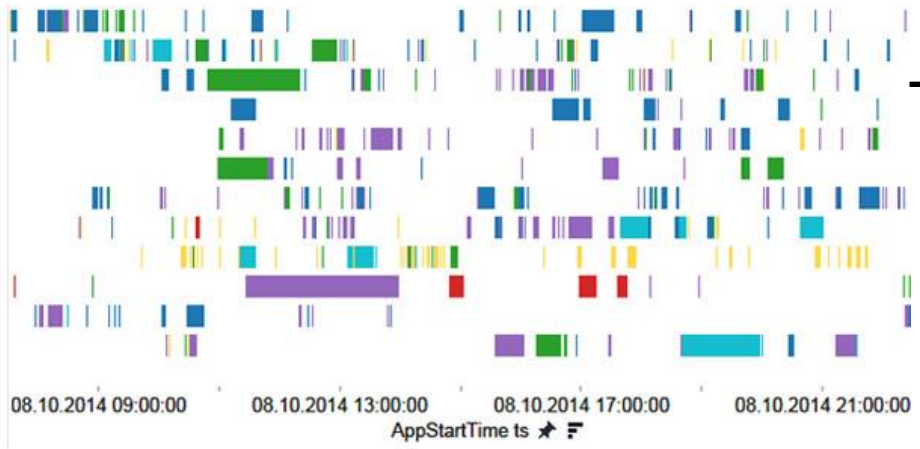
Linkage with survey and admin data



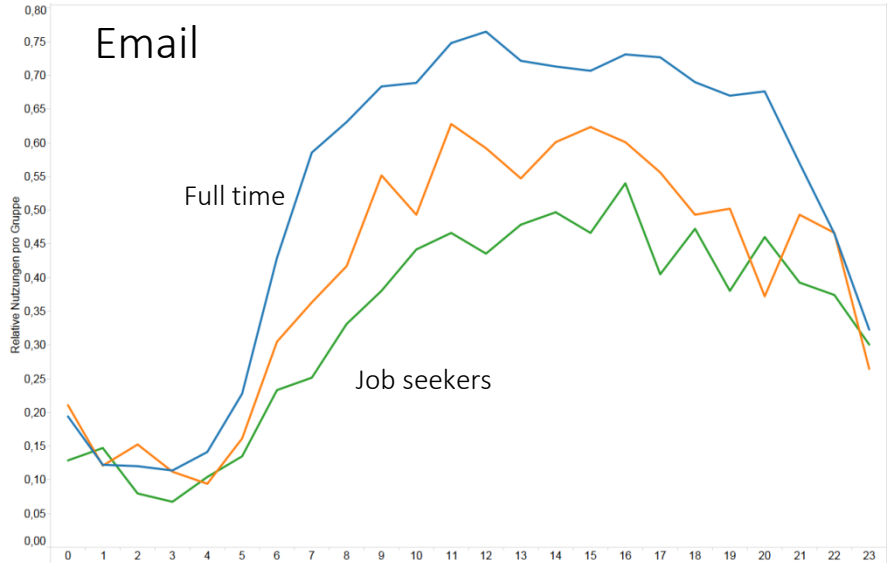


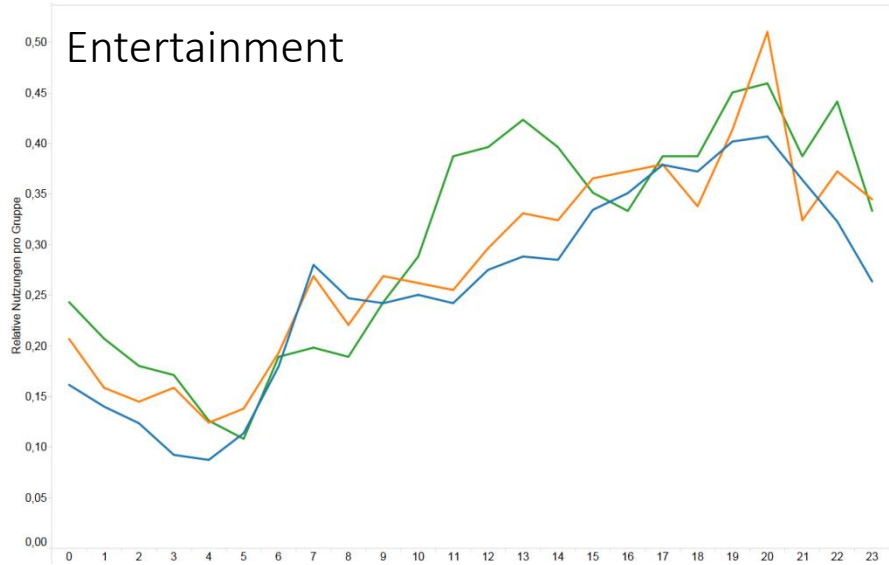
Full-time employed
→ App use past 5pm

Part-time employed
→ App use at noon

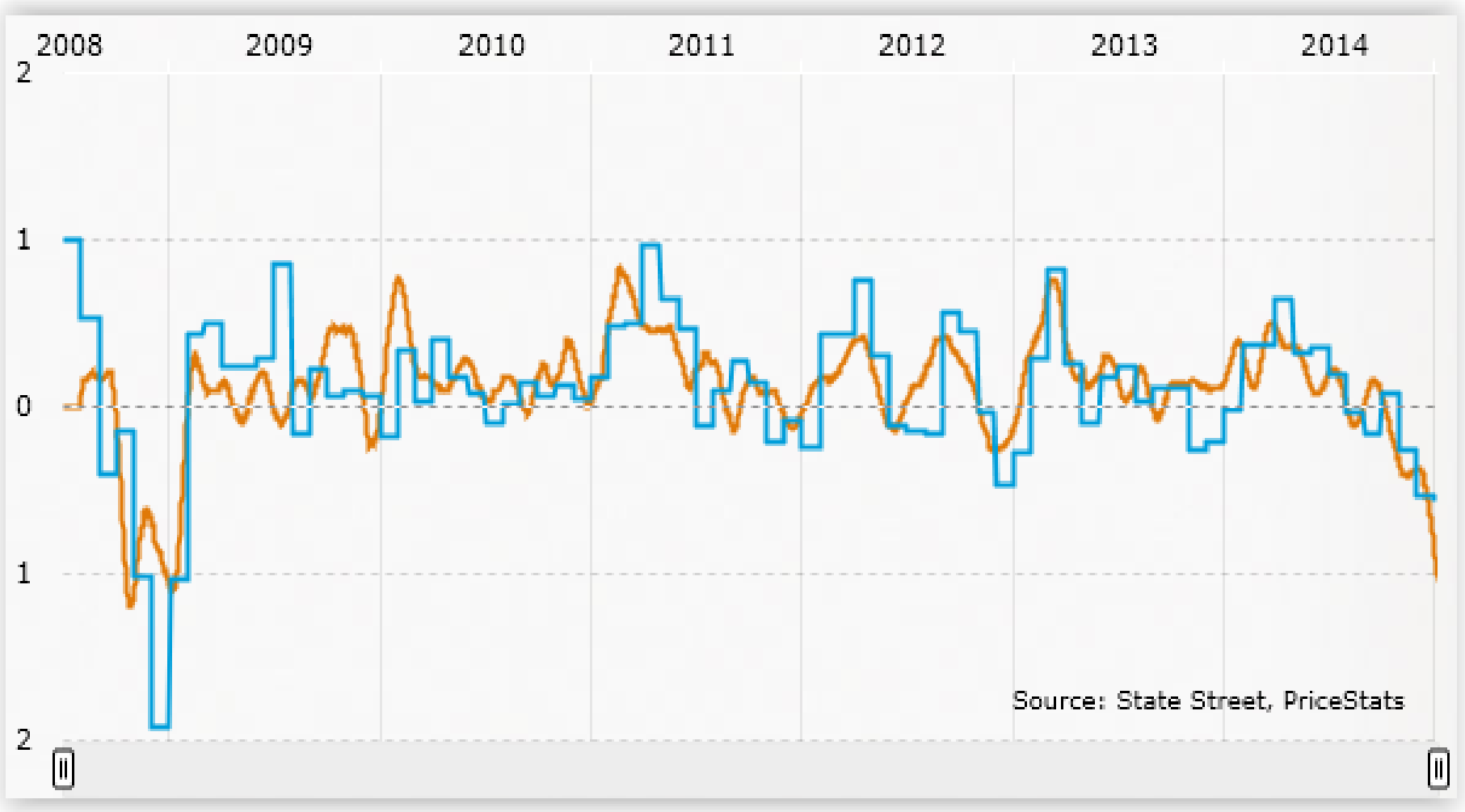


Job seekers
→ Continuous app use

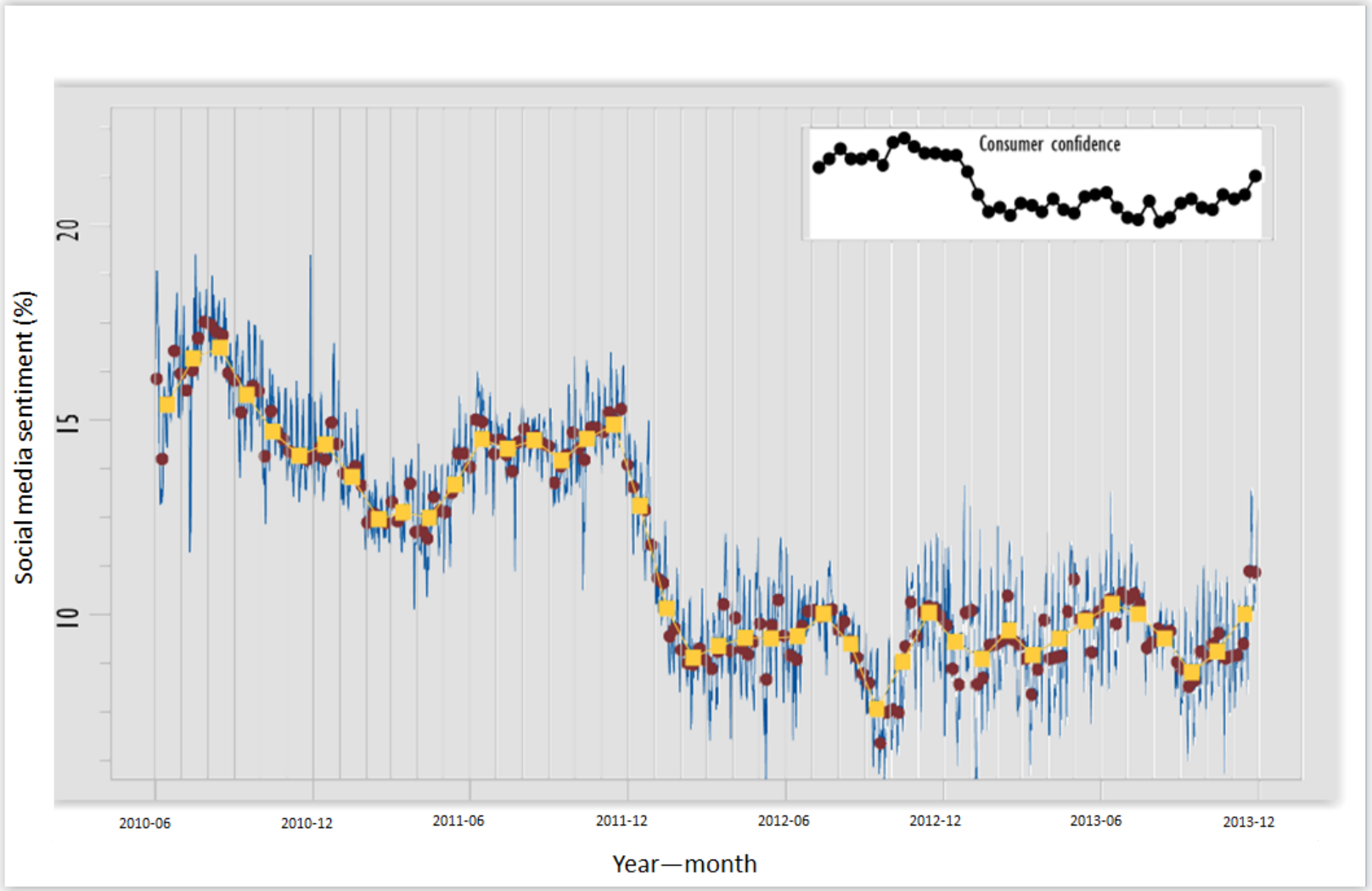




Economic Indicators



US Aggregated Inflation Series, Monthly Rate, PriceStats Index vs. Official CPIthe PriceStats website. . 1/1/2015



Social media sentiment (daily, weekly and monthly) in the Netherlands, June 2010 - November 2013. The development of consumer confidence for the same period is shown in the insert (Daas and Puts 2014).

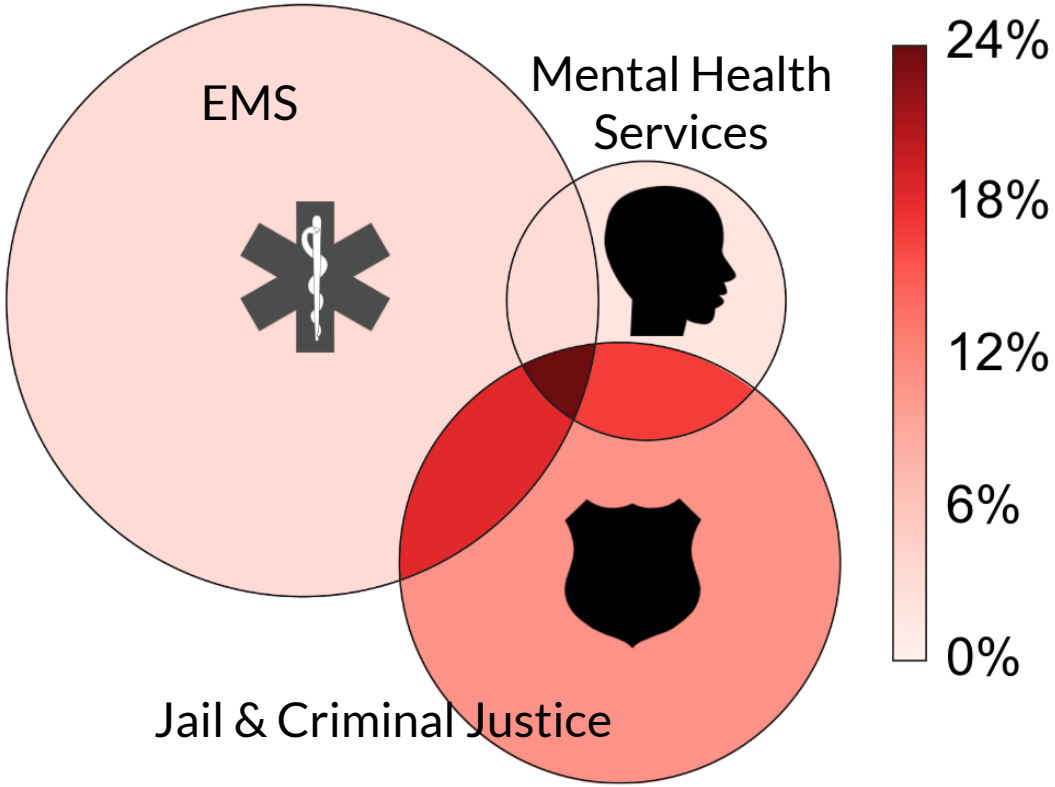
Public Policy

11 million people move through 3,100 Jails

$22 Billion in costs

- 64 % suffer from mental illness,
- 68% have a substance abuse disorder
- 44 % suffer from chronic health problems

Hope: Combined data and predictive systems can support targeted, preventative interventions to help people at risk of interactions with the criminal justice system



Of the top 200 predicted individuals

104 went to jail within 1 year

19 years total jail time

Skills

DOMAIN EXPERT

User, analyst, or leaders with deep subject matter expertise related to the data, its appropriate use, and its limitations

SYS ADMIN

Team member responsible for defining and maintaining a computation infrastructure that enalbes large scale computation

RESEARCHER

Team member with experience applying formal research methods, including survey methodology and statistics

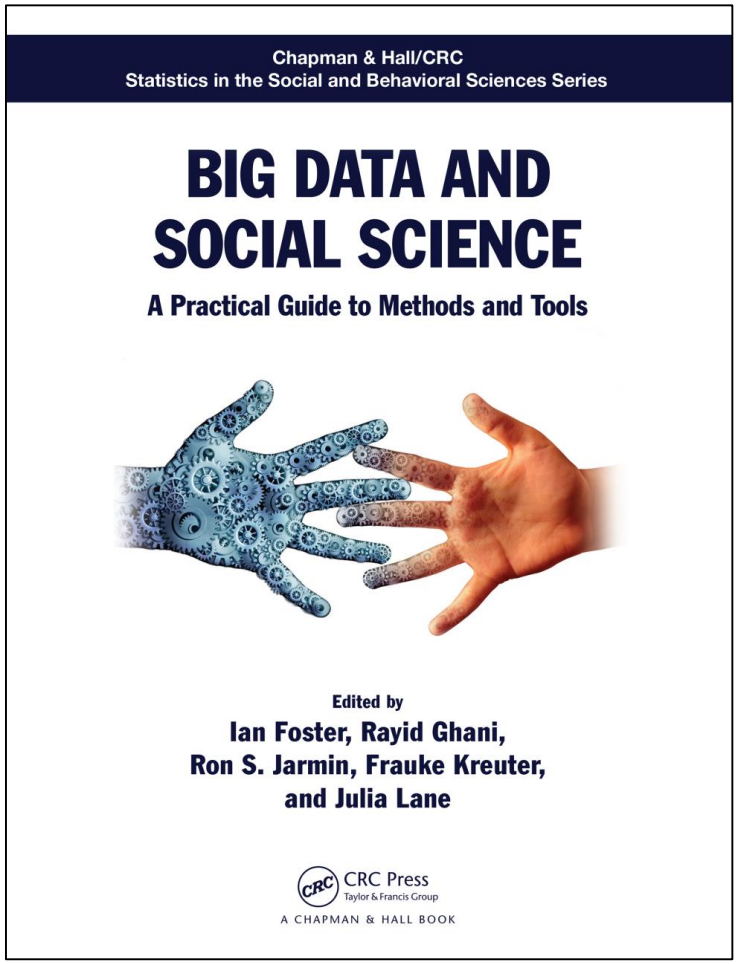
COMPUTER SCIENTIST

Technically skilled team member with education in computer programming and data processing technology

Usher 2015

1st Example – Coleridge Initiative

Professional Training Workshops



Three Classes

- Different cohorts (ex-offenders, welfare recipients and veterans)
- Joined with housing, transportation and jobs data

Class Format

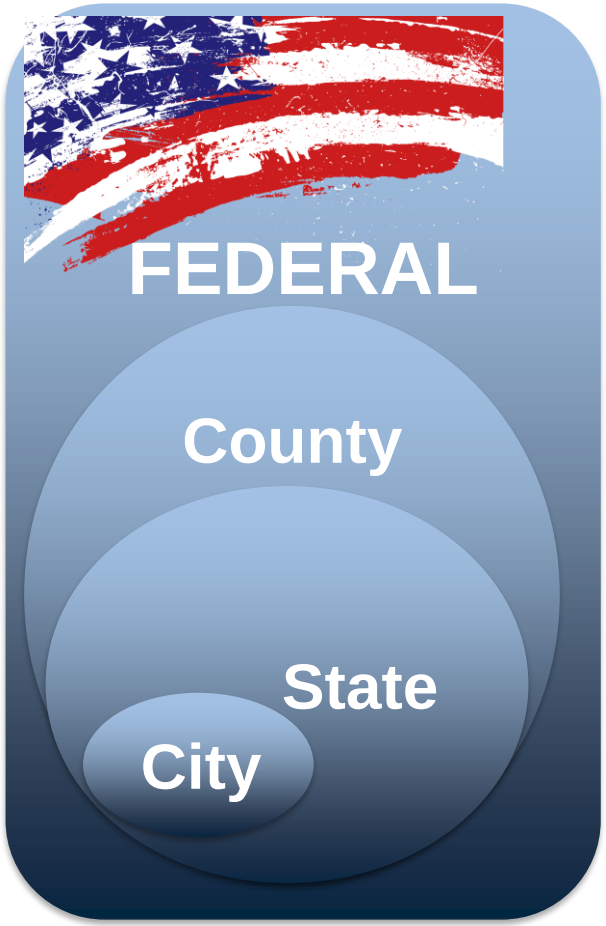
- Module 1: Foundations – Research Questions, Python, SQL
- Module 2: Data Acquisition – Web Scraping, API, Record Linkage
- Module 3: Data Analysis – Machine Learning, Networks, Text, Spatial
- Module 4: Visualization, Inference, Ethics, Privacy

Additional Information

- Final reports are all virtual
- Teaching Assistants and facilitators will be at each site for each module

Networks: The first two classes brought together

~40 agencies from city, state, county and federal agencies



HEALTHY CHICAGO
CHICAGO DEPARTMENT OF PUBLIC HEALTH

MECKLENBURG COUNTY NORTH CAROLINA

NEW YORK CITY HOUSING AUTHORITY

CHICAGO POLICE

NEW YORK STATE OF OPPORTUNITY.
Office of Information Technology Services

Virginia Department of Behavioral Health & Developmental Services

USDA

City of Milwaukee

Illinois Department of Corrections

THE CITY OF SOUTH BEND, INDIANA
PEACE
1865

IDES
ILLINOIS DEPARTMENT OF EMPLOYMENT SECURITY

Allegheny County
Department of Human Services

UNITED STATES GOVERNMENT ACCOUNTABILITY OFFICE

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

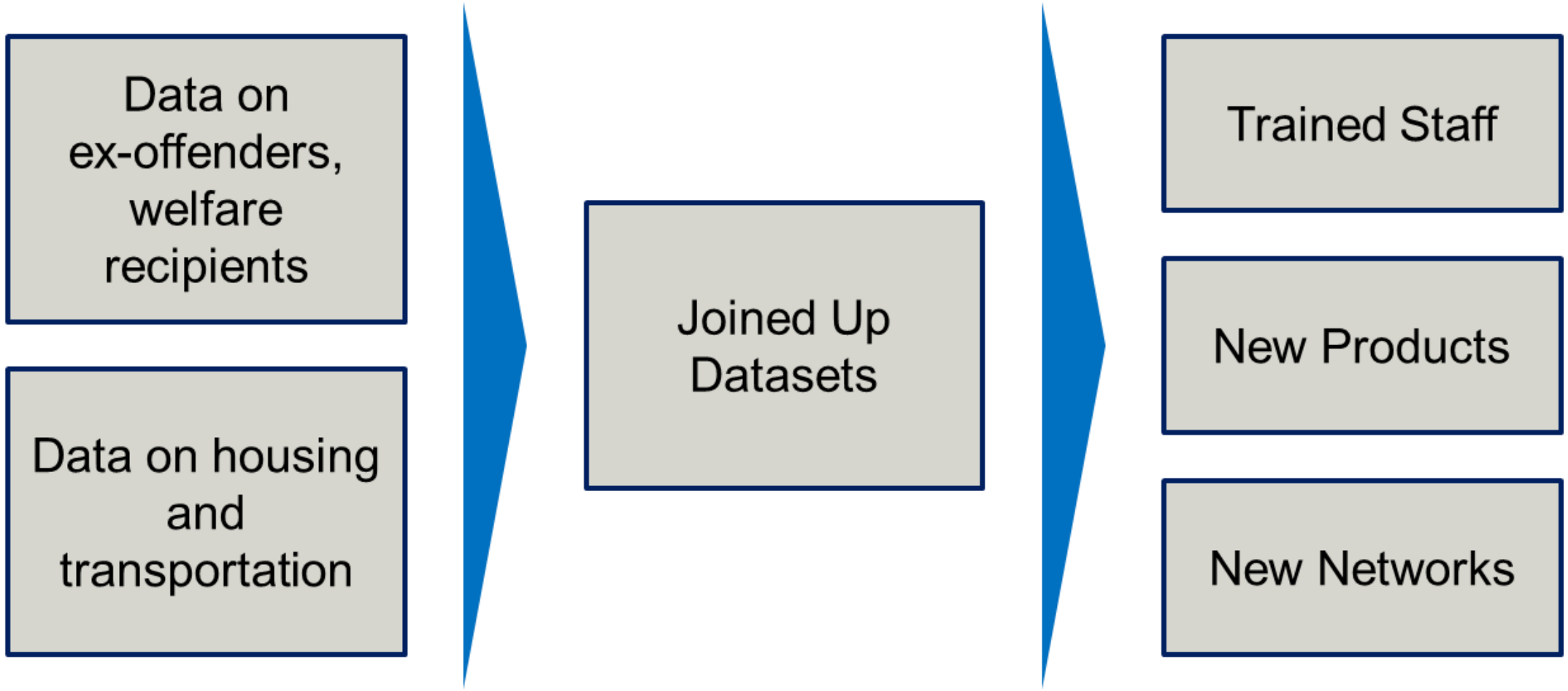
COUNTY of DANE WISCONSIN
1839

NYC.gov
always open

NEW YORK STATE
Office of Alcoholism and Substance Abuse Services

CITY OF BOULDER

Approach


Data on ex-offenders, welfare recipients
Data on housing and transportation
Joined Up Datasets
Trained Staff
New Products
New Networks

Approach

Taught using **hands-on projects** with **real microdata** in a **secure environment** so that participants can learn the basics of how to:

- Code and collect new data
- Work with spatial data
- Manage complex data,
- Apply machine learning, text and network analysis
- Visualize relationships
- Address inference issues
- Manage privacy and confidentiality

Content Example

Problem

Go back to Table o

First, turning some t action
can you take base

Four Main

- **Description:**
- **Prediction:** W
- **Detection:** W
- **Behavior Cha

Model Evaluation

Go back to Table of Contents

In this phase, you take the predictors from your test set and apply your model to them, then assess the quality of the model by comparing the *predicted values* to the *actual values* for each record in your testing data set.

- **Performance Estimation**: How well will our model do once it is deployed and applied to new data?

Now let's use the model we just fit to make predictions on our test dataset, and see what our accuracy score is:

Python's `scikit-learn` is a commonly used, well documented Python library for machine learning. This library can help you split your data into training and test sets, fit models and use them to predict results on new data, and evaluate your results.

We will start with the simplest `LogisticRegression` model and see how well that does.

You can use any number of metrics to judge your models (see model evaluation), but we'll use `accuracy_score()` (ratio of correct predictions to total number of predictions) as our measure.

```
# Let's fit a model
from sklearn import linear_model
model = linear_model.LogisticRegression(penalty='l1', C=1e5)
model.fit( X_train, y_train )
print(model)
```

Content Example: API

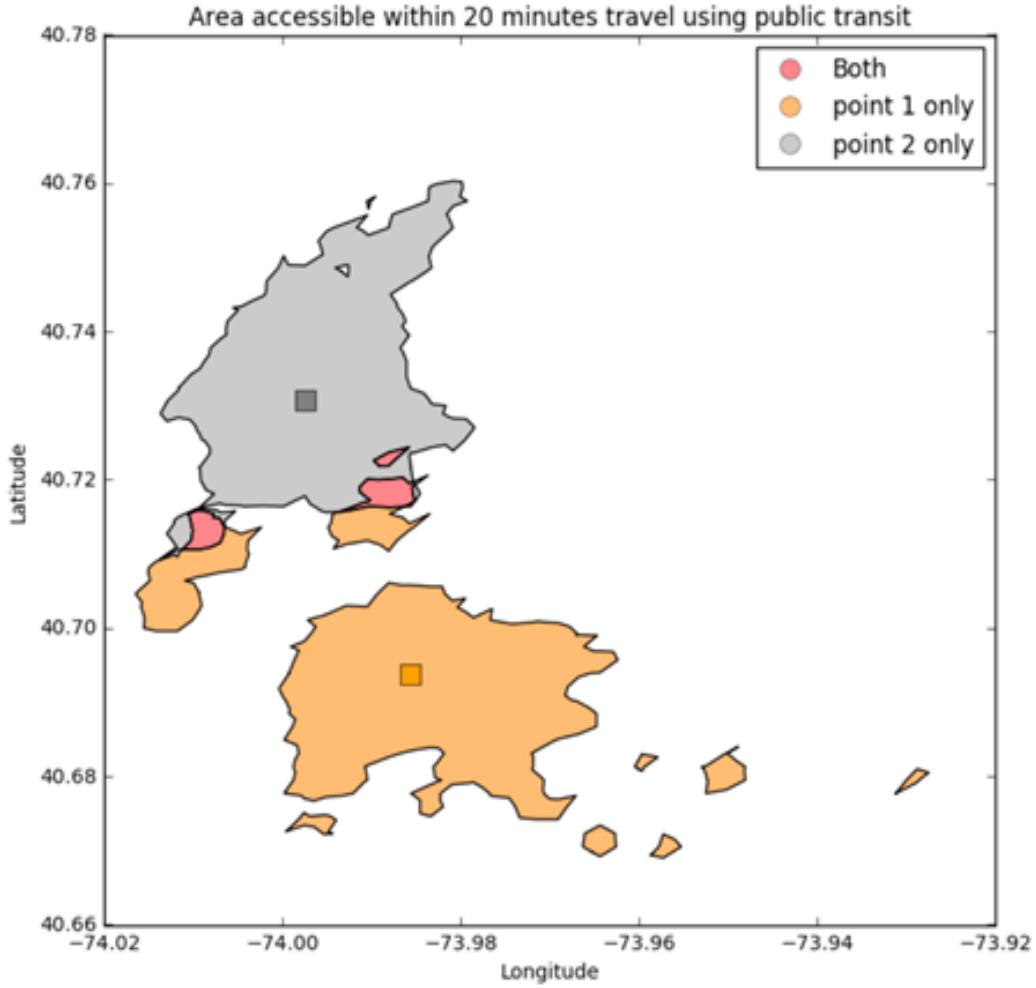
Isochrone API

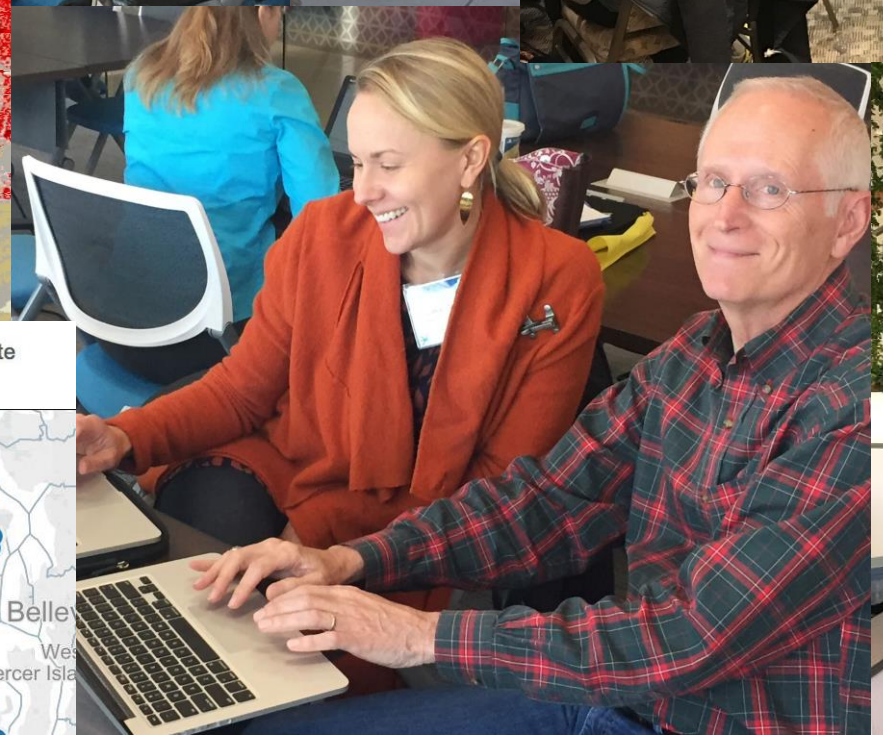
- Back to the Table of Contents

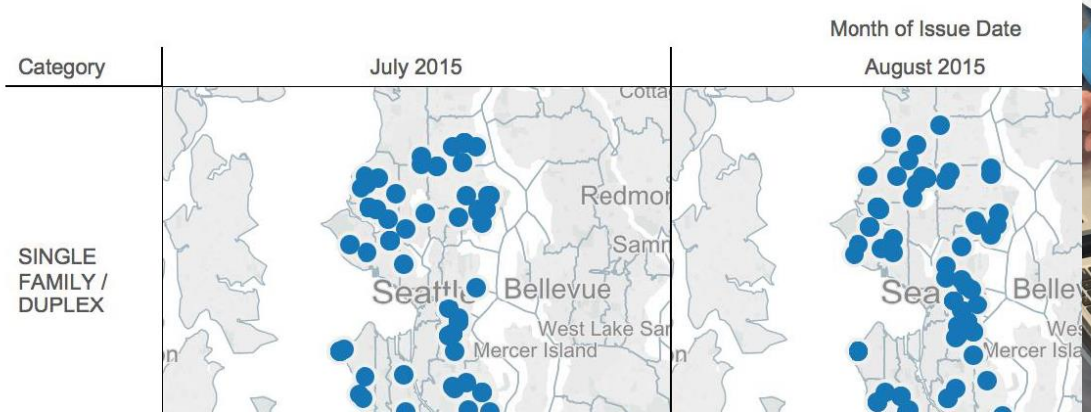
Gives the area (as a polygon) a traveler can reach from a
the user can set if so desired, description here

s

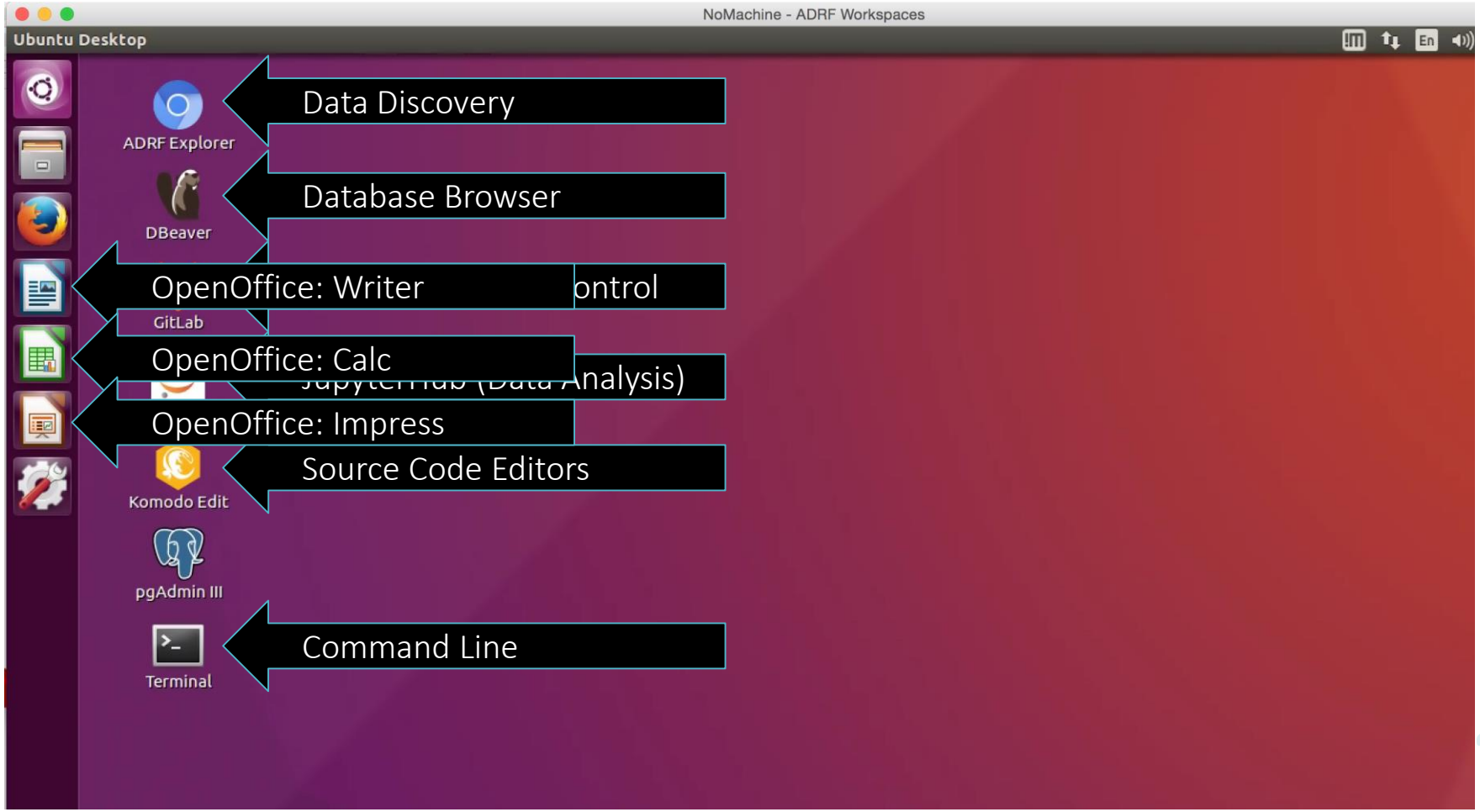
```
# set start location
start_point = [40.693856, -73.985754] # Do

# set travel time - in seconds
travel_time = 60*20 # 20 minutes

# create query URL
qry_url = '{}isochrone?fromPlace={},{}&mod
nt[0],

vel_time)

# get json request
iso_json = json.loads(requests.get(qry_url

## load isochrone into a geopandas datafra
iso_gdf = gpd.GeoDataFrame.from_features(iso_json['features'])
```






Month of Issue Date
Category
July 2015
August 2015
SINGLE FAMILY / DUPLEX
Seattle
Bellevue
Mercer Island

Collaborative secure environment



What our participants say about the program

"Love the Jupyter notebooks!! ... I love how the code snippets and explanations are set up in the Jupyter notebooks. The format of going through it individually and discussing questions/challenges in your group, with the experts available when needed, worked really well for my learning style."

Danielle Fulmer
Director of Business Analytics

I could see our agency benefiting potentially from something like this in that, as the system builds out and collects additional resources/datasets that impact criminal justice system practices, this may be an option for a place for us to look for the results of studies using evidence based practices.

Katy Fitzgerald
Management Analyst

What they put on their *out of office*

"Thanks for your email. I will be away from the office starting on April18th and returning Monday, April 24th.

Where did I go? University of Maryland - College Park, Maryland

Why so long? I am at the most awesome, intense, hands-on training for using data to improve public policy.

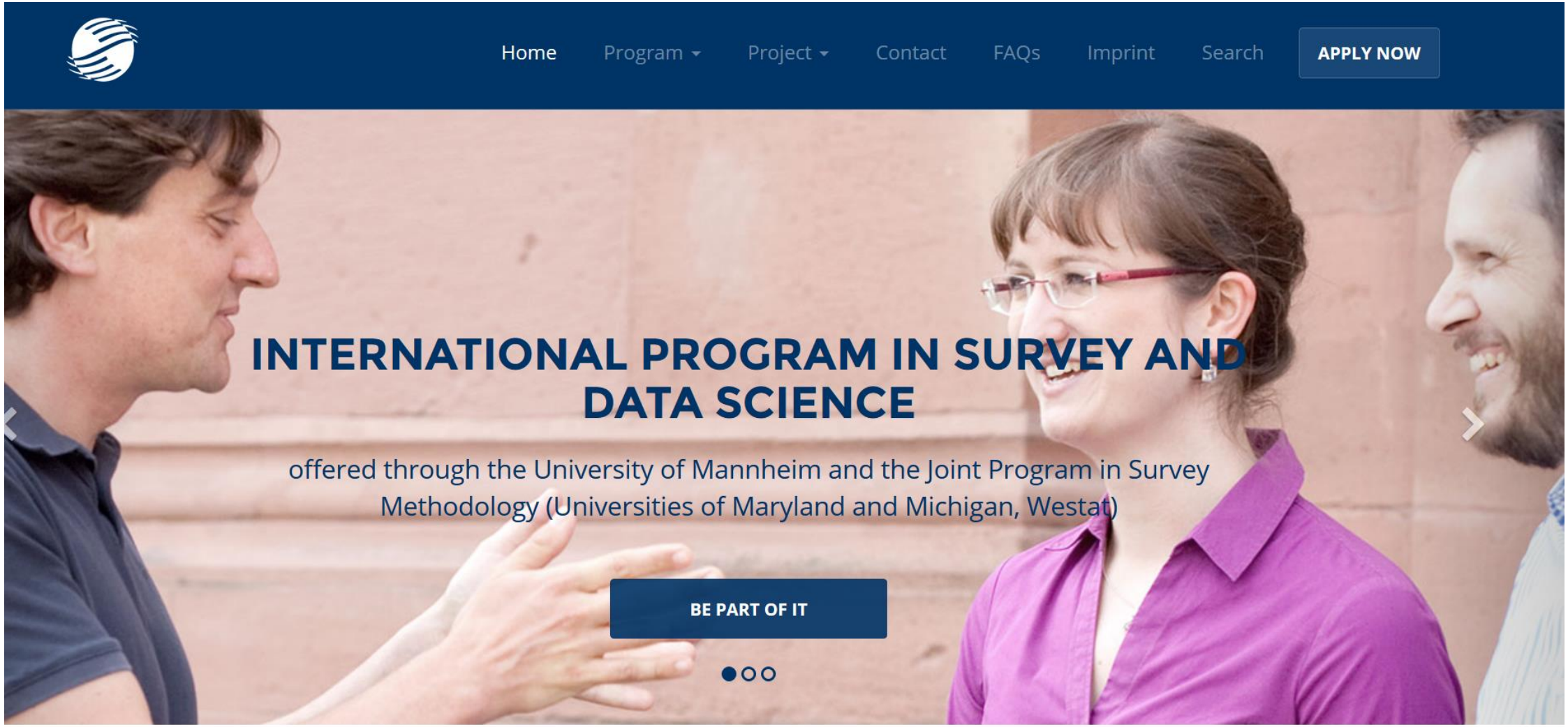
Why? Noemi Reyes and I were accepted into the program – AND received a very generous scholarship from the Laura and John Arnold Foundation.

What can I do? If you have data you would like to contribute, send me an email with the Subject: Dane Data – that will get the attention of the little robot I set up to prioritize that message! We can set up a time to chat when I get back."

Noyemi Reyes
Research Analyst

2nd Example – International Program in Survey and Data Science

survey-data-science.net



We are pleased to announce the launch of the International Program in Survey and Data Science (IPSDS). Fundamental changes in the nature of data, their availability, the way in which they are collected, integrated, and disseminated are a big challenge for all those working with designed data from surveys as well as organic data. IPSDS was developed in response to the increasing demand from researchers and practitioners for the appropriate methods and right tools to face these changes. We offer a multidisciplinary curriculum, world-class faculty, and a web-based learning environment that allows you to take courses from anywhere in the world.

Problem we tried to solve – In brief

- Allow for multidisciplinary curriculum
- Modularized – adapt to prior skills and work needs
- Relevant methods and tools
- Mix of faculty from academia and industry

Key elements:

- Flexible web-based learning environment
- Live (video) interaction with faculty and students
- Face-to-face networking meetings

Partners and Funding

University Partners

- University of Maryland
- University of Mannheim

- Catholic University of Santiago de Chile
- Australian National Unversity
- Beijing University
- Ashoka University (expressed interest)
- U. of Capetown (planned)

Other Partners

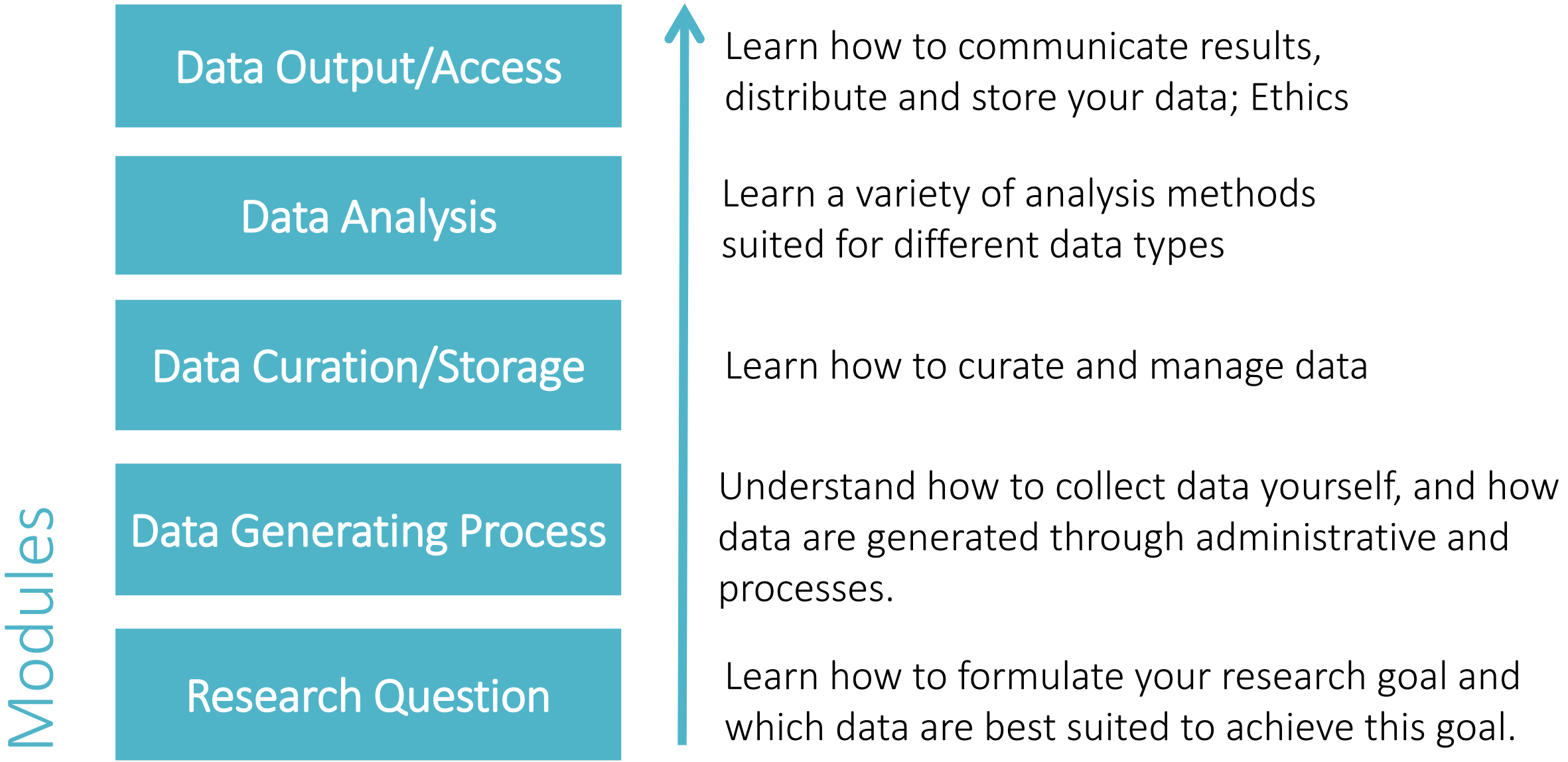
- SRO - Michigan
- PEW
- German Record Linkage Center
- GESIS
- Bureau of Labour Statistics
- U.S. Census Bureau
- Statistics Netherlands

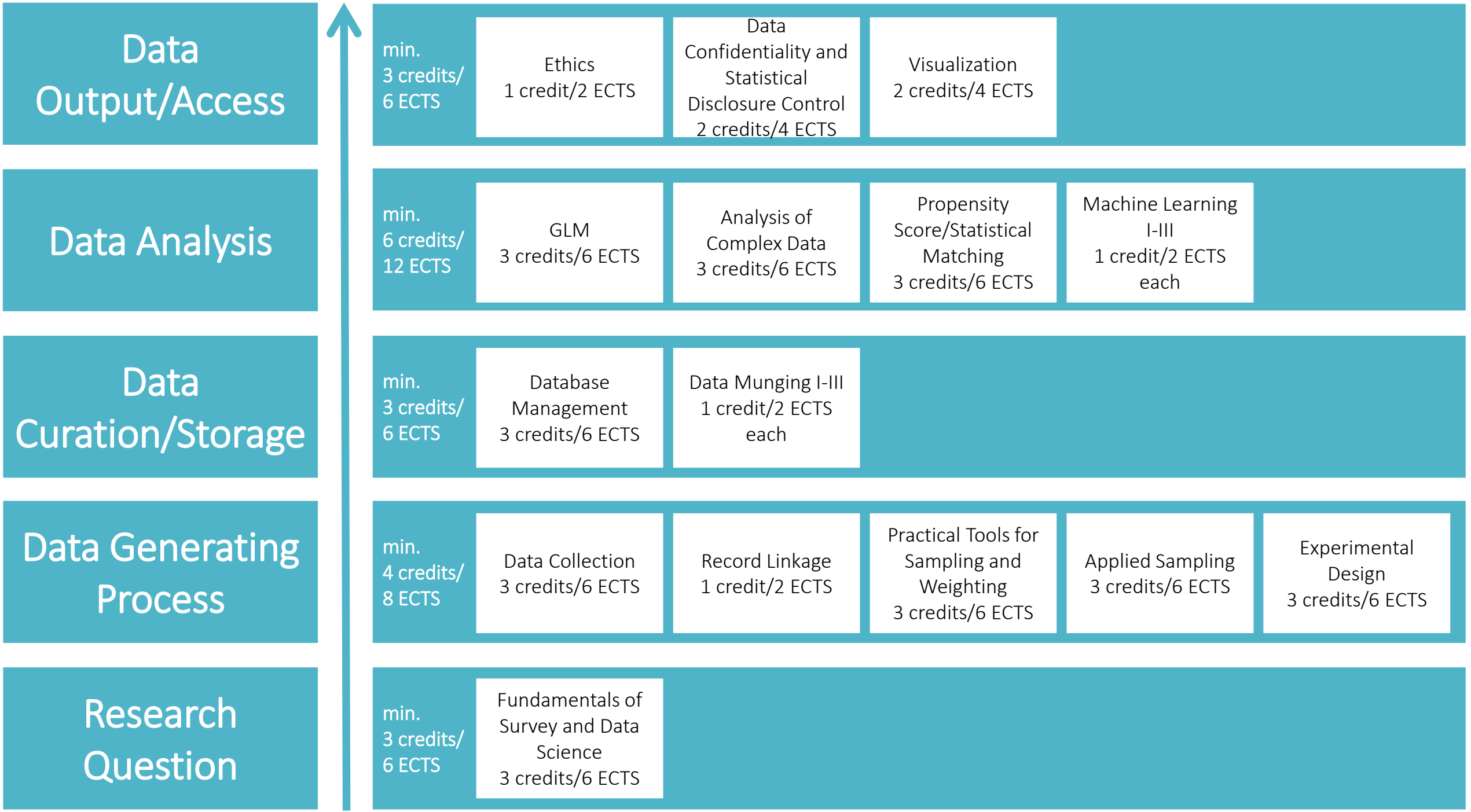
SPONSORED BY THE

Federal Ministry of Education and Research

AUFSTIEG DURCH BILDUNG >> OFFENE HOCHSCHULEN

Modules


Data Output/Access
Learn how to communicate results, distribute and store your data; Ethics
Data Analysis
Learn a variety of analysis methods suited for different data types
Data Curation/Storage
Learn how to curate and manage data
Data Generating Process
Understand how to collect data yourself, and how data are generated through administrative and processes.
Research Question
Learn how to formulate your research goal and which data are best suited to achieve this goal.

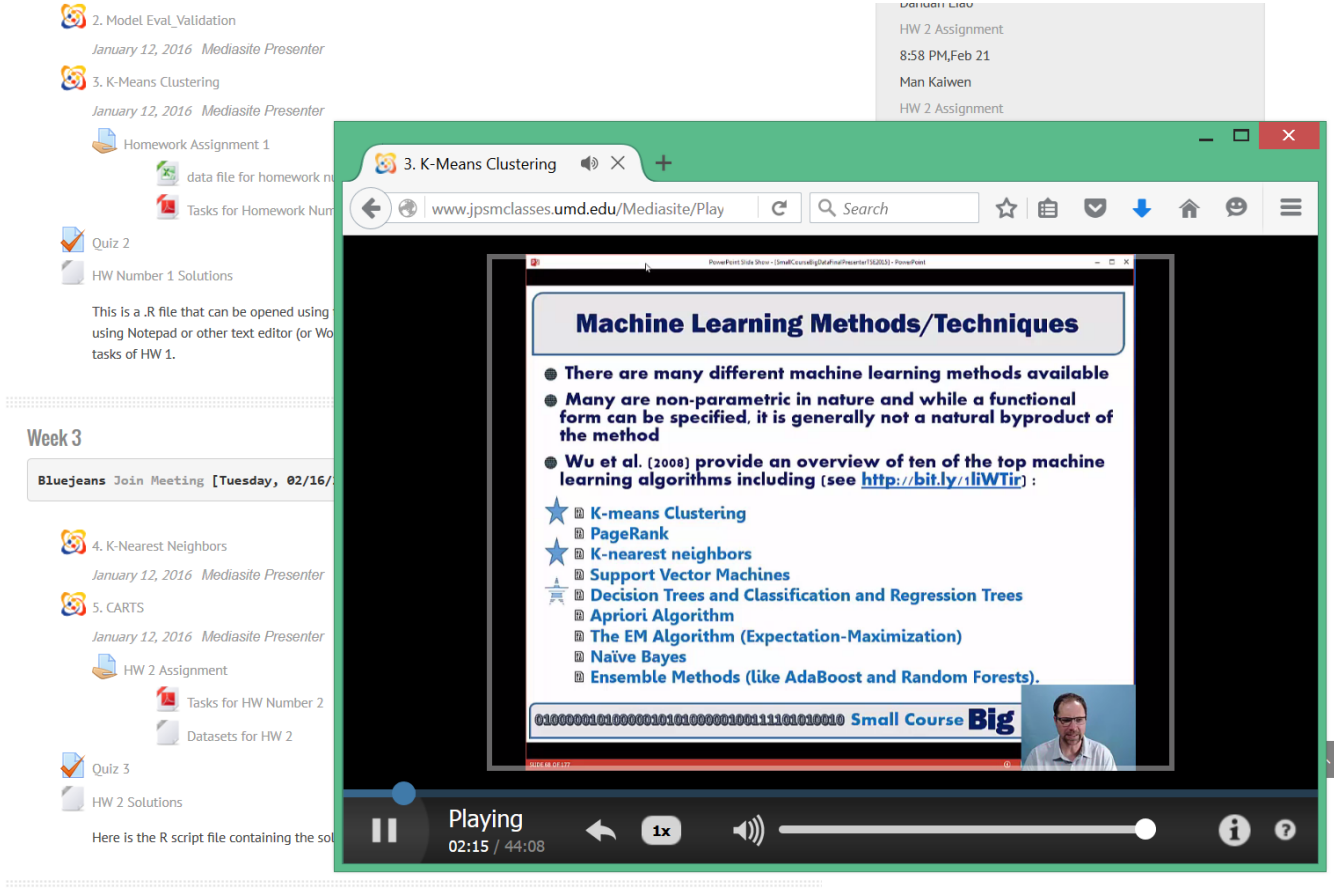

Data Output/Access
min. 3 credits/ 6 ECTS
Ethics 1 credit/2 ECTS
Data Confidentiality and Statistical Disclosure Control 2 credits/4 ECTS
Visualization 2 credits/4 ECTS
Data Analysis
min. 6 credits/ 12 ECTS
GLM 3 credits/6 ECTS
Analysis of Complex Data 3 credits/6 ECTS
Propensity Score/Statistical Matching 3 credits/6 ECTS
Machine Learning I-III 1 credit/2 ECTS each
Data Curation/Storage
min. 3 credits/ 6 ECTS
Database Management 3 credits/6 ECTS
Data Munging I-III 1 credit/2 ECTS each
Data Generating Process
min. 4 credits/ 8 ECTS
Data Collection 3 credits/6 ECTS
Record Linkage 1 credit/2 ECTS
Practical Tools for Sampling and Weighting 3 credits/6 ECTS
Applied Sampling 3 credits/6 ECTS
Experimental Design 3 credits/6 ECTS
Research Question
min. 3 credits/ 6 ECTS
Fundamentals of Survey and Data Science 3 credits/6 ECTS

Format

Each week set of videos (pre-recorded)

Lectures are broken into easily digestible sessions to help participants to better focus on the material

Engage with the material at their own pace



Annual „Connect“ Event (next June 9, 2018)

Lessons Learning

- Modular approach much appreciated by working professionals
- Learning with application at hand is key
- Participants from all sectors and disciplines
- Very high demand on graduates
- Privacy and confidentiality very important

- Hardest to learn and hardest to teach: Asking the right question!

http://coleridgeinitiative.org
http://survey-data-science.net/

fkreuter@umd.edu