Data Analytics

Unit 7 - Storytelling with Data, Web Scraping, APIs, AB Testing

NOV - DEC 2020 | BERLIN

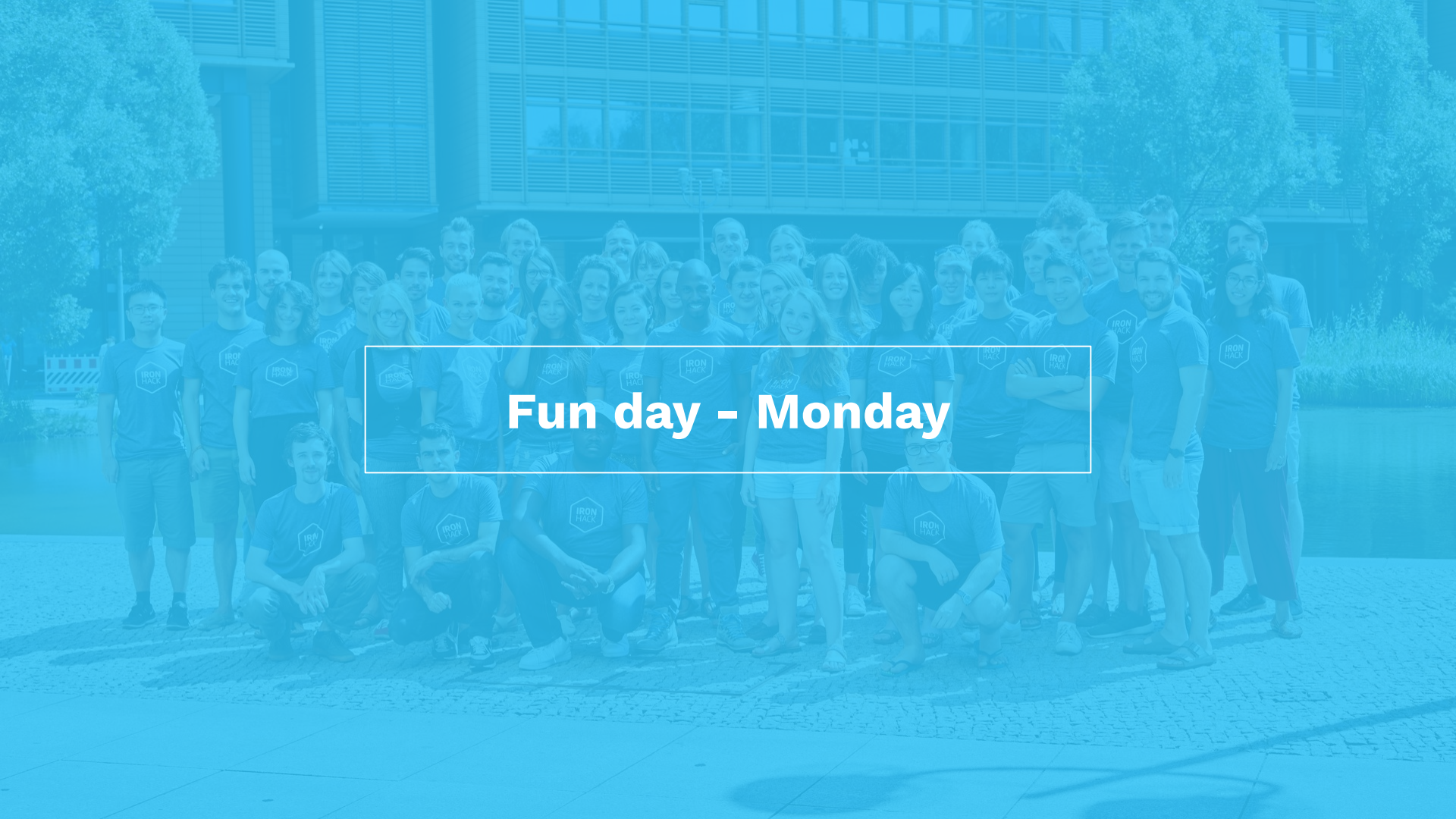
What will I learn in this unit?

Unit #8

Python HTML Tableau Presenting

The aim of this unit is to polish their data analytics and engineering skills by performing an end-to-end data product: we will create a program that takes an input from the user and automatically collects data from the internet through web scraping and APIs; then it goes through a clustering model and finally returns an output back to the user.

They will implement agile methodologies to develop the product and finally they will "sell it" with an engaging presentation



Fun day - Monday

Morning lecture

LFB Best of class dashboards

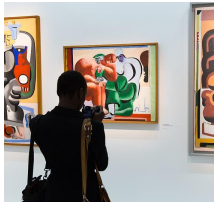
Why do we tell stories?
Zoom in Zoom out
Data storytelling
Narrative Arc
Tips on Tableau Story setup

--Project intro--
(split into groups)

Afternoon Session

Group Project

Covid-19 and Human Movement



Gallery

4.30-4.45 Break

4.45 Gallery of Data Stories

Why do we tell stories?

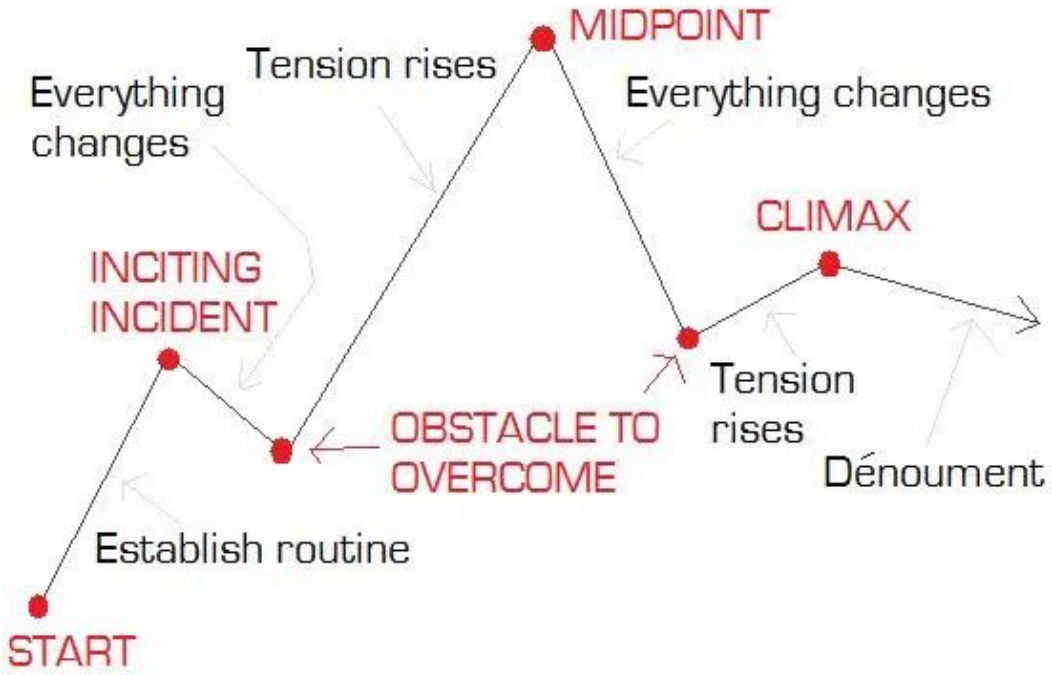
Value and meaning
Oldest tradition
Learn its important in childhood
To be remembered - emotion causes memory
Makes us human - relate the story of everything - how we relate to things- impact!
Connection - is a story - make something relevant - you feel involved
Communicate ideas - shared reality/ history
Tells you who you are
Explain our world
Distinctly human trait - religion, nationhood
Identifies us and other
Information - warnings - morality

What makes a good story?

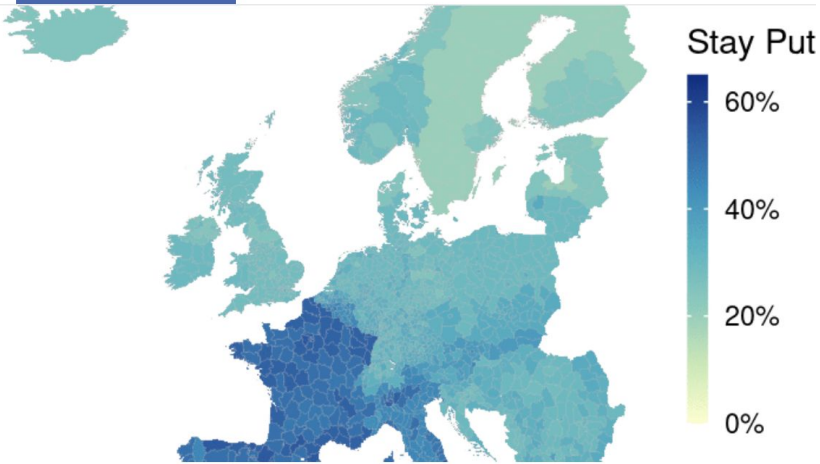
Clarity
Visuals are vivid
Tone
Humour
Strength in storyline - peak
Structure
Common thread
Relatability
Shock , Surprise, unexpected
Elicit an emotional reactions

Zoom in

Zoom out

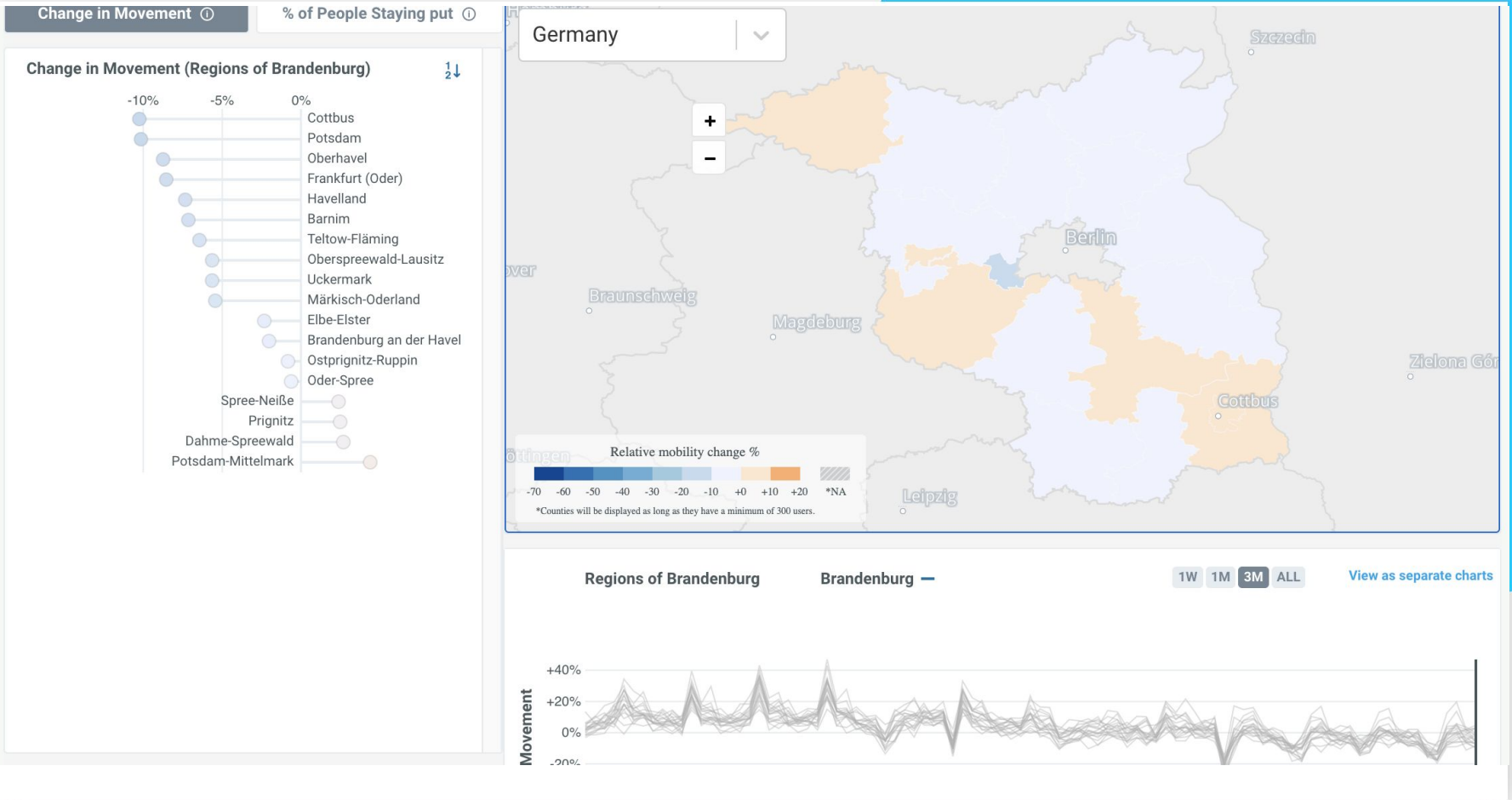


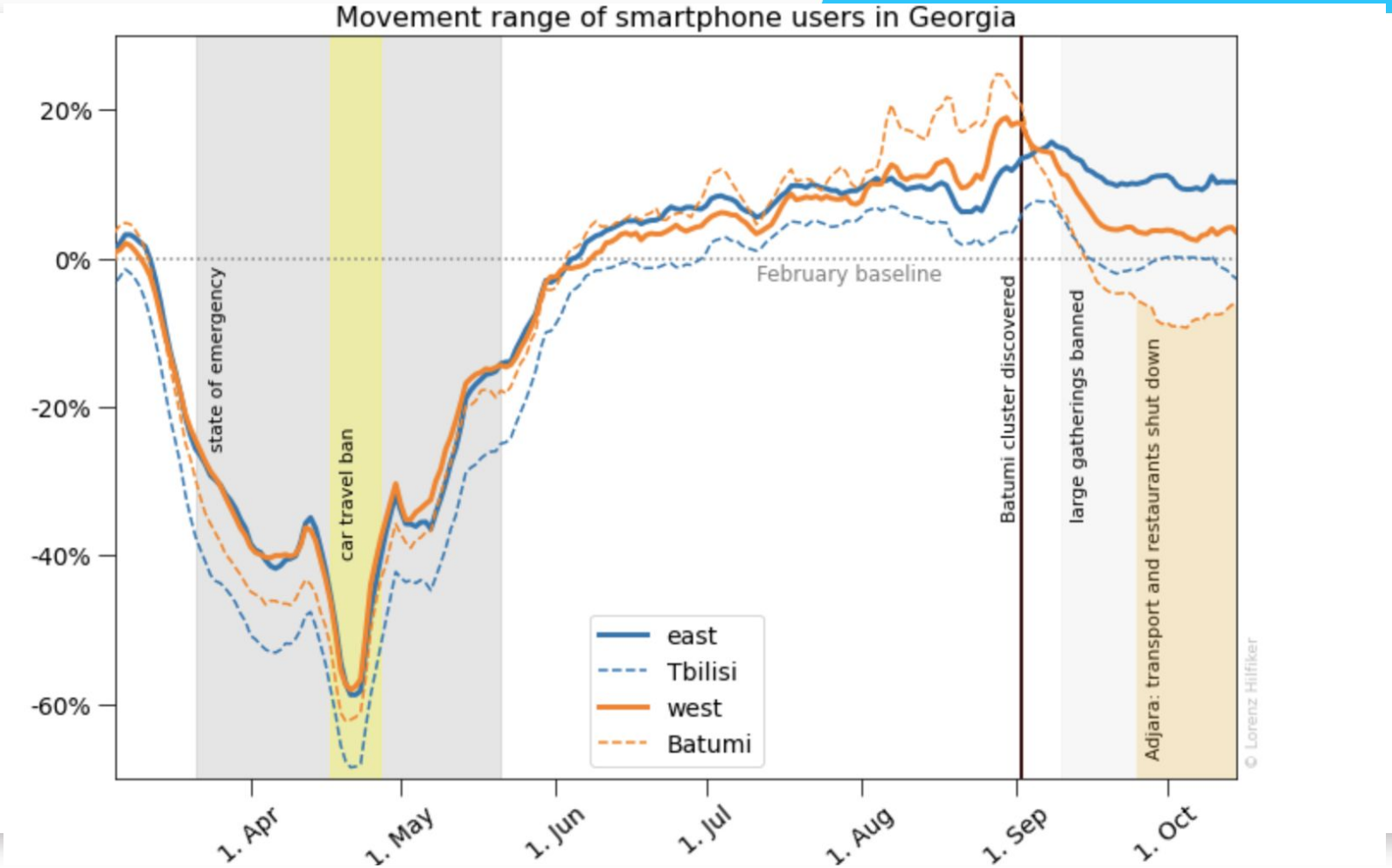
THE STORY ARC



Movement Range Maps

Movement Range Maps inform researchers and public health experts about how populations are responding to physical


Change in Movement
% of People Staying put
Change in Movement (Regions of Brandenburg)
-10%
-5%
0%
Cottbus
Potsdam
Oberhavel
Frankfurt (Oder)
Havelland
Barnim
Teltow-Fläming
Oberspreewald-Lausitz
Uckermark
Märkisch-Oderland
Elbe-Elster
Brandenburg an der Havel
Ostprignitz-Ruppin
Oder-Spree
Spree-Neiße
Prignitz
Dahme-Spreewald
Potsdam-Mittelmark
Germany
Szczecin
Berlin
Braunschweig
Magdeburg
Cottbus
Leipzig
Relative mobility change %
-70 -60 -50 -40 -30 -20 -10 +0 +10 +20 *NA
*Counties will be displayed as long as they have a minimum of 300 users.
Regions of Brandenburg
Brandenburg
1W 1M 3M ALL
View as separate charts
+40%
+20%
0%
Movement


Movement range of smartphone users in Georgia
20%
0%
-20%
-40%
-60%
state of emergency
car travel ban
February baseline
Batumi cluster discovered
large gatherings banned
Adjara: transport and restaurants shut down
east
Tbilisi
west
Batumi
1. Apr
1. May
1. Jun
1. Jul
1. Aug
1. Sep
1. Oct
© Lorenz Hilfiker

Two Day - Tuesday

Morning session

Introduction to WebScraping

Case Study explained

When do we need it? 8.01.1

Html basics

- **Tags, structure, inspect**
- **Next steps for newbies**

Beautiful Soup & Parsing 8.01.2

Scraped data & pandas

Andres presentation- final project - and deep learning

Afternoon Session

Lunch 12:30 - 1:30

Review of Pandas and Getting started with Web Scraping with Flo

Lab Session

->TA assisted Labs from 16:15 -

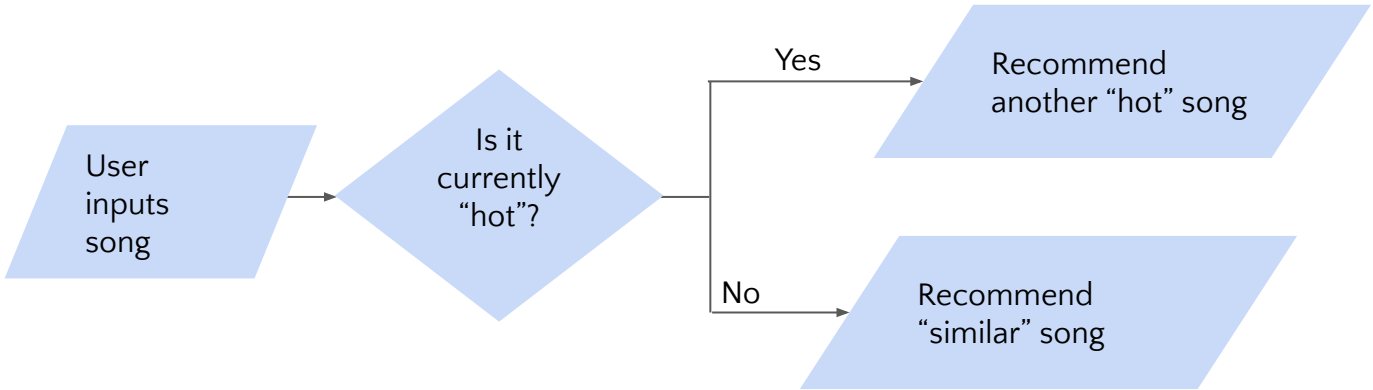
8.01 (inside lesson unit in Day 2 of student portal) **HTML Web Scraping**

Web Scraping -optional

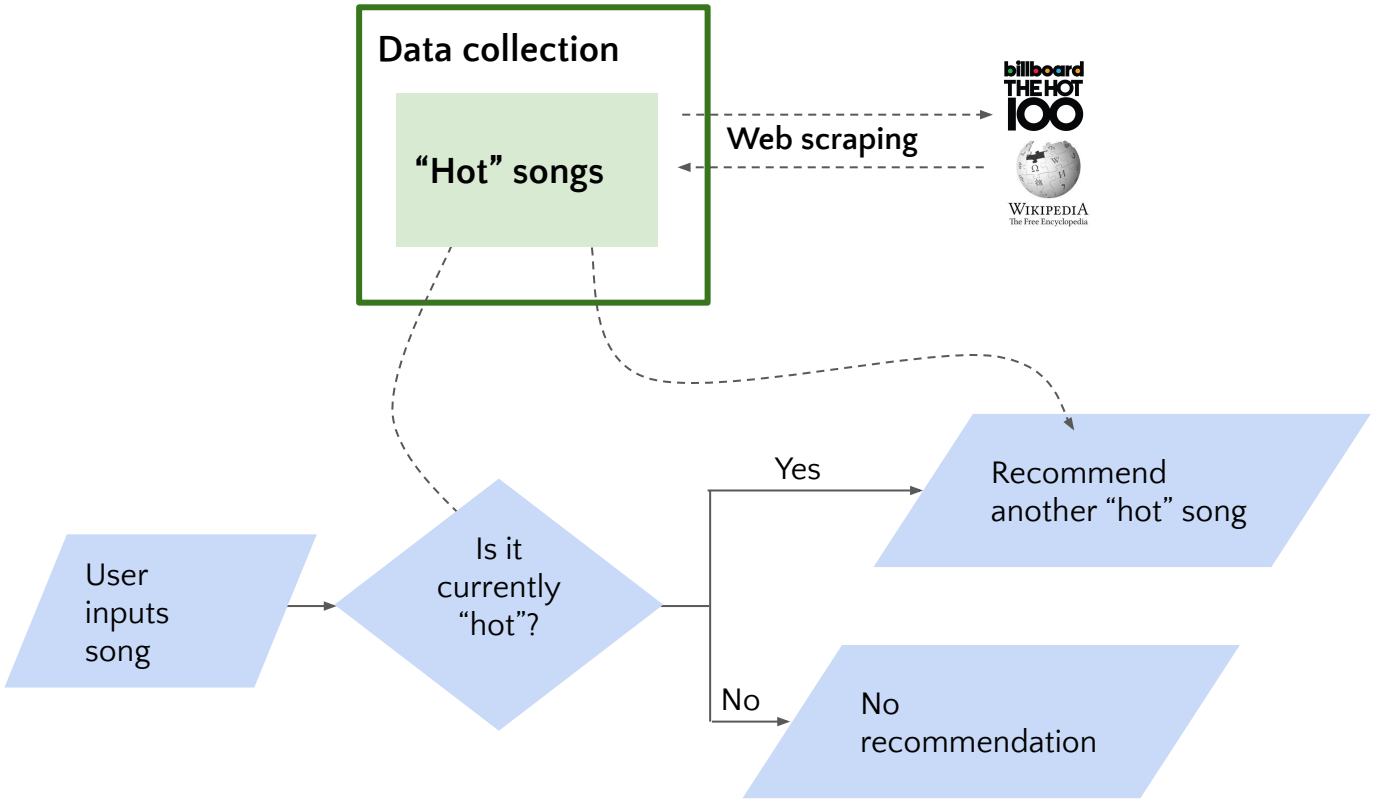
HTML Tutorial - optional

CSS Level 32 - optional

Project flowchart - GNOD Case Study



1st prototype



When to use web scraping

No API - if API is available, normally better to use it

Automation Needed - of course we can copy + paste but ... ugh

Less Restricted - eg no API account required, less rules to follow (eg limit on # requests)

ISSUES

- You depend on the structure of the site being scraped
  - Can be messy
  - Can change overnight
  - Website protections

When to use web scraping

Ideas for sites and use cases

Yellow pages - addresses of companies in a city
Reddit
Asos - images of menswear
Social networks
Amazon - prices of products
Bbc news - see how countries are described
Airbnb - apartments and room prices / sizes / locations - impact
Twitter - Bit coin all time high - look for acronyms
Skyscanner - demand forecasting - prices - best times to book
Linkedin - for filtering jobs

Web scraping slides

Basic html (tree) structure

```
<!DOCTYPE html>
<html>
    <head>
        <title>Page Title</title>
    </head>
    <body>
        <h1>My First Heading</h1>
        <p>My first paragraph.</p>
        <p>My second paragraph has a <b>bold<b> word!</p>
    </body>
</html>
```

- An **HTML element** is defined by a start tag, some content and an end tag. When web scraping we will mostly be interested in the content, but the tag will be crucial in locating the content.
- **Tags** are just keywords that encapsulate some content. They tell the web browser how to display the content. Some examples of common tags are:
- `<!DOCTYPE>` and <html> define the document type
- <head>, <title> and <body> define the main parts of the document
- <h1> to <h6> define headings
- <p> defines a paragraph
- <b> will make its contents bold

Tags , attributes and value pairs

```
<a href="https://www.ironhack.com/">a data bootcamp</a>
```

Attributes you need to know

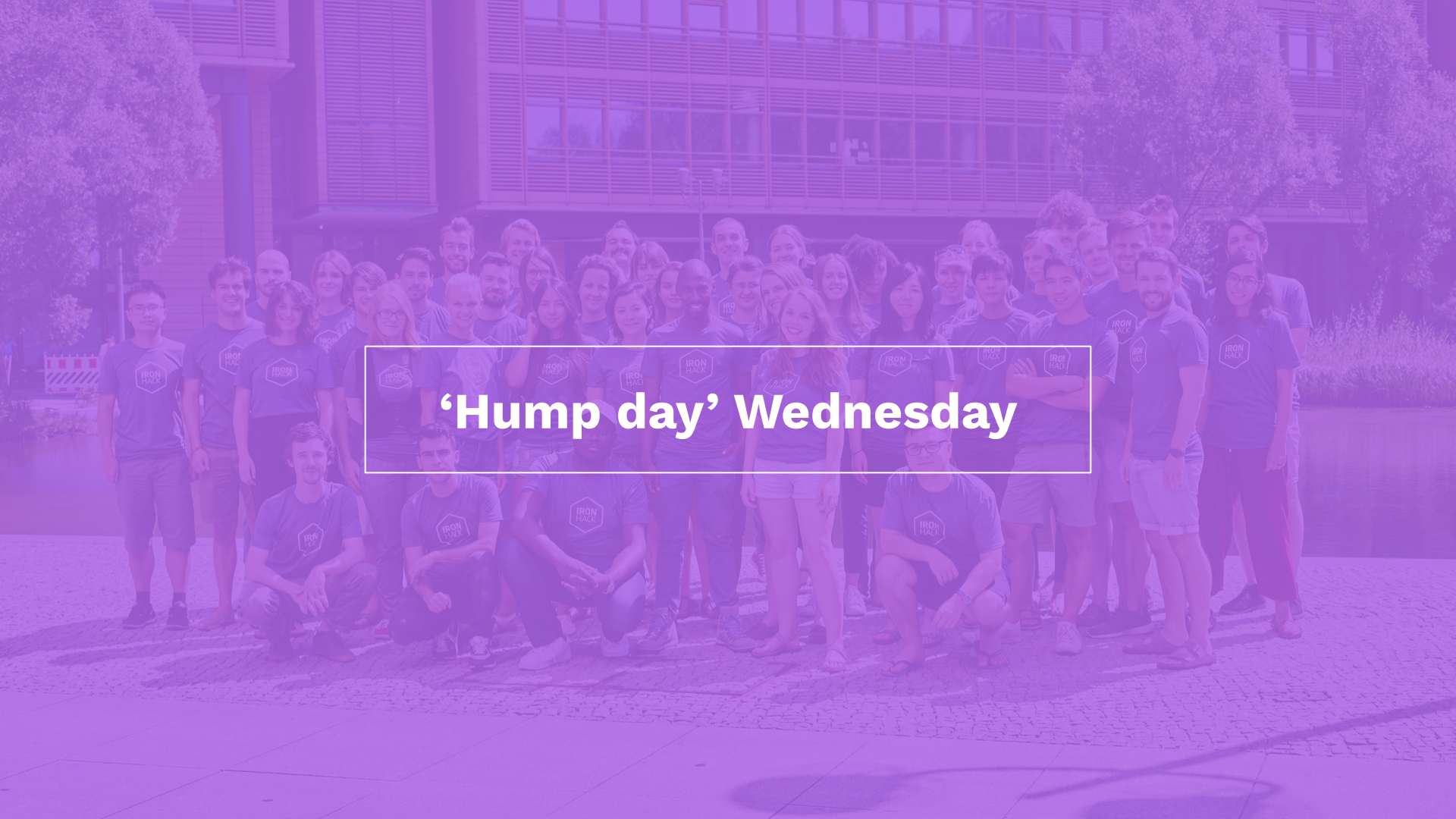
- The **id** attribute: unless the creator of the site has broken basic conventions, id's are unique. That makes them the best attributes for locating data in a site. If you discover that the piece of information you're trying to collect is an element that has an id, your job will be SO EASY. Bad news though: that doesn't happen often.

- The **class** attribute: it's often used to give style to multiple elements. For example, go to https://xkcd.com/. Notice how there are elements like "boxes" or "buttons" that are styled similarly in a site. Instead of defining the style for each one of these elements, the style for all the "boxes" might be defined in a different script (a CSS document), and it just points to all elements with `class = "box"`. This is often a useful way to locate content inside of an HTML script.


Found It!!!
Congratulations, it only took you 65298 seconds
www.jolyon.co.uk

The dormouse's story

Wikipedia - languages



‘Hump day’ Wednesday

Morning session

Fresh Brain Lab time -10:30

- **Finish working on web scraping labs from Tues**

Web scraping extended - multiple pages

Project definition & data assessment

Intro to APIs 8.04.2, 3

Lunch 12:50 - 14:00

Afternoon Session

Finish lecture - skyscanner API

3:15 Mapping using Folium with Brecht

Defining your final project & MVP as a brief - due PM friday

Activity 8.04.3 - skyscanner

Lab Session

->TA assisted Labs from 16:15-

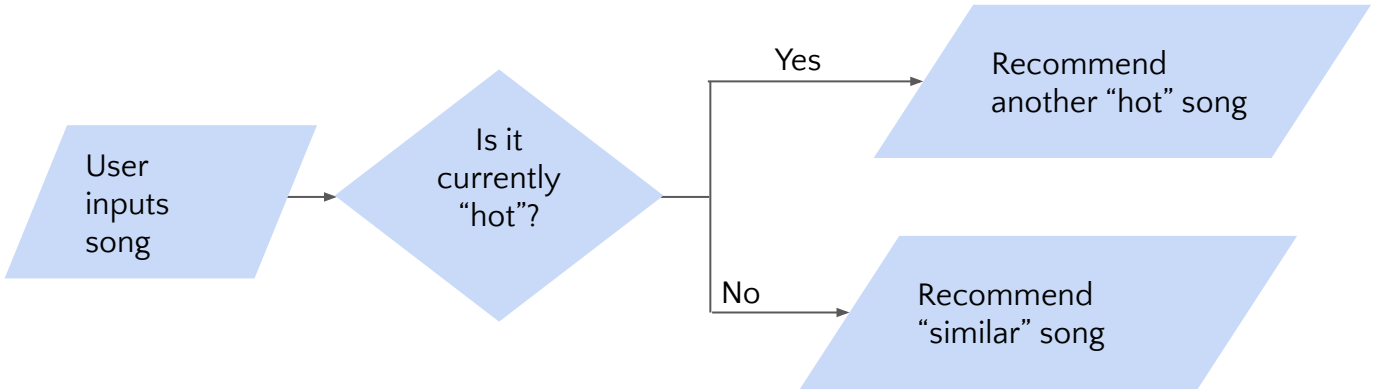
8.02 Web Scraping extended

8.03 Intro to APIs - optional

(Both are inside respective lesson unit in Day 2 of student portal)

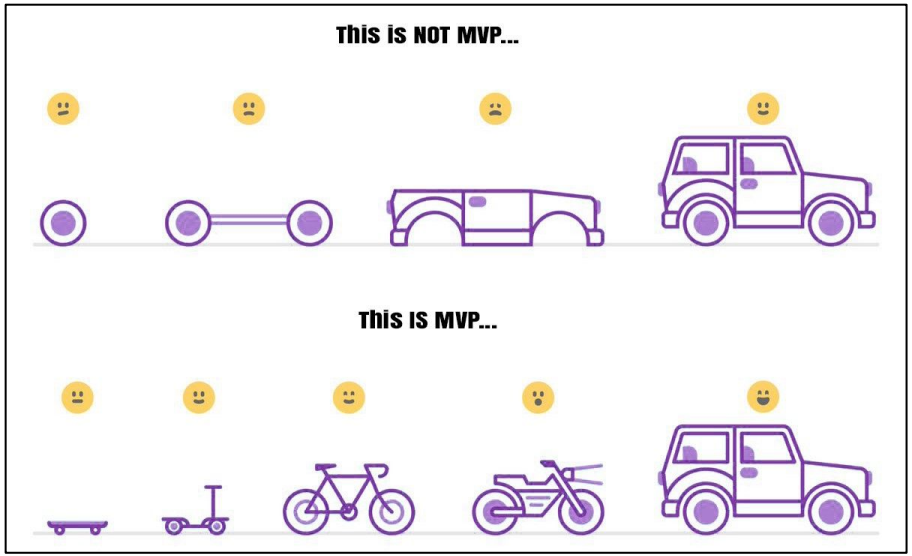
[LAB] Advanced Web Scraping - optional see student portal

Project flowchart - GNOD Case Study



Scraping multiple pages

IMDB - notebook provided
Assemble urls to send multiple requests
Using sleep()
Pull 631 movie titles and synopsis
US presidents - your turn
Collect all wikipedia links
Scrape each page
Organise in data frame
Extract some facts
Using error handling



Your first prototype

Specifics of your GNOD product

What's your MVP?

Create your python pipeline

- User experience
- Architecture
- Scheduling
- Testing


STEPS TO BUILD AN
MVP
1. Market Research
2. Express Your Idea
3. Design Process & User Flow
4. List the Project Features
5. Build Your MVP
6. Build, Measure and Learn

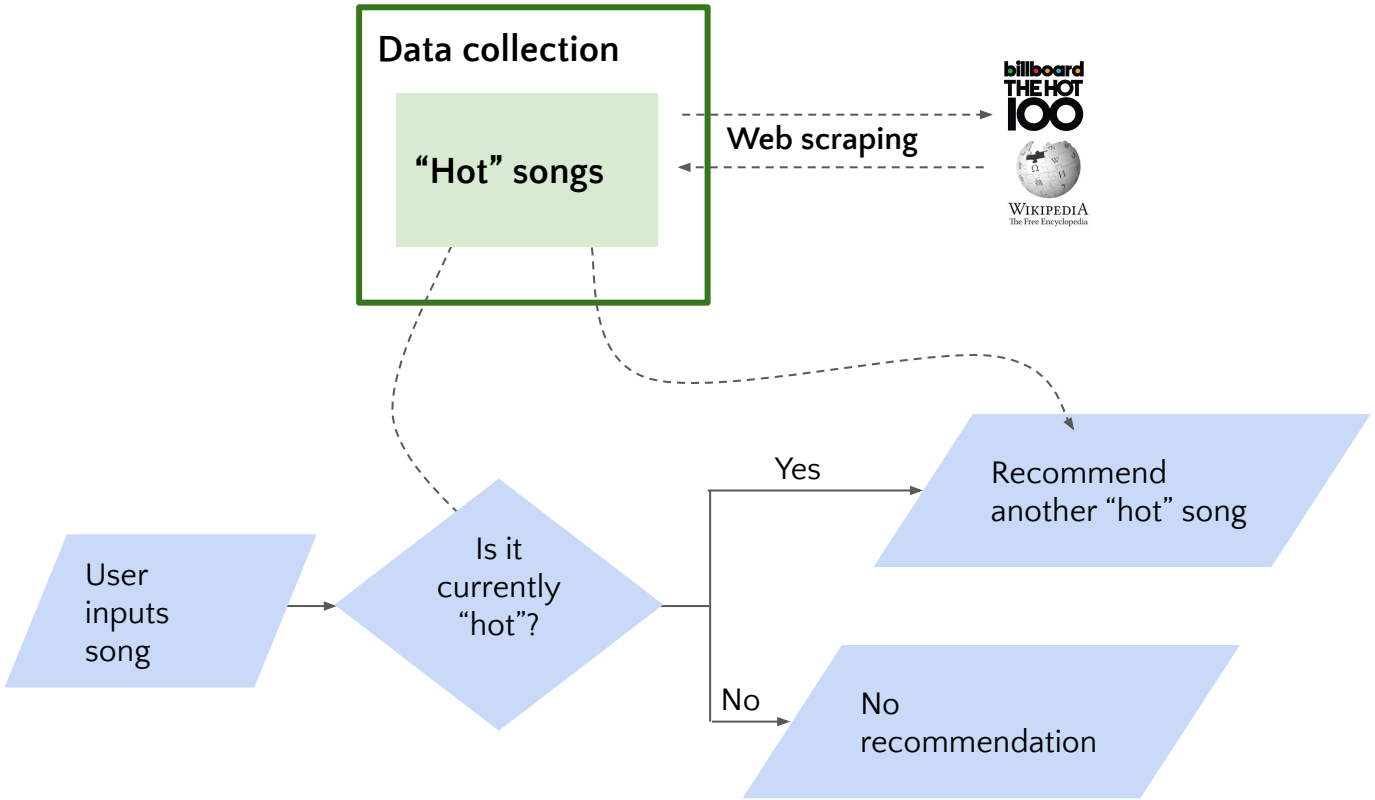
Prototype

MVP

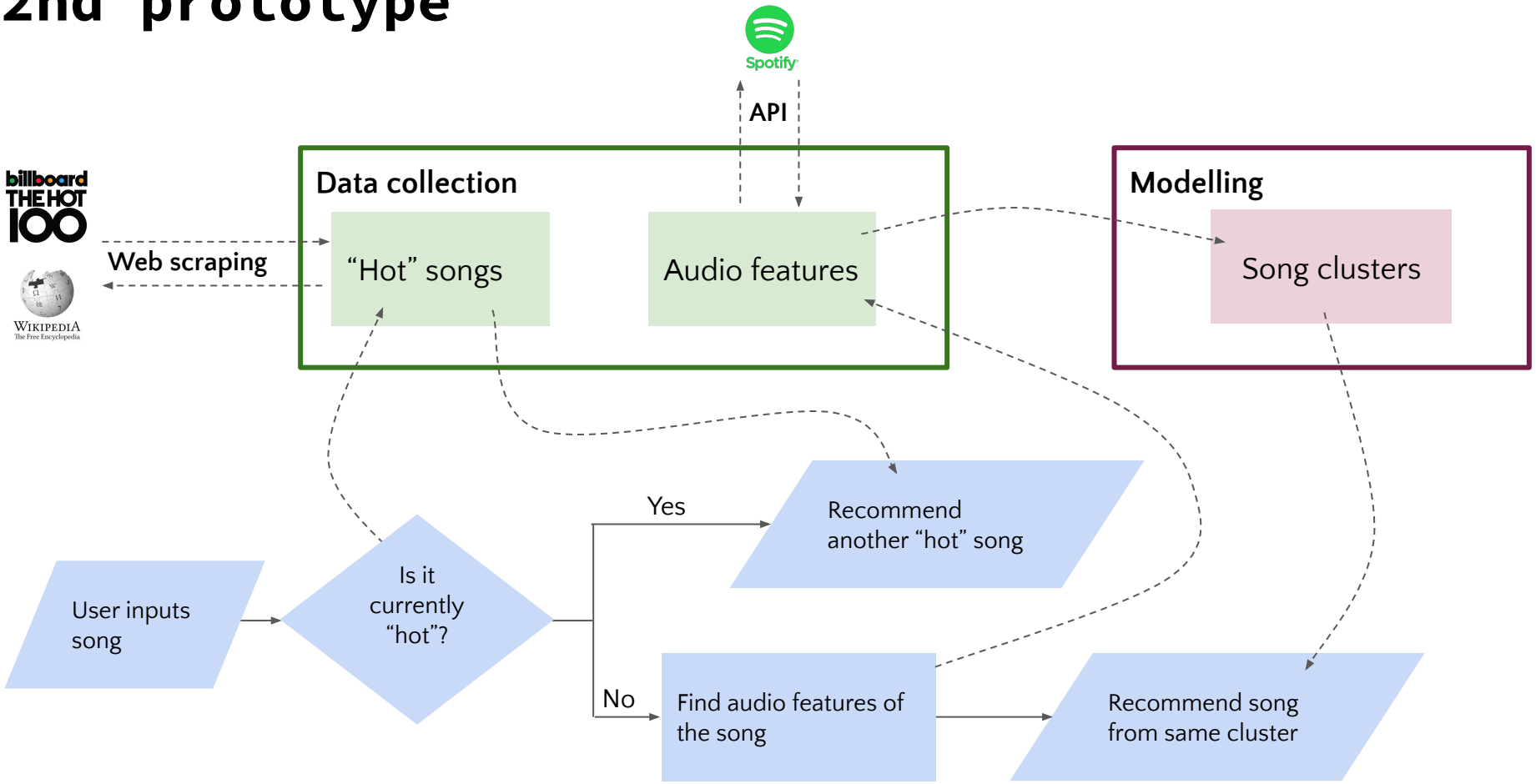
Product

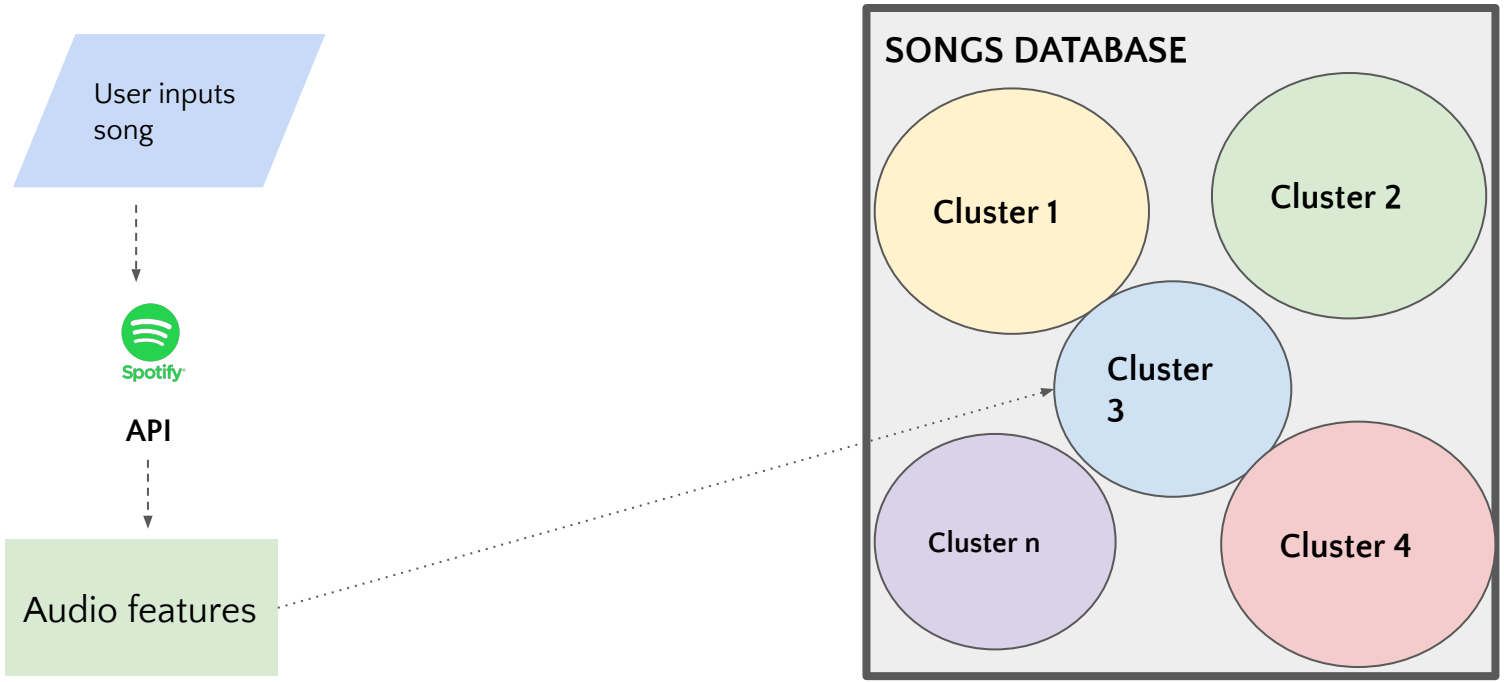
[Medium article - step by step]

1st prototype



2nd prototype




User inputs song
Spotify
API
Audio features
SONGS DATABASE
Cluster 1
Cluster 2
Cluster 3
Cluster n
Cluster 4

User experience:

- What happens if the user inputs a song that doesn't exist?
- What do we do with songs that have the same name, but a different artist?
- How do we deal with typos?

Architecture:

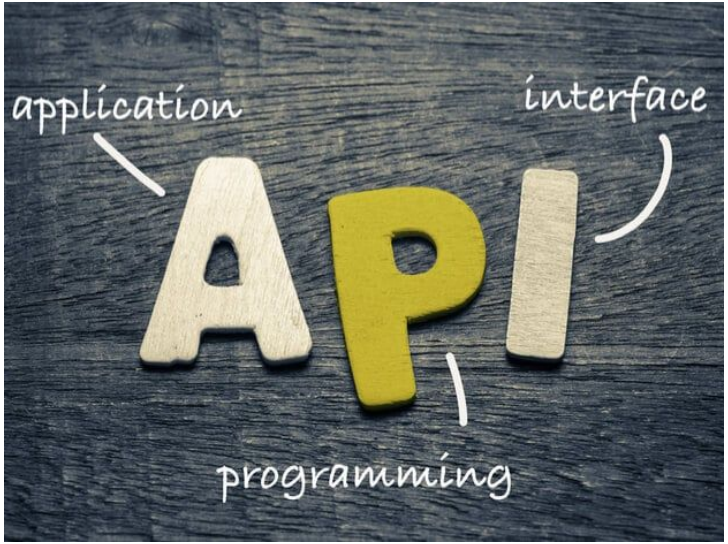
- Do we build the interaction with the user in the same notebook as the web-scraping?
- Where do we store the scraped songs?

Scheduling / Automation:

- Should we scrape billboard / wikipedia every time a user sends a request?

Testing:

- Does it work when you test it with a real user (a classmate or colleague or relative)?



Intro to APIs

What is it - in plain english
REST API
Requests Library - try 3 web pages
Status Codes review

Skyscanner API- sign up and use
Understanding JSON
Apply this to the Skyscanner API

Intro to APIs

----------Why do we need this for the Gnod Case study?

Our company Gnod is interested in grouping clients by their musical interests.
To do that we will need to collect data from musical sites so we can understand better this topic.

We have heard that the Spotify **API** is pretty good for this kind of data collection so we will take a look at it.

If it's not enough or we need more information, we will try other data collection methods.

Intro to APIs

API stands for **Application Programming Interface**.

At some point or another, most large companies have built APIs for their customers, or for internal use.

Every page on the internet is stored somewhere on a remote server. ...you can spin up a server on your laptop capable of serving an entire website to the Web

When you type www.facebook.com into your browser, a request goes out to Facebook's remote server. Once your browser receives the response, it interprets the code and displays the page.- the browser interacts with a remote server's API.

Kudos to this site https://www.freecodecamp.org/news/what-is-an-api-in-english-please-b880a3214a82/

Intro to APIs

An API isn't the same as the remote server — rather **it is the part of the server that receives requests and sends responses**.

You've probably heard of companies packaging APIs as products. For example, Weather Services like OpenWeather sells access to APIs

In technical terms, the difference is the format of the request and the response- your browser expects html, and gets data eg json

When a company offers an API to their customers, it just means that they've built a set of dedicated URLs that return pure data responses

Some APIs dont need access tokens - eg github

Kudos to this site https://www.freecodecamp.org/news/what-is-an-api-in-english-please-b880a3214a82/

APIs- better than a csv file?

- **The data changes quickly**. Stock price data or betting houses are a perfect example for it. It doesn’t really make sense to regenerate a dataset and download it every second. It is incredibly expensive and wouldn't be efficient nor effective at all, as it would be not just expensive but also really slow.
- **You want just a piece of all your data**. Imagine you want to download your facebook pictures. Without an API you would need to download the entire Facebook dataset, and that doesn't really make a lot of sense since we have APIs to filter that information.
- **Repeated computation involved**. The `Spotify API` that can tell you the genre of a piece of music. You could theoretically create your own classifier, and use it to compute music categories, but you’ll never have as much data as `Spotify` does, saving a lot of space.

RESTful APIs

REpresentational **S**tate **T**ransfer

- Frequently used web service method
- There are some **Architectural constraints**.
- This generalizes the use of **HTTP**, making requests to specific URLs
- We will use this tool to interact with an API
- Using **GET** and **POST**

Lets try web pages to retrieve json - which status code comes back?

Import requests and run a url request to the below webpages

- google
- NBA
- rottentomatoes

Request status codes

- 200: Everything went okay and the result has been returned (if any).
- 301: The server is redirecting you to a different endpoint. This can happen when a company switches domain names, or an endpoint name is changed.
- 400: The server thinks you made a bad request. This happens when you don’t send along the right data, among other things.
- 401: You are not properly authenticated.
- 403: The resource you’re trying to access is forbidden: you don’t have the right permissions to get it.
- 404: The resource you tried to access doesn't exist.
- 503: The server can't handle the request. </details>


Nearly there Thursday

Morning session

Spotipy installation

8.05.1 Spotify registration and App setup **(Client ID + Secret)**

9:30 Guest Lecture - Tania

API wrappers(Spotipy)8.05.2

Track dictionary 8.05.3

(OR) Spotify data on Kaggle

Lunch 12:50 - 14:15

Afternoon Session

Introduction to Unsupervised Learning

Debates in machine learning - ethics - optional

Consulting skills workshop with Sian 1 (3.30-4.15pm)

Lab Session

->TA assisted Labs from 15:00

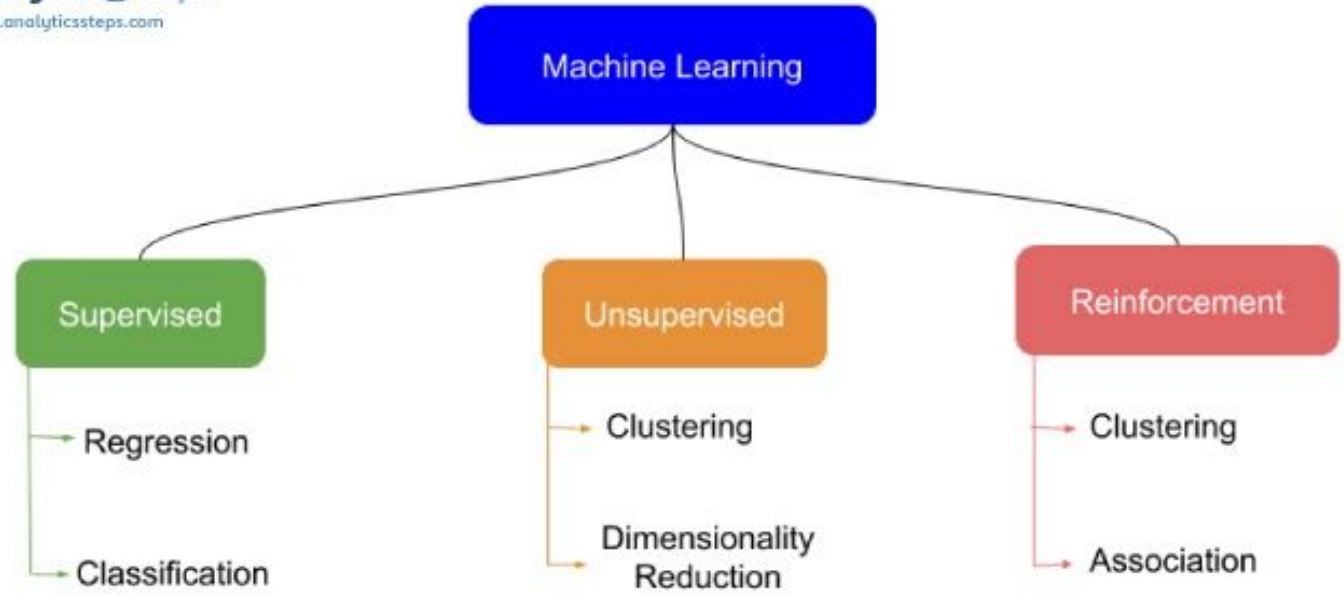
[Lab] API Wrappers (or data merge and dedupe) - Create collection- solution provided

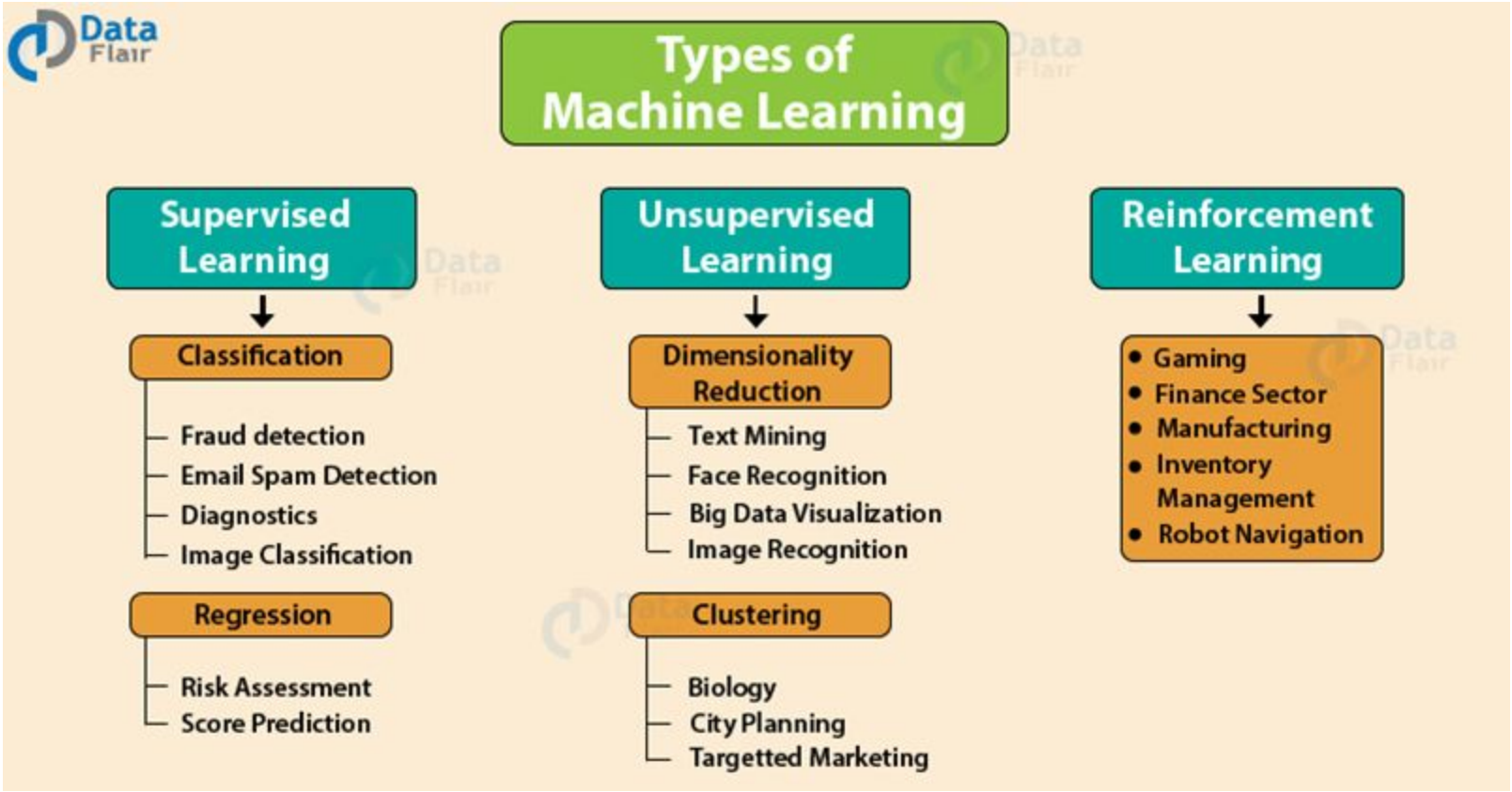
[Lab] Coingecko (optional)

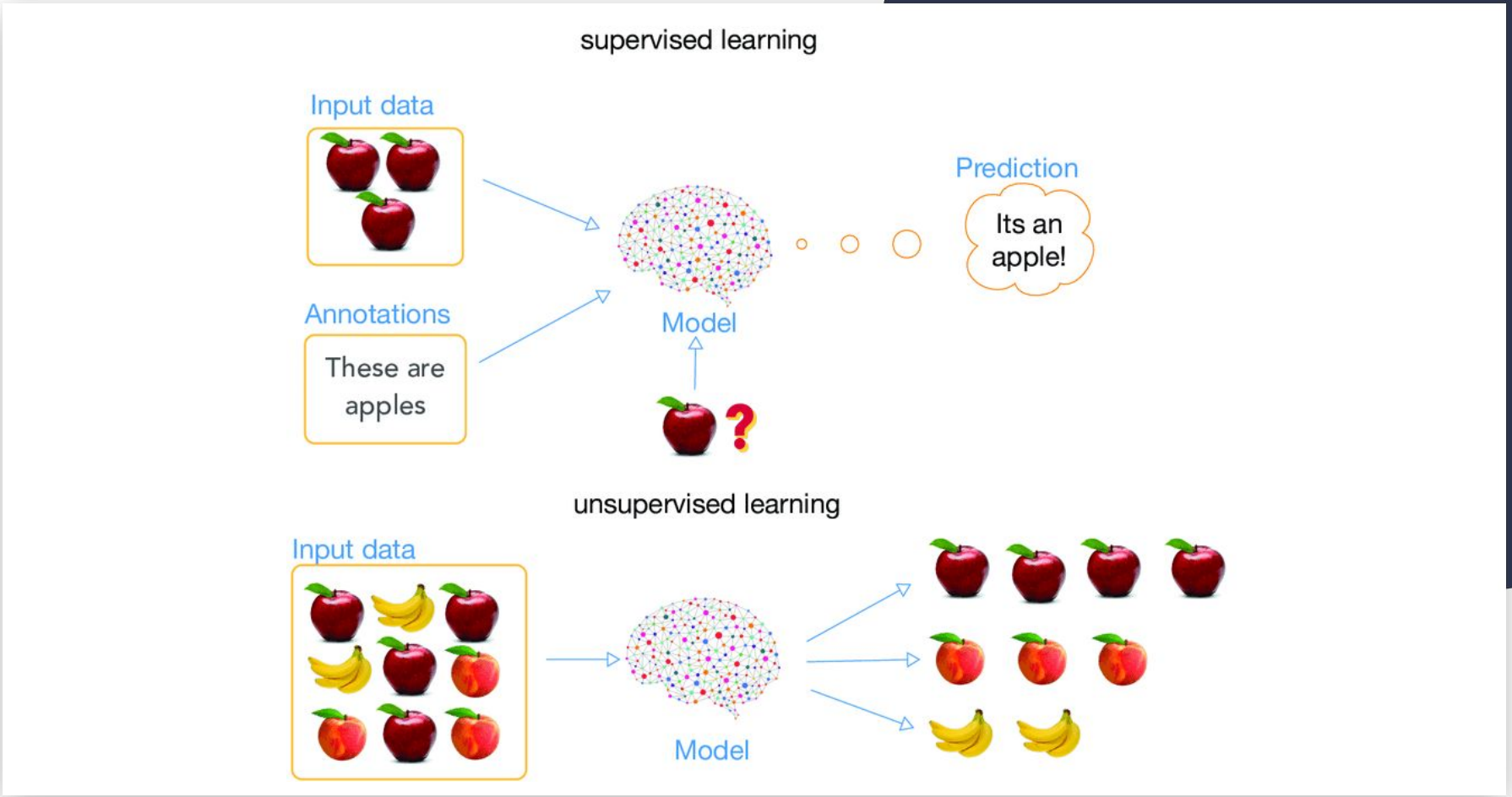
[Lab] Intro to Unsupervised Learning - review

[Lab] Iris Data (optional)

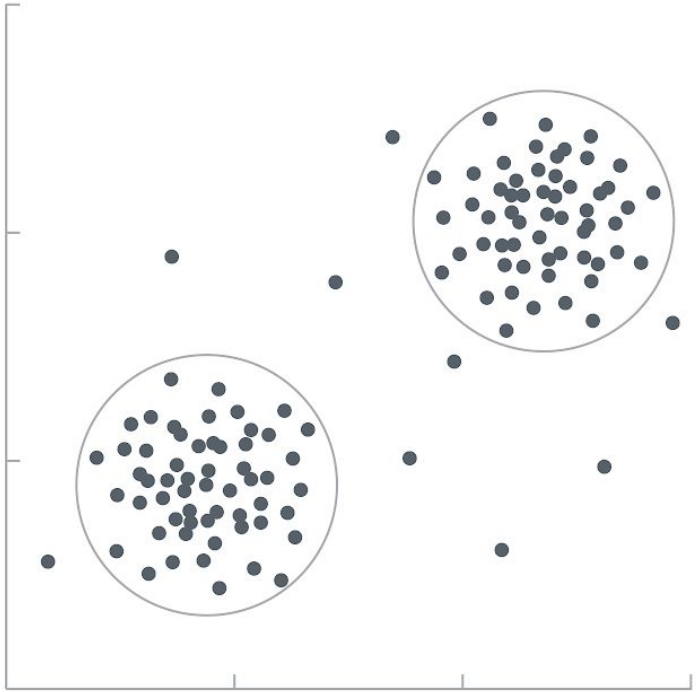
analyticSteps
www.analyticssteps.com



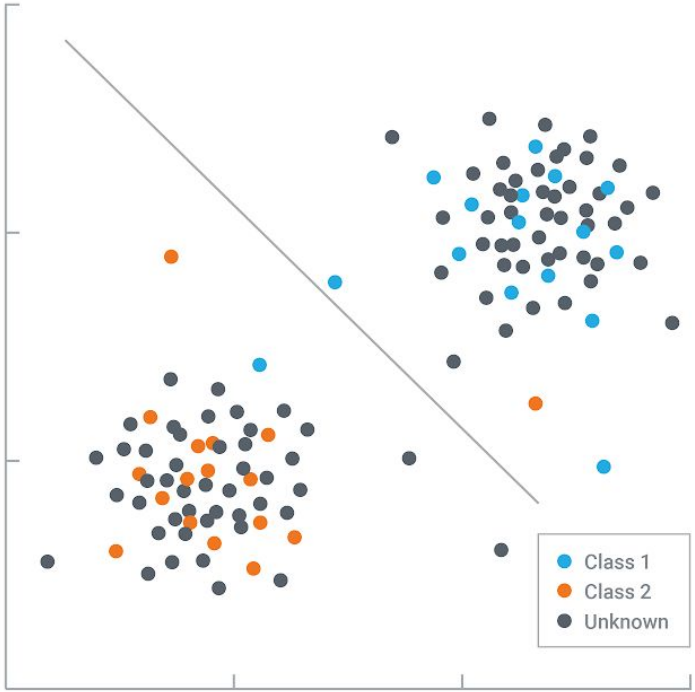

Data Flair
Types of Machine Learning
Supervised Learning
Classification
Fraud detection
Email Spam Detection
Diagnostics
Image Classification
Regression
Risk Assessment
Score Prediction
Unsupervised Learning
Dimensionality Reduction
Text Mining
Face Recognition
Big Data Visualization
Image Recognition
Clustering
Biology
City Planning
Targetted Marketing
Reinforcement Learning
Gaming
Finance Sector
Manufacturing
Inventory Management
Robot Navigation

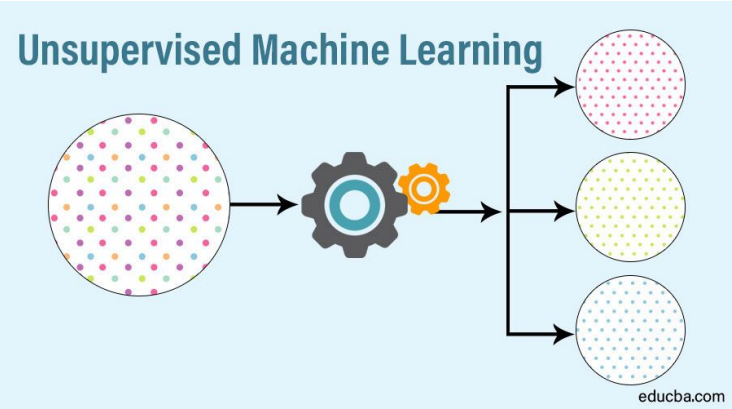

supervised learning
Input data
Annotations
These are apples
Model
Prediction
Its an apple!
unsupervised learning
Input data
Model

UNSUPERVISED



SUPERVISED





Unsupervised learning is a type of machine learning algorithm used to draw inferences from datasets consisting of input data without labeled responses.

The most common unsupervised learning method is cluster analysis, which is used for exploratory data analysis to find hidden patterns or grouping in data. The clusters are modeled using a measure of similarity which is defined upon metrics such as Euclidean or probabilistic distance.

Common clustering algorithms include:

Hierarchical clustering: builds a multilevel hierarchy of clusters by creating a cluster tree

k-Means clustering: partitions data into k distinct clusters based on distance to the centroid of a cluster

Gaussian mixture models: models clusters as a mixture of multivariate normal density components

Self-organizing maps: uses neural networks that learn the topology and distribution of the data

Hidden Markov models: uses observed data to recover the sequence of states

Pros of Unsupervised Machine Learning

It can detect what human eyes can not understand

The potential of hidden patterns can be very powerful for the business or even detect extremely amazing facts, fraud detection etc.

Output can determine the un-explored territories and new ventures for businesses. Exploratory analytics can be applied to understand the financial, business and operational drivers behind what happened.

Cons of Unsupervised Machine Learning

unsupervised learning is harder as compared to supervised learning

it can be a costly affair, as we might need external expert look at the results for us

Usefulness of the results; if what we have seen is of any value or not is difficult to confirm since no answer labels are available

Other Unsupervised Learning tasks

- *Principal Component Analysis:* PCA is a method that takes a dataset with *p* features that are assumed to be somewhat correlated and produces *p* new features, called Principal Components, ordered in such a way that the first few Principal Components explain most of the variability in the dataset.
- *Anomaly detection*: using algorithms such as the Local Outlier Factor or Gaussian Mixtures- find observations that deviate strongly from the norm.
- *Generative modelling*: using, for example, Generative Adversarial Network (GANs) - learn patterns of input data in such a way that the model can be used to generate new observations that plausibly could have been drawn from the original dataset

What will we do? - a simple K means Cluster approach

The *k*-means clustering method is an unsupervised machine learning technique used to identify clusters of data objects in a dataset.

k-means is one of the oldest and most approachable method.

These traits make implementing *k*-means clustering in Python reasonably straightforward, even for novice programmers and data scientists.

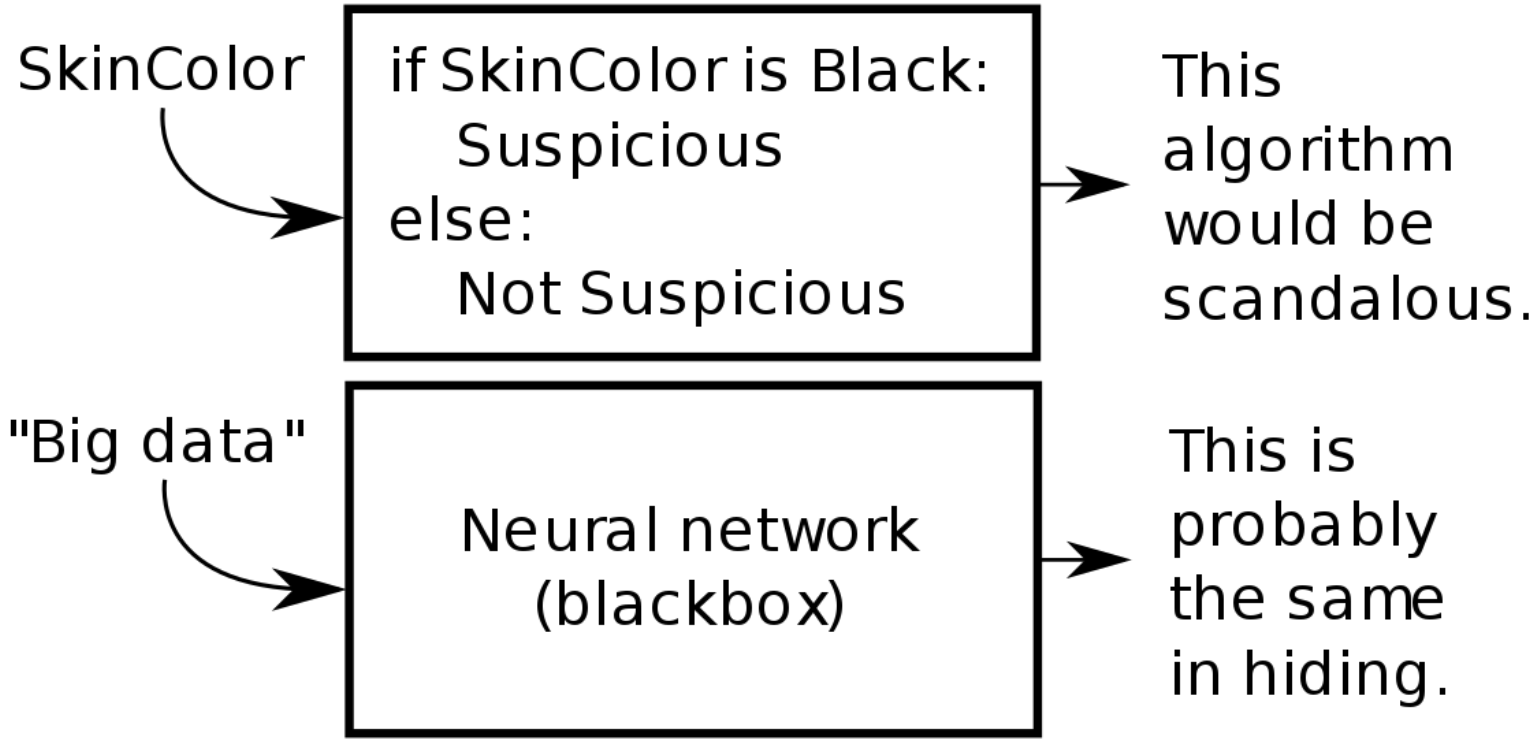
Warning - it is non-deterministic!

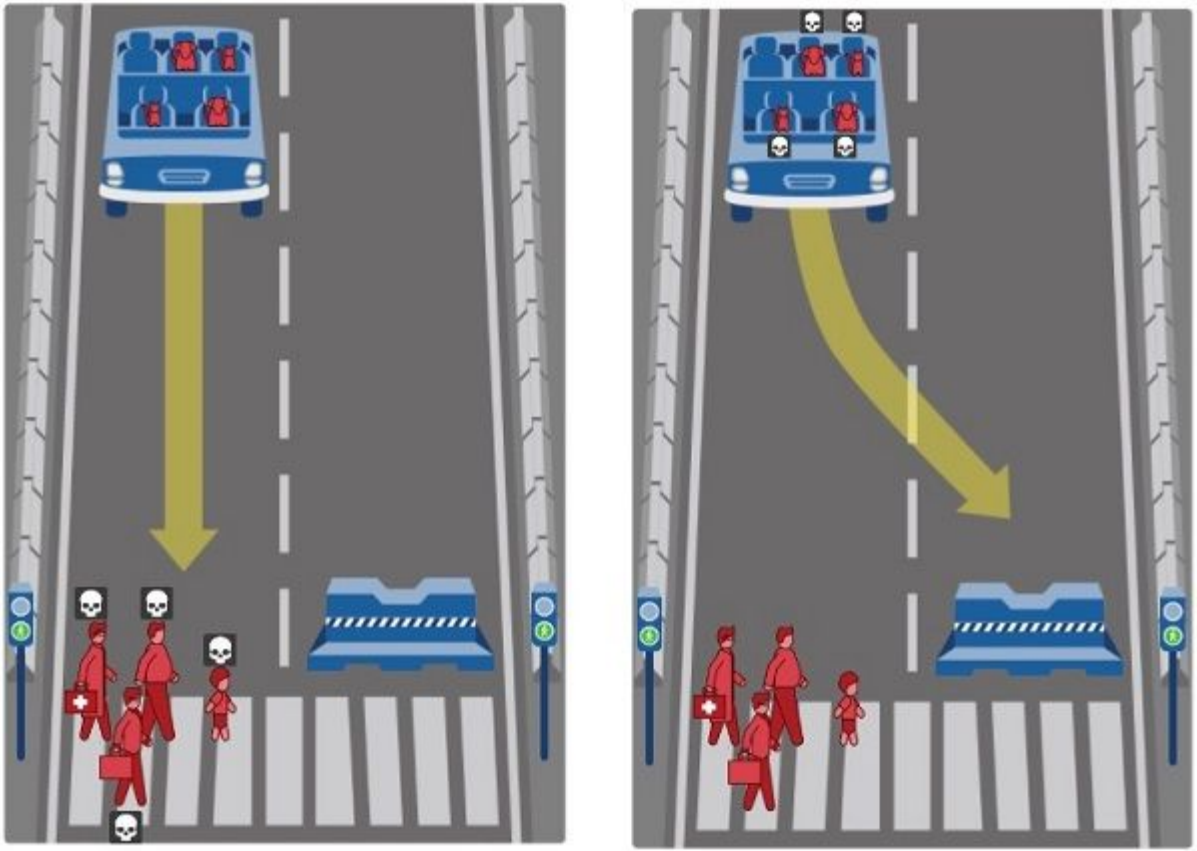
How do we know if our results are meaningful?

1)Let an expert look at the results (external evaluation)

2)Define an objective function on clustering (internal evaluation)


AI ETHICS


SkinColor
if SkinColor is Black:
Suspicious
else:
Not Suspicious
This algorithm would be scandalous.
"Big data"
Neural network (blackbox)
This is probably the same in hiding.



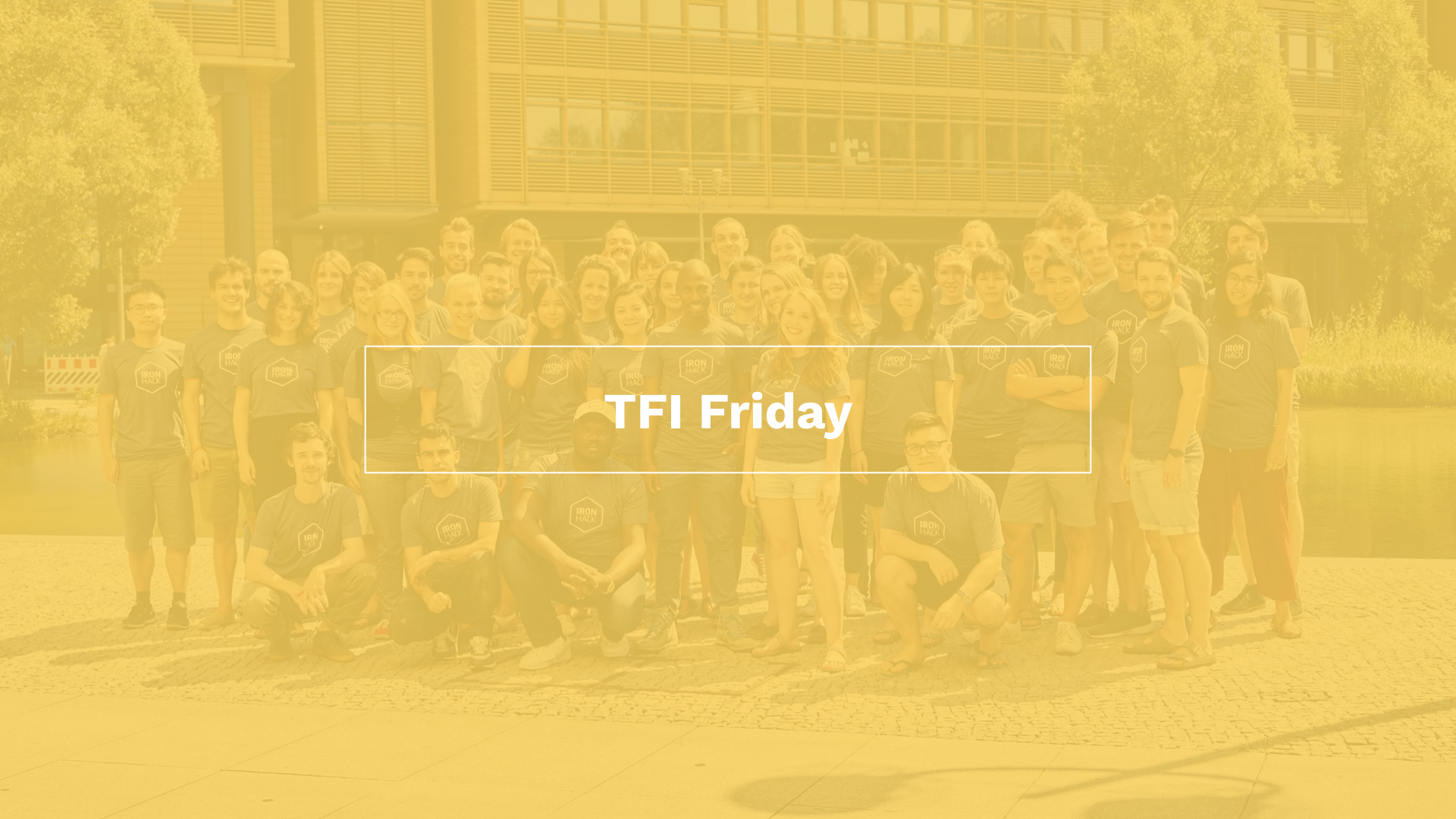
It's more technically feasible to automate predictable physical activities than unpredictable ones.

Technical feasibility of automation, %[1]

Predictable physical work	Unpredictable physical work
	
For example, welding and soldering on an assembly line, food preparation, or packaging objects	For example, construction, forestry, or raising outdoor animals

[1]% of time spent on activities that can be automated by adapting currently demonstrated technology.

McKinsey&Company


TFI Friday

Morning session

9:00-11:00 Project definition and identifying the data sources you will work with
- Make sure to complete the form to tell us about your project!
- reach out to LT or TA if you are struggling to define a project goal/ question / hypothesis

11:00 Guest Lecture - Ian Goodrich

Lunch 12:30 - 13:30

Afternoon Session

13:30 Clustering and Data Pipeline

Self guided
-or-
walk through / code along with Flo (optional)

Submit Labs for this week

Lab optional x 2

End of Day

16:00 Share class MVPs

17:00 Last Retro of the Bootcamp

17:45 Briefing on next week - what to expect
&
End of the week Toast