EU CoVis-19
VISUAL ANALYSYS

Covid-19 effects in Europe

OUR TEAM

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INTRODUCTION

Why EU CoVis-19?

Introduction

BACKGROUND

In the last two years one of the biggest pandemics in history: The Coronavirus or **Covid-19**.

BIG DATA

Covid-19 provide a huge amount of data to analyze

TARGET

Knowledge discovered helps: *researchers*, *epidemiologists*, and *policymakers*

MAIN ASPECTS

Three main aspects: **Cases**, **Deaths**, and **Vaccinations**

OBJECTIVES

Three main objectives:

1. **Comparisons** between different European countries
2. **Interactive** Visualizations
3. Analyze not only factors caused by COVID-19

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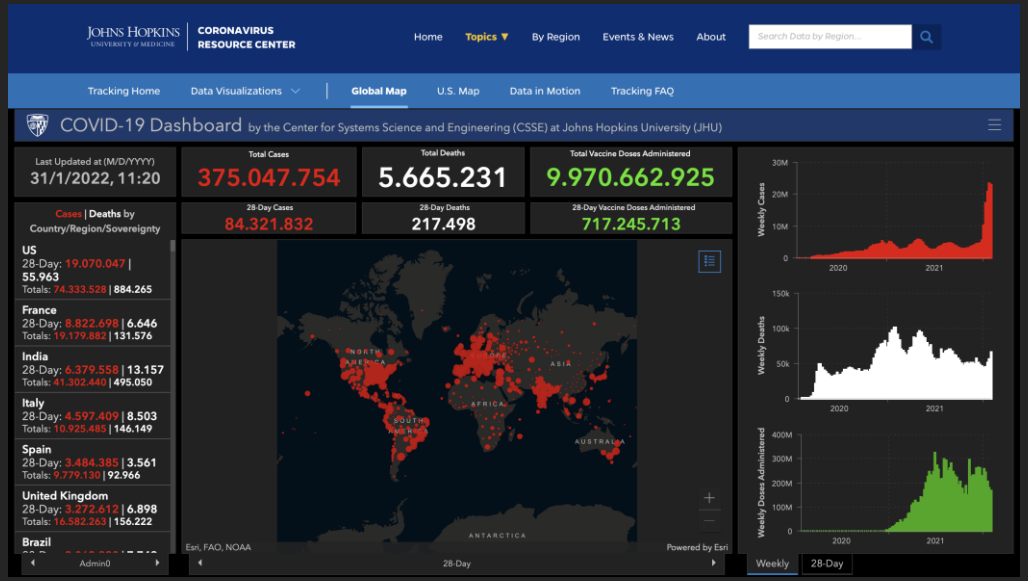
RELATED WORKS

Literature

Related Works

Due to the COVID-19 pandemic, many viewers and dashboards have been developed in the past year.

- Some of them viewed literature related to COVID-19 research and others viewed the economic impact
- Most of them focused on *actual COVID-19 cases*.
- However none of them deals with **visual analytics** but only with information visualization



Related Works

We analyze the related works with the goal to start from those ideas and then build our system.

Platform	*Comparisons*	*Interactions*	*Analytics*	*PCA*	*Structure*
JHU	❌	❌	❌	❌	multi-page
ECDC	❌	❌	❌	❌	multi-page
WHO	❌	poor	❌	❌	multi-page
CSSE	only textual	❌	❌	❌	multi-page
OWID	✅	tooltip	only aggregations	❌	multi-page
EU CoVis-19	✅	✅	✅	✅	single-page

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DATASET

Data management

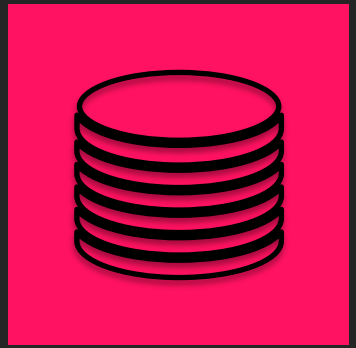
Dataset

SOURCES

We took the dataset by *Our World in Data.* It is very huge (AS index greater than 6 million), it contains the collected data for all the world.

Different sources:

- COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)
- European Centre for Disease Prevention and Control
- Government sources



DATA MANAGEMENT

Because we have to manage a very huge amount of data, we have chosen to store them inside a non-relational DataBase, making the accessibility easier.

Preprocessing

Very huge dataset:

- Only European countries
- Discarded countries: Guernsey, Jersey, Vatican, Andorra, Faeroe Islands, Gibraltar, Isle of Man, Kosovo, Liechtenstein, Monaco, San Marino, North Macedonia
- We select only a part of the features, the ones related to vaccinations, deaths, cases, and static factors

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TECHNOLOGIES

What’s inside EU CoVis-19

Back End

Scalable

Supports both vertical and horizontal scaling, it's well-suited for microservices due to a node based approach.

Fast

Built upon Google V8 Javascript runtime has a non-blocking I/O philosophy.

DB

Node.js best suites with MongoDB, a NoSQL distributed database which allows ad-hoc quesries and real-time integrations.

Community

There are plenty of interactive courses, tutorials, libraries and examples on GitHub.

Front End

D3.JS

A JavaScript library used to create interactive visualizations in the browser.
D3.js allows us to manipulate the elements on the DOM, making possibile to build interactive charts with smooth transitions and interactions.

REACT.JS

Opensource JavaScript library that allows users to build user interfaces through a component-based approach. Flexible, Reusable, Independent and Integrable. Those are the primary feature of this incredible library.

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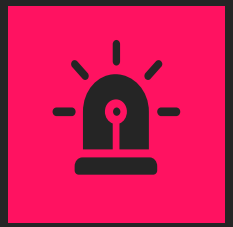
VISUALIZATIONS

And interactions of our project

OUR VIEWS

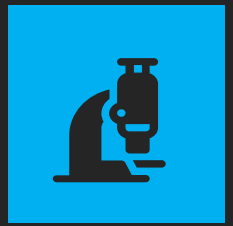


DEATHS

~1.7M

VACCINATIONS

336M at least 1 doses
317M at least 2 doses



CASES

~125M

EU CoVis-19

Deaths Cases Vaccinations 01 Jun 2021 - 27 Jan 2022

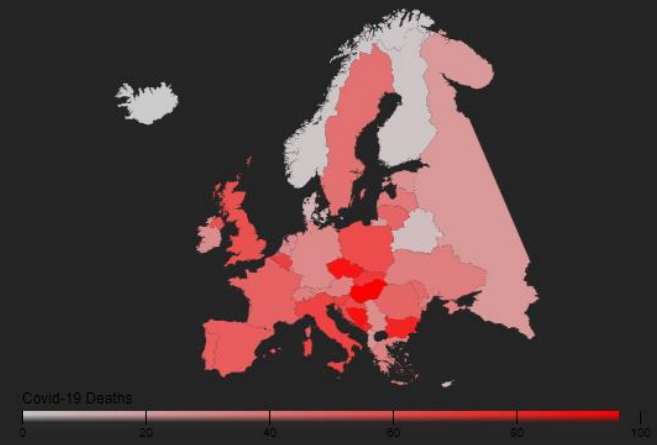


Table Chart

- In our case table chart has been used as an interactive legend for the current view
- Each nation have a specific color constant for all the graphs.
- On click changes the focus of the environment on the selected country.

Country	Population	Pop. density	Life Expect	GDP	Median age	HDI
United Kingdom	68.2 M	272.898	81.32	39753.2	40.8	0.932
Spain	46.7 M	93.105	83.56	34272.4	45.5	0.904
France	67.4 M	122.578	82.66	38605.7	42	0.901
Italy	60.4 M	205.859	83.51	35220.1	47.9	0.892

Choropleth Map

- Simple but effective view that allows to visualize at first glance how covid affects counties in Europe.
- Colors in the map respect how much high is the percentage of deaths/cases/vaccination related to the population (an appropriate legend has been placed for reference).
- On click select/remove focus on the country.
- Zoom when select a country with a projection of data.

Flag button

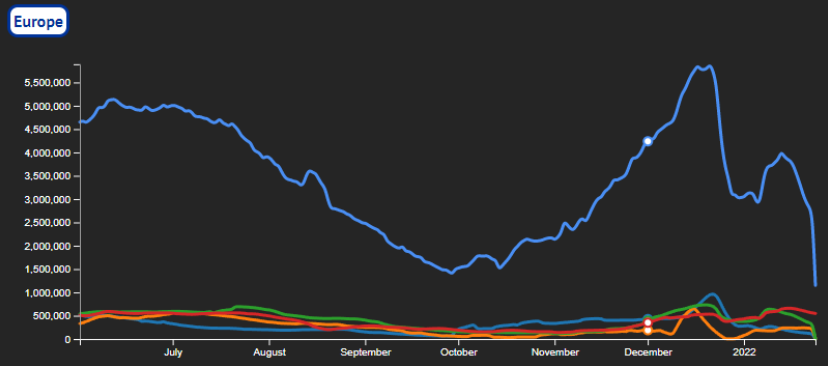
Time selector

Country search bar

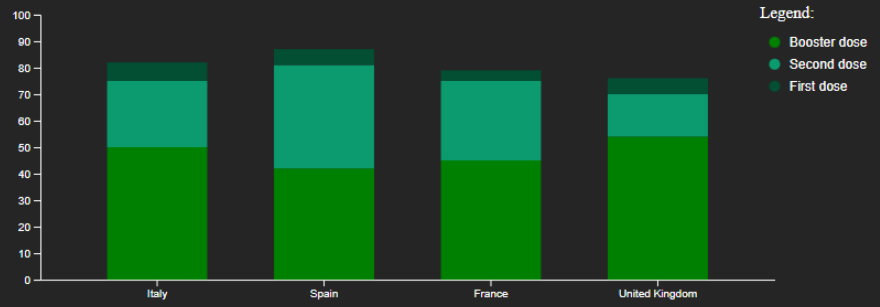
Navbar

Line Chart

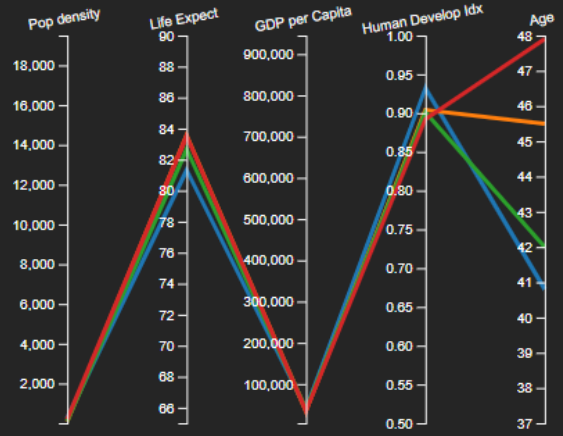
- Displays information as a series of data points connected by straight line segments.
- Great visualization to display temporal information about the presented data.
- Immediate comparison between countries and Europe.
- Color encoded among all the charts.
- On mouse over shows a tooltip with data about selected countries.



Bar Chart



- In this kind of views vertical bars has length proportional to the values represented.
- Stacked bar chart to compare different countries.
- **Vaccination** -> percentage of vaccinated related to doses status.
- **Deaths** -> percentage of deaths compared with positive over population.
- **Cases** -> percentage of positives over population compared with deaths and stringency index
- On click select/remove focus on the country.
- On mouse over shows a tooltip with the displayed data.

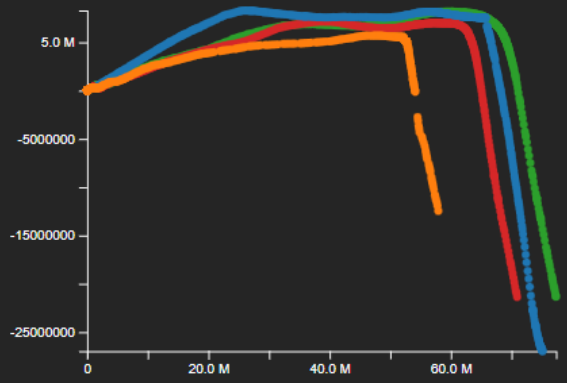


Parallel Coordinates Chart

- Computes the feature of several observations about a set of numeric variables.
- Each bar represents a variable with its related scale.
- Values displayed as series of lines connected across axis.
- Different feature, that better describes the healthiness and wealth of a country, for each visualizations.

PCA Chart

- Scatterplot to display pairs of data into Cartesian coordinates.
- 2D visualization of the two principal components for each selected countries.
- Highlight the differences between countries, it’s easy to see which of them have provided a small amount of data.
- Changes based on selected countries and interval of time.
- Different visualization in base of the views (Death and Cases shares the same graph).



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ANALYTICS

Simple and Complex

Simple

Make the comparison as simple as possible:

- The aggregation of the data are based on countries and period selected, computed at the selection
- Very high number of possible combination

About:

- *Parallel coordinates* and *TableChart* are simple aggregation
- *LineChart* is aggregation plus summation
- All the percentage shown in the *BarChart* are the result of a computation
- *European data* are computed at the selection

Complex

PCA:

- Not used only for dimensionality reduction, but also making the data shown by PCA useful for comparison
- Applied to different data to help to understand how much data we have of each country
  → some countries provide much more data than others
- Analytics because the computation is done at each selection and is not precomputed

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CASE OF STUDY

An example of use

Italy, Russia and Romania

At first look:

- Russia: most affected nation for both infections and deaths
- Romania: one of the least affected countries even having vaccinated people
- Italy: almost affected as Russia being much smaller and having a very high percentage of vaccinated people

Overall: Italy takes excessive measures that are not effective, Romania is healthy while not taking measures and Russia is in catastrophe

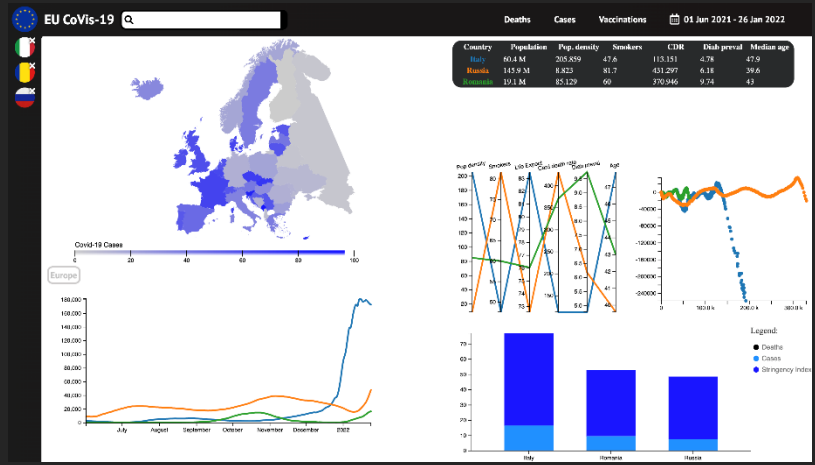
Italy, Russia and Romania

Let's analyze with EU CoVis-19:

- *MapChart*: Italy has the highest percentage of cases and vaccination relatives to the population, but the percentage of deaths in Romania and Russia is higher

- *BarChart*: Italy is the one that maintains the highest stringency index, which together with the vaccinations influence the saturation of intensive care

- *Table and Parallel coordinates*: Italy has the most population density, longest life expectancy and is oldest country ⟶ faster infection
- *PCA chart*: few data of Romania ⟶ undisclosed data that would influence the percentage of cases, deaths and vaccinations



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CONCLUSION AND FUTURE WORK

What we can do more

Conclusion

- Different from other views, we take into account all the possible factors that can affect the pandemic
- We made the view in one-page structure ⟶ make the comparison as efficient as possible
- By incorporating PCA we provide also a tool that helps to ideally understand how different country data is and how much data is being provided

Future work

- Our tool can be applied to other real-world applications, by changing the data in the dataset
- We explore the possibility of incorporating other tools into the project to make prediction of trends or help better understanding of the data

THANKS!

Do you have any questions?

https://github.com/EU- CoVis-19