

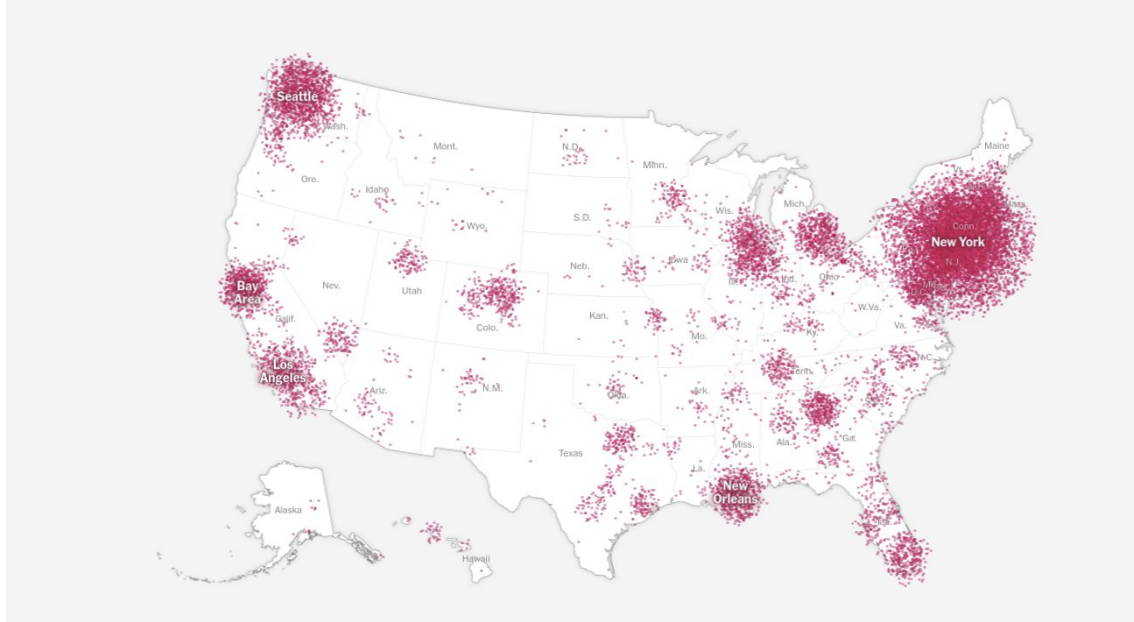
Corona-Vis: Covid-19 around the world

Expansion of COVID-19



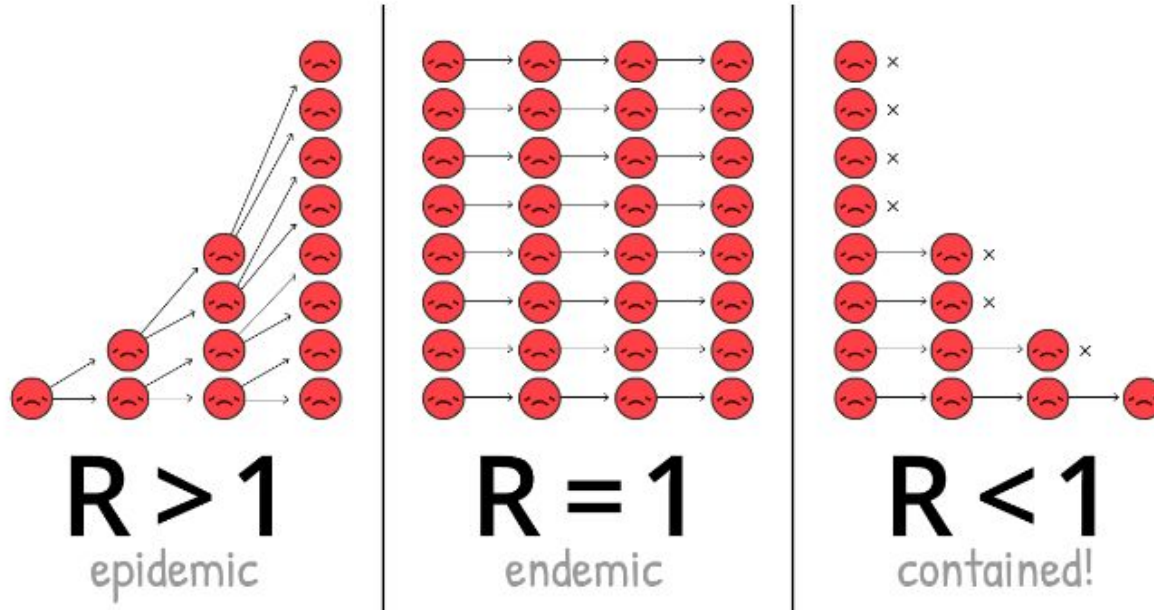
New York Times, covid-19 China.

Expansion of COVID-19

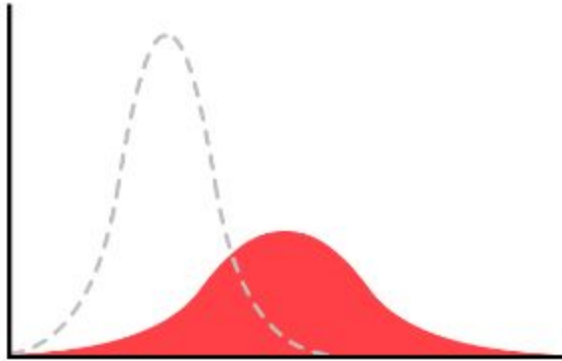


New York Times, covid-19 EEUU.

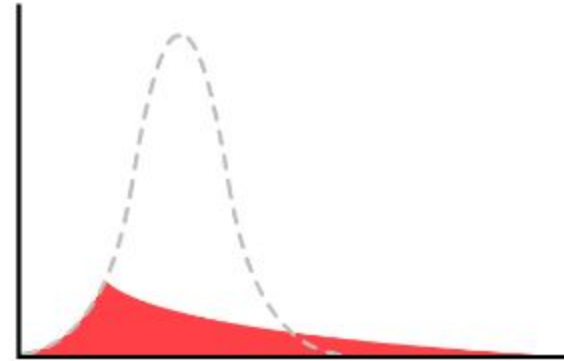
Prediction basic reproductive ratio (R) through time



Prediction basic reproductive ratio (R) through time



Mitigation ($R > 1$)



Suppression ($R < 1$)

Estimation: Bettencourt & Ribeiro 2008 - SIR model

Estimate real-time R_t using a Bayesian approach with Gaussian noise.

$$\frac{dS}{dt} = -\beta \frac{S}{N} I \quad \frac{dI}{dt} = \beta \frac{S}{N} I - \gamma I,$$

Where I is the average number of infectious (rate), S is average number of susceptibles at time t (k)

So we have the bayes rule having seen k new cases, we believe the distribution R_t of I is equal to:

$$P(R_t | k) = \frac{P(k | R_t) \cdot P(R_t)}{P(k)}$$

- The **likelihood** of seeing k new cases given R_t times ...
- The **prior** beliefs of the value of I without the data ...
- divided by the probability of seeing this many cases in general

Estimation: Bettencourt & Ribeiro 2008 - SIR model

Estimate real-time R_t using a Bayesian approach with Gaussian noise.

$$\frac{dS}{dt} = -\beta \frac{S}{N} I \quad \frac{dI}{dt} = \beta \frac{S}{N} I - \gamma I,$$

So, to estimate today's prior $P(R_t)$ we use yesterday's prior $P(R_{t-1})$ assuming that R_t is a gaussian distribution with center in R_{t-1} .

$$P(R_t | R_{t-1}) = N(R_{t-1}, \sigma)$$

$$P(R_1 | k_1) \propto P(R_1) \cdot \mathcal{L}(R_1 | k_1)$$

On day two:

$$P(R_2 | k_1, k_2) \propto P(R_2) \cdot \mathcal{L}(R_2 | k_2) = \sum_{R_1} P(R_1 | k_1) \cdot P(R_2 | R_1) \cdot \mathcal{L}(R_2 | k_2)$$

Estimation: Bettencourt & Ribeiro 2008 - SIR model

Each new arrival will modeled by continuous distribution poisson like:

$$P(k|\lambda) = \frac{\lambda^k e^{-\lambda}}{k!}$$

Given an average arrival rate of λ new cases per day, the probability of seeing k new cases

Finding relationship between R_t and λ , so We have $P(\lambda_t | k_t)$ which is parameterized by λ but we were looking for $P(k_t | R_t)$

So, calculating the derivation we have $\lambda = k_{t-1} e^{\gamma(R_t - 1)}$, where γ is the reciprocal of the serial interval (with value of 7 for Covid-19*).

Source: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0002185>

* https://wwwnc.cdc.gov/eid/article/26/7/20-0282_article

Estimation: Bettencourt & Ribeiro 2008 - SIR model

Since we know every new case count on the previous day, we can now reformulate the likelihood function as a Poisson parameterized by fixing k and varying R_t , we have:

$$\lambda = k_{t-1} e^{\gamma(R_t-1)} \qquad P(k|R_t) = \frac{\lambda^k e^{-\lambda}}{k!}$$

So we calculate the likelihood to get the best σ , that maximizes k : $P(k|\sigma)$, that is maximizes $P(k)$.

$$P(k) = P(k_0, k_1, \dots, k_t) = P(k_0)P(k_1) \dots P(k_t)$$

Using Bayes to calculate $P(k_t)$, we have:

$$P(R_t|k_t) = \frac{P(k_t|R_t)P(R_t)}{P(k_t)} \quad P(k_t, R_t) = P(k_t|R_t)P(R_t) \quad P(k_t) = \sum_{R_t} P(k_t|R_t)P(R_t)$$

Estimation: Bettencourt & Ribeiro 2008 - SIR model

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Likelihood:

$$L(P(k)) = \prod P(k_0)P(k_1) \dots P(k_t)$$

Maximizes the likelihood is the same as minimizing "negative log likelihood":

$$\log(L(P(k))) = \sum_{i=0}^t \log(P(k_i))$$

Estimation: Bettencourt & Ribeiro 2008 - SIR model

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$$\log(L(P(k))) = \sum_{i=0}^t \log(P(k_i))$$

We obtain the best σ , derivating the log of the likelihood:

$$\sigma = \sqrt{\frac{1}{n} \sum (k_i - \mu)^2}$$

Where μ :

$$\mu = \frac{1}{n} \sum k_i$$

Confidence Interval:

$$P(Z \leq z) = 1 - \alpha/2$$

$$P(Z \leq z) = 0.9$$

$$\phi(z) = 0.9$$

$$P\left(-z \leq \frac{X - \mu}{\sigma/\sqrt{n}} \leq z\right) = 0.9$$

Data Source

- Plataforma Nacional de Datos Abiertos, Minsa, Peru.
- Data positivo por COVID-19 - [Ministerio de Salud]

The screenshot shows the 'Plataforma Nacional de Datos Abiertos' website. The header is red with the 'gob.pe' logo and the text 'Plataforma Nacional de Datos Abiertos'. The breadcrumb trail is 'Home / Datasets / Casos positivos por COVID-19 - [Ministerio de Salud - MINSA]'. There are buttons for 'Ver' (with an eye icon) and 'Revisiones' (with a document icon). The main title is 'Casos positivos por COVID-19 - [Ministerio de Salud - MINSA]'. Below the title, there are icons for 'COVID-19' and 'Salud'. The text states: 'Los datos publicados, corresponden al total de casos reportados que dieron positivo al COVID - 19, por departamento, provincia y distrito.' and 'Adicionalmente encontraran datos que son de interés nacional, los mismos que se ponen a disposición de la ciudadanía.' The 'Fuente' is 'Instituto Nacional de Salud y Centro Nacional de Epidemiología, prevención y Control de Enfermedades - MINSA.' The 'Frecuencia de actualización' is 'La información se actualiza diariamente'. On the left side, there is a section 'Datos Abiertos de COVID-19' with a 'Licencia' section showing 'Open Data Commons Attribution License' and an 'Otros accesos' section stating 'La información en esta página (los metadatos del conjunto de datos) también está disponible en formato (json)' with a 'Ver Formato' button.

Open data from "Ministerio de Salud"

Data Source

- Structure

- UUID
- Departamento
- Provincia
- Distrito
- Método
- Edad
- Sexo
- Fecha Resultado

	UUID	DEPARTAMENTO	PROVINCIA	DISTRITO	METODO0DX	EDAD	SEXO	FECHA_RESULTADO
0	7320cabdc1aaca6c59014cae76a134e6	LIMA	LIMA	LIMA	PCR	32.0	MASCULINO	23/05/2020
1	e81602051997ace8340bb8c18fe24c65	LIMA	LIMA	MIRAFLORES	PCR	63.0	MASCULINO	23/05/2020
2	cecdbf10074dbc011ae05b3cbd320a6f	LIMA	LIMA	LA VICTORIA	PCR	45.0	MASCULINO	23/05/2020
3	71ecb6bccb248b0bb2ac72ed51b5e979	LIMA	LIMA	CHORRILLOS	PCR	37.0	MASCULINO	23/05/2020
4	566af4276cbe9359abe93f9aa86396c3	LIMA	LIMA	LIMA	PCR	25.0	MASCULINO	23/05/2020
...
123974	2549a57f71a380ee34b55354268e6c86	UCAYALI	CORONEL PORTILLO	CALLERIA	PR	30.0	FEMENINO	11/05/2020
123975	f3b32bee298af92986485f48867e163c	UCAYALI	CORONEL PORTILLO	CALLERIA	PR	46.0	MASCULINO	9/05/2020
123976	fbba38dee89edd2257c0c6e8f5b9123	UCAYALI	CORONEL PORTILLO	MANANTAY	PR	65.0	MASCULINO	23/05/2020
123977	be8057931a6e88bd760a101c0d2c6151	UCAYALI	CORONEL PORTILLO	CALLERIA	PR	37.0	MASCULINO	22/05/2020
123978	cdd2d9cb9abeaf9f12f82265918ededd	UCAYALI	CORONEL PORTILLO	YARINACOA	PR	25.0	MASCULINO	9/05/2020

Open data from “Ministerio de Salud”

Data Source

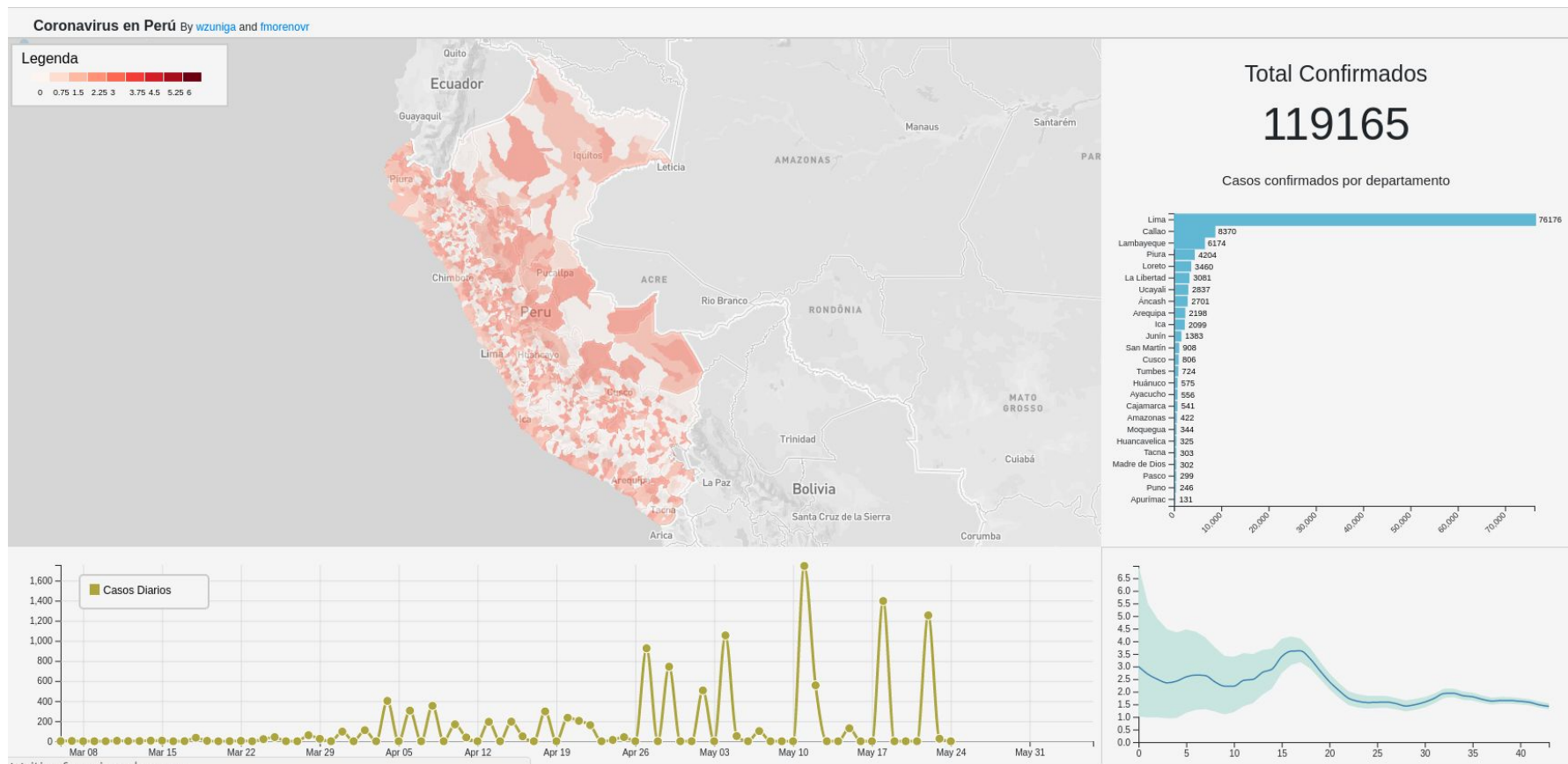
Errors:

- 11443 / 123979 wrong values.
- 0 or 1 value per district.

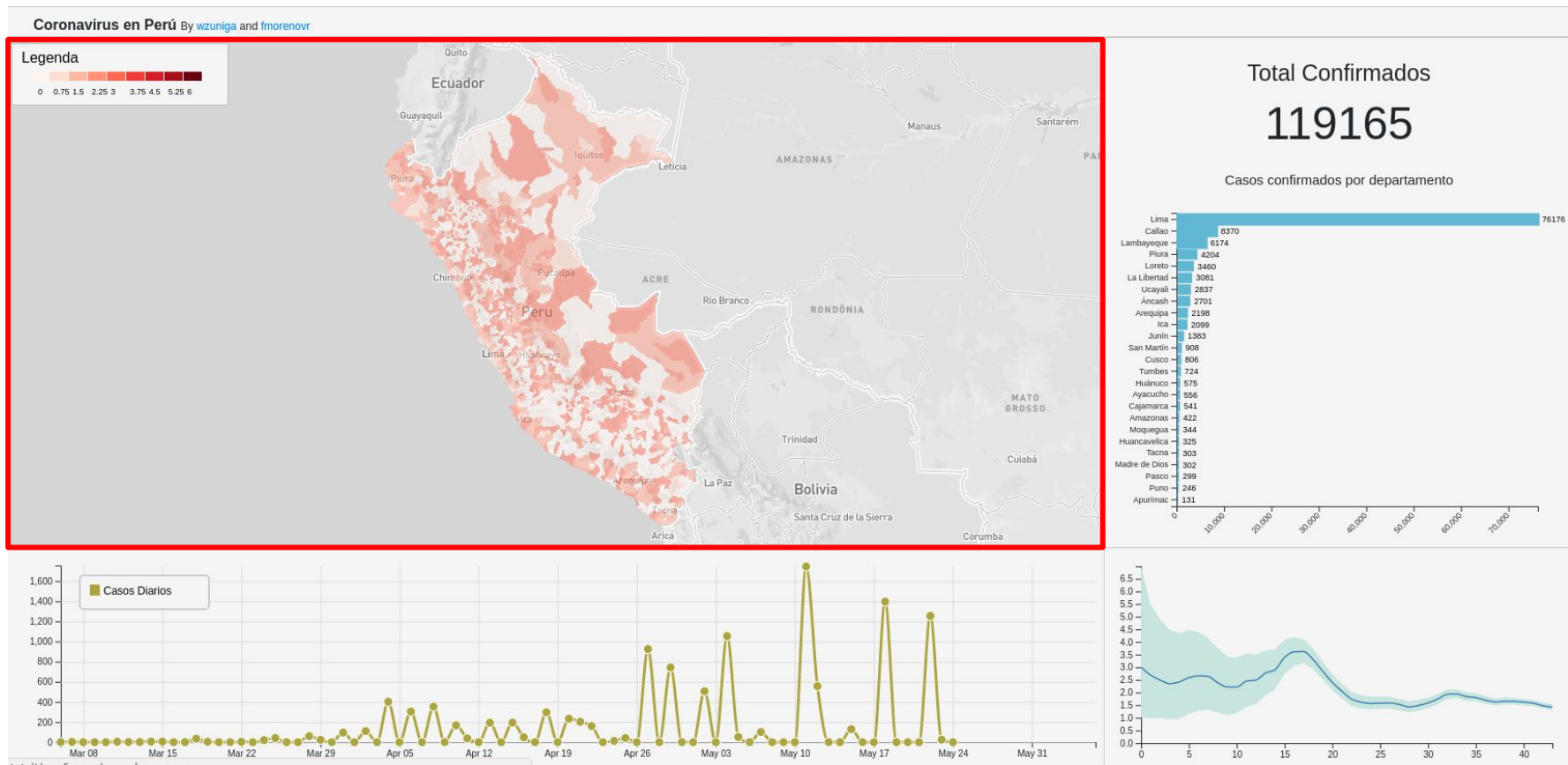
	UUID	DEPARTAMENTO	PROVINCIA	DISTRITO	METODO0DX	EDAD	SEXO	FECHA_RESULTADO
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2	cecdbf10074dbc011ae05b3cbd320a6f	LIMA	LIMA	LA VICTORIA	PCR	45.0	MASCULINO	23/05/2020
3	71ecb6bccb248b0bb2ac72ed51b5e979	LIMA	LIMA	CHORRILLOS	PCR	37.0	MASCULINO	23/05/2020
4	566af4276cbe9359abe93f9aa86396c3	LIMA	LIMA	LIMA	PCR	25.0	MASCULINO	23/05/2020
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123976	fbba38dee89edd2257c0c6e8f5b9123	UCAYALI	CORONEL PORTILLO	MANANTAY	PR	65.0	MASCULINO	23/05/2020
123977	be8057931a6e88bd760a101c0d2c6151	UCAYALI	CORONEL PORTILLO	CALLERIA	PR	37.0	MASCULINO	22/05/2020
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Open data from “Ministerio de Salud”

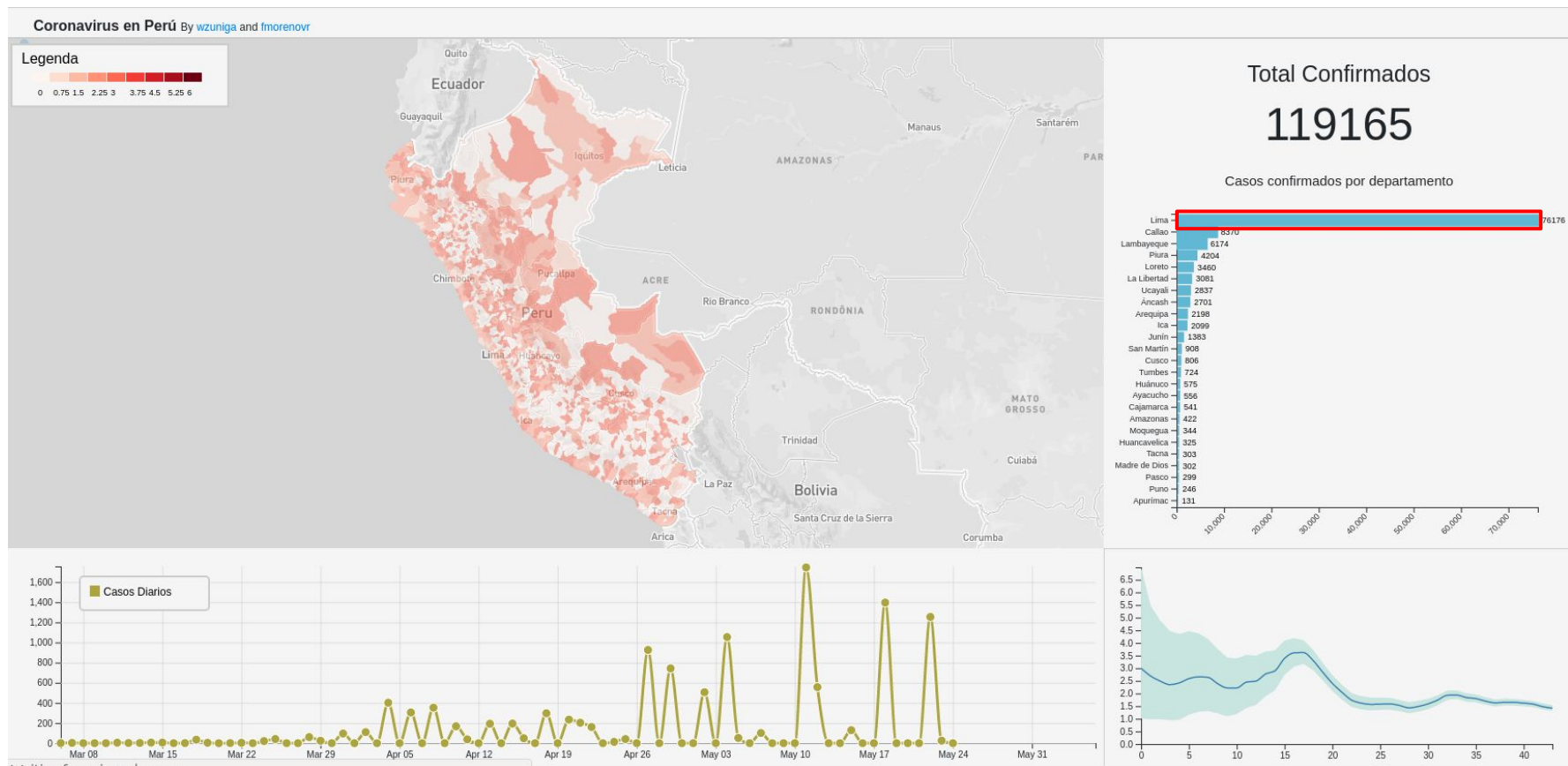
CoronaVis 2.0



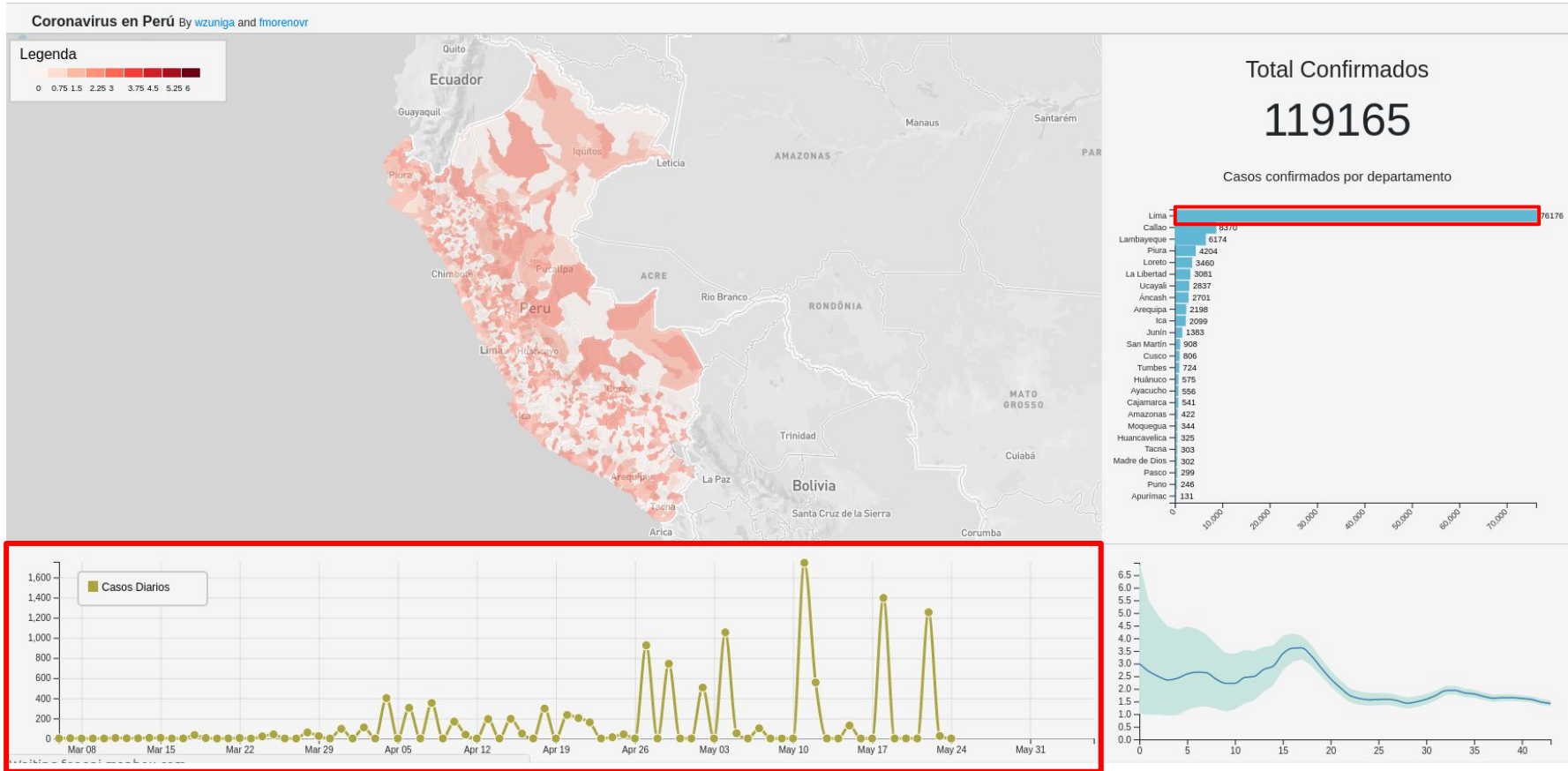
Case Example: Perú - Departments



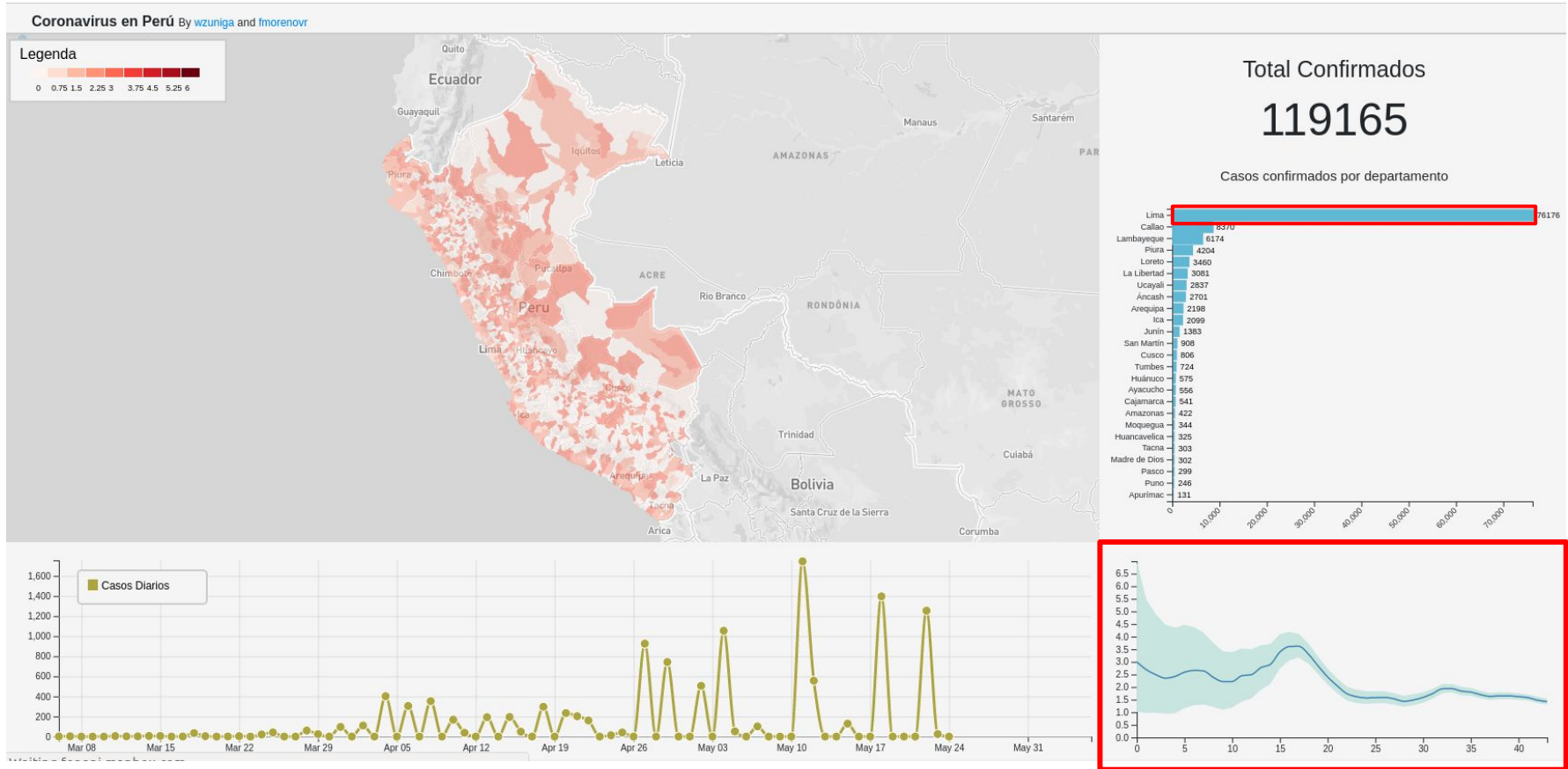
Case Example: Perú - Departments



Case Example: Perú - Departamentos



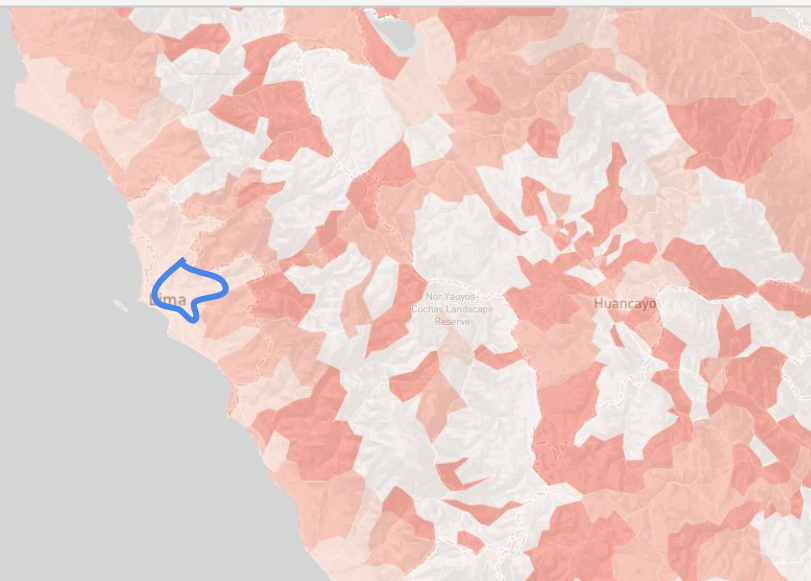
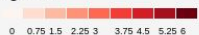
Case Example: Perú - Departamento



Case Example: Perú - Distritos

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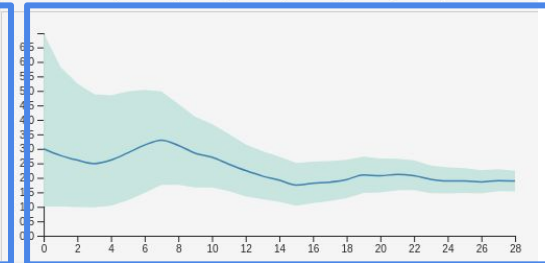
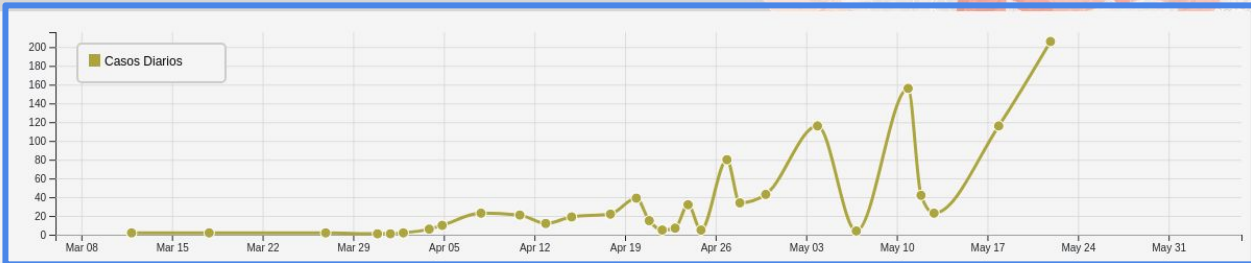
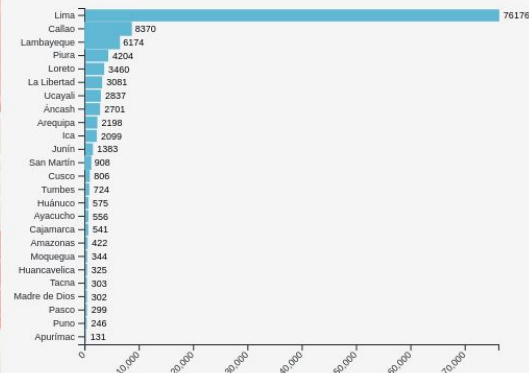
Legenda



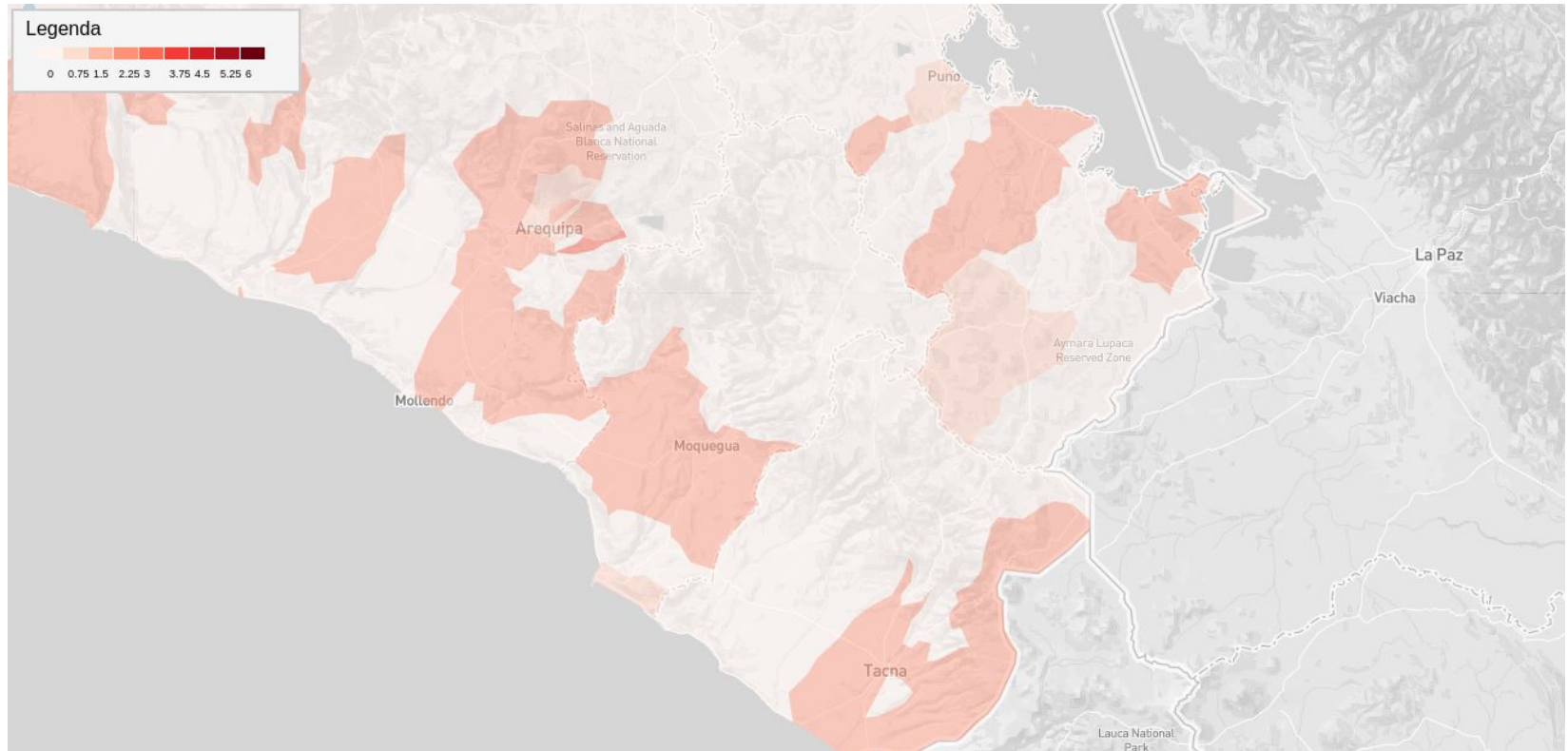
Total Confirmados

119165

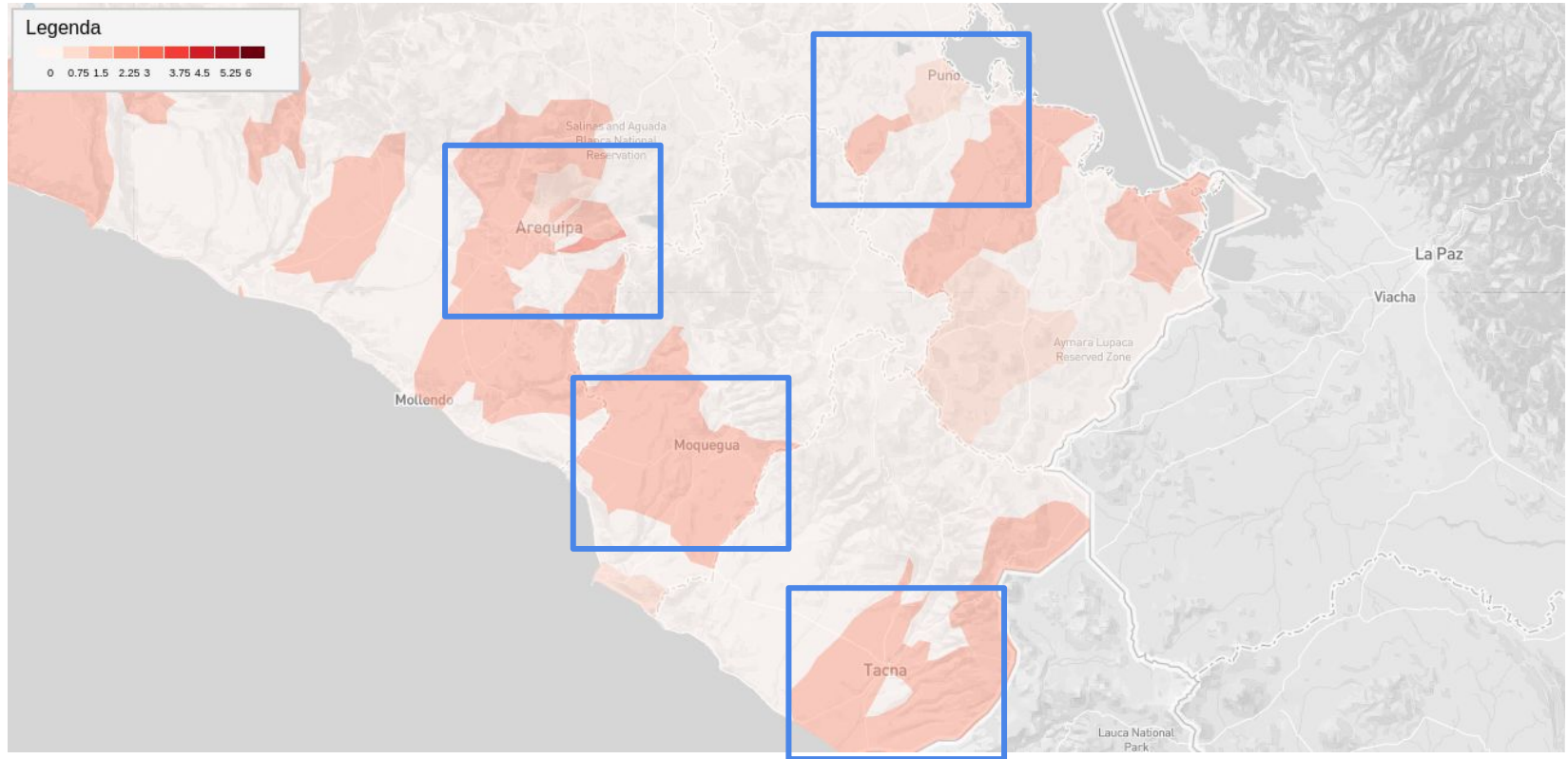
Casos confirmados por departamento



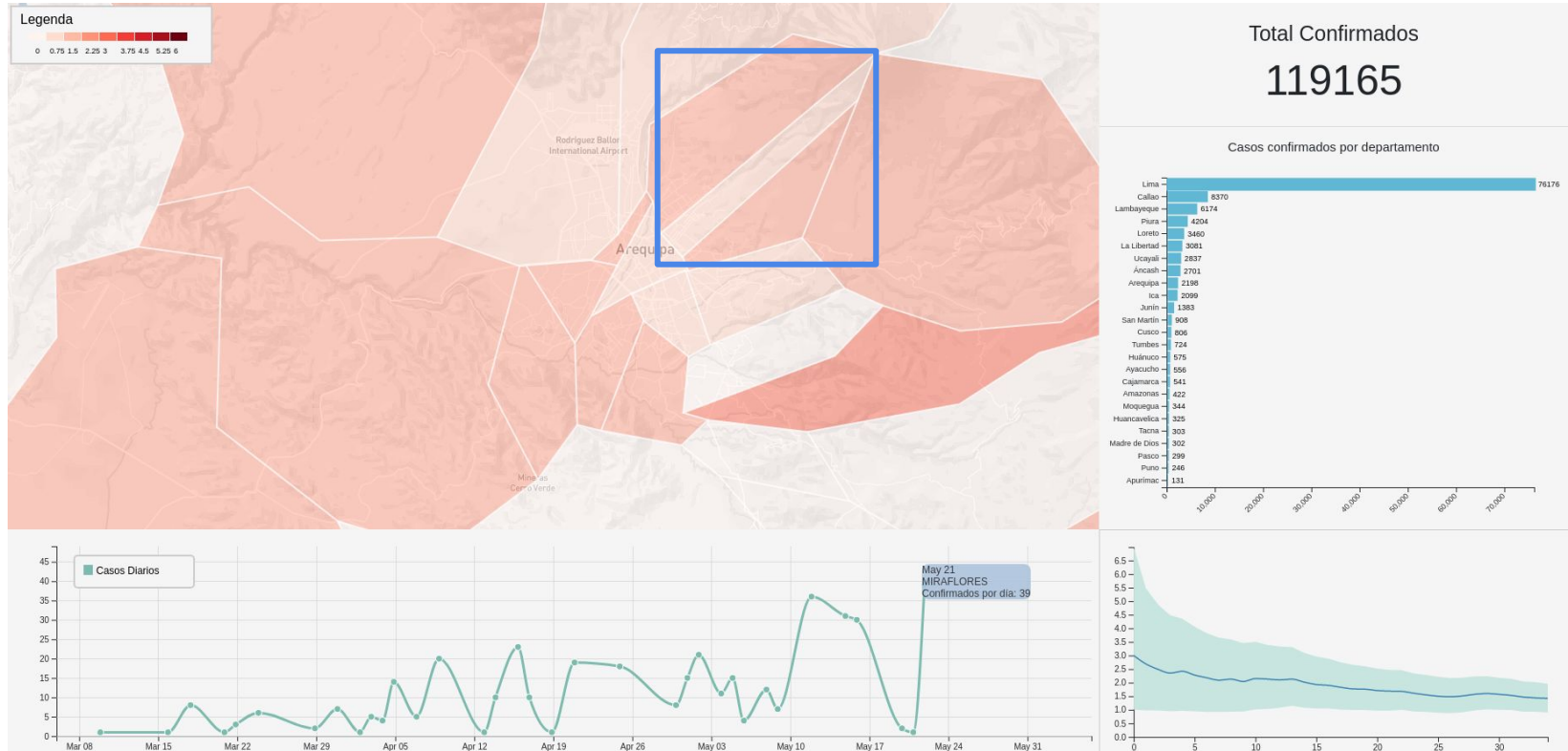
Case Example: Perú - Districts



Case Example: Perú - Districts

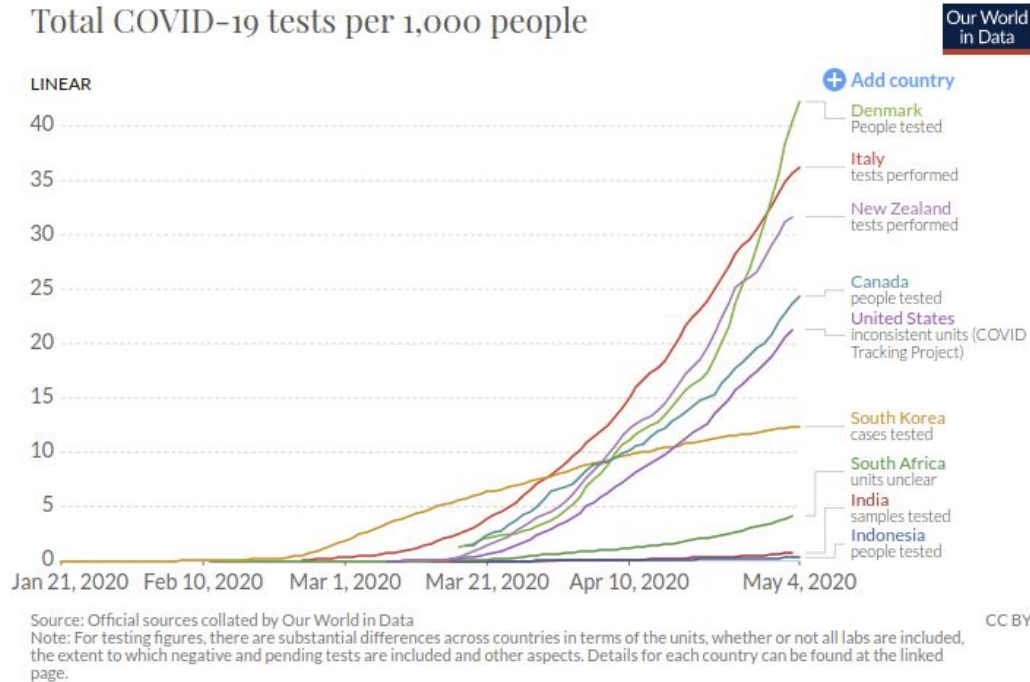


Case Example: Perú - Districts

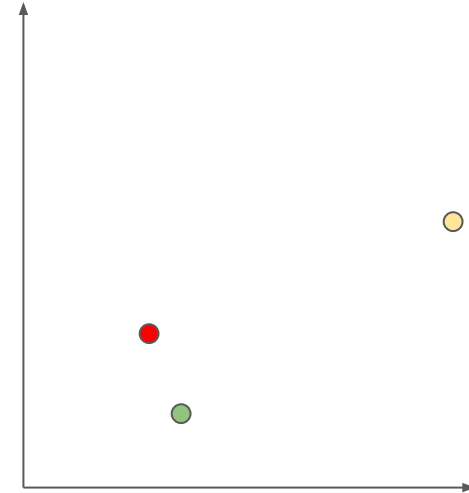
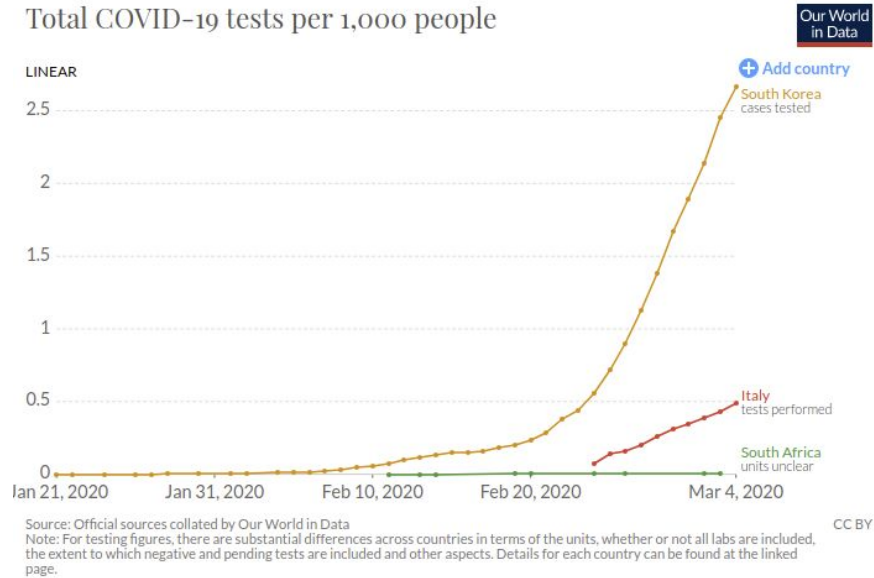


Thank you!

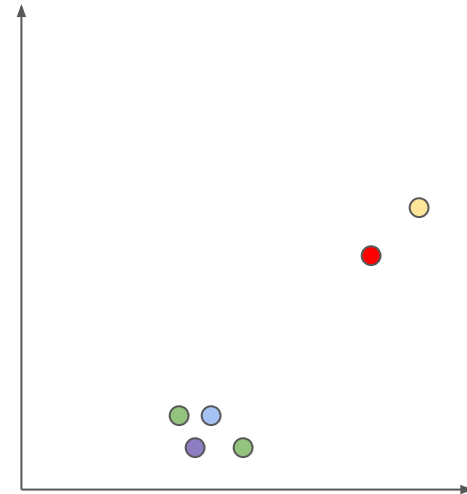
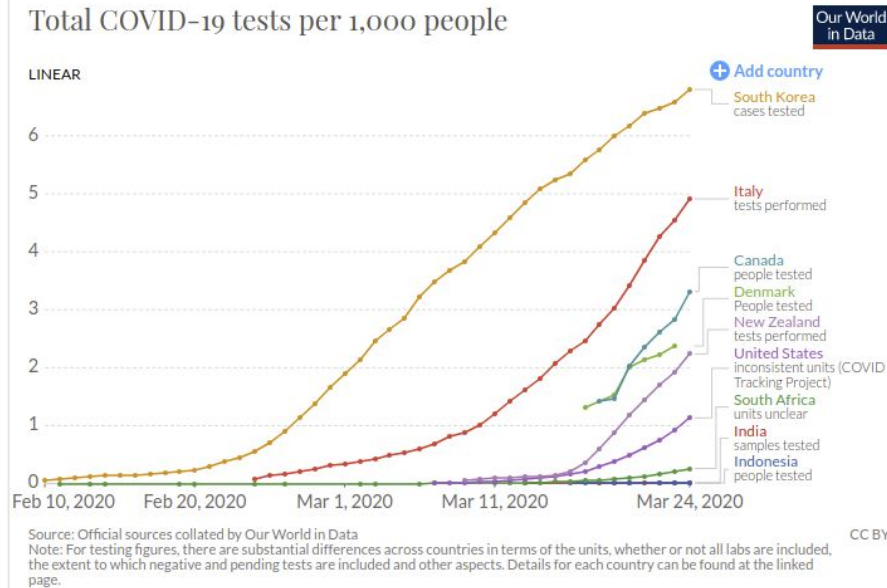
Visual Analysis



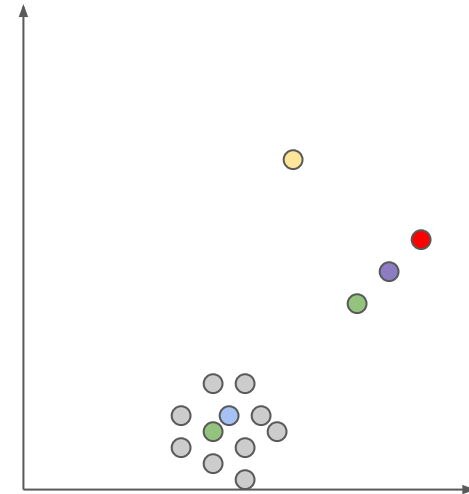
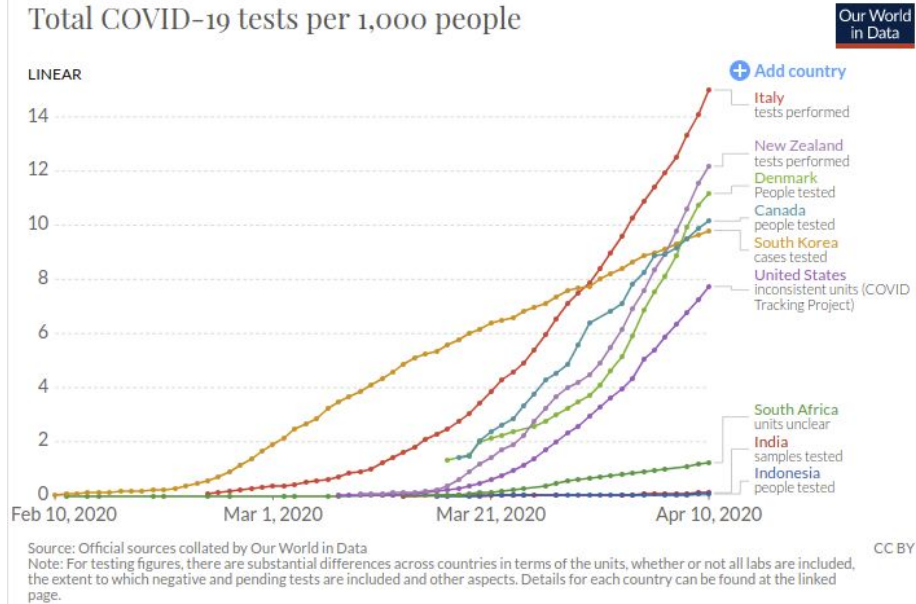
Visual Analysis



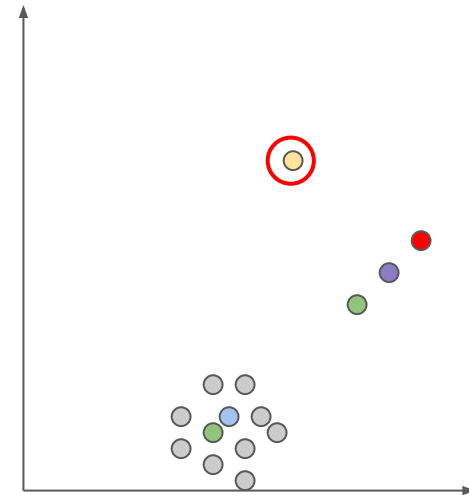
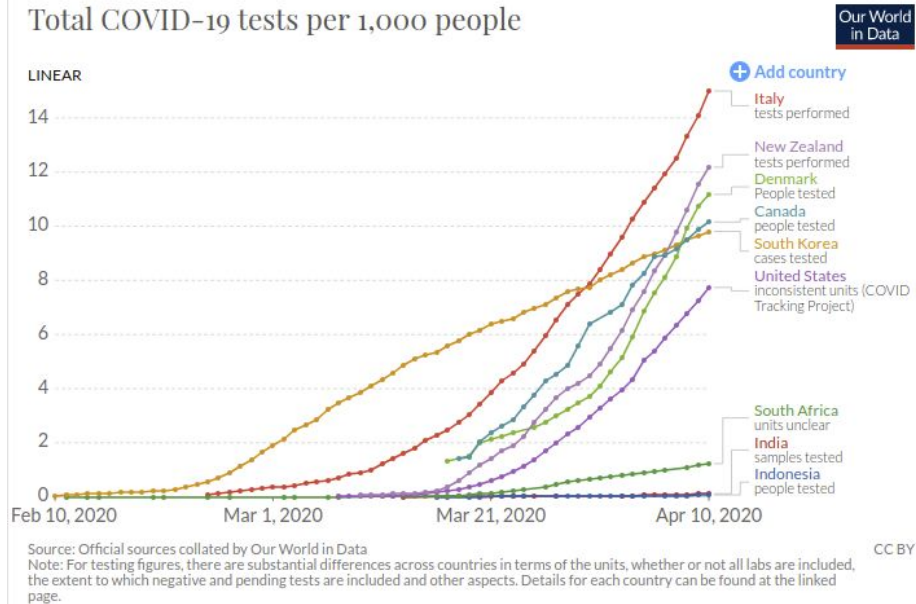
Visual Analysis



Visual Analysis

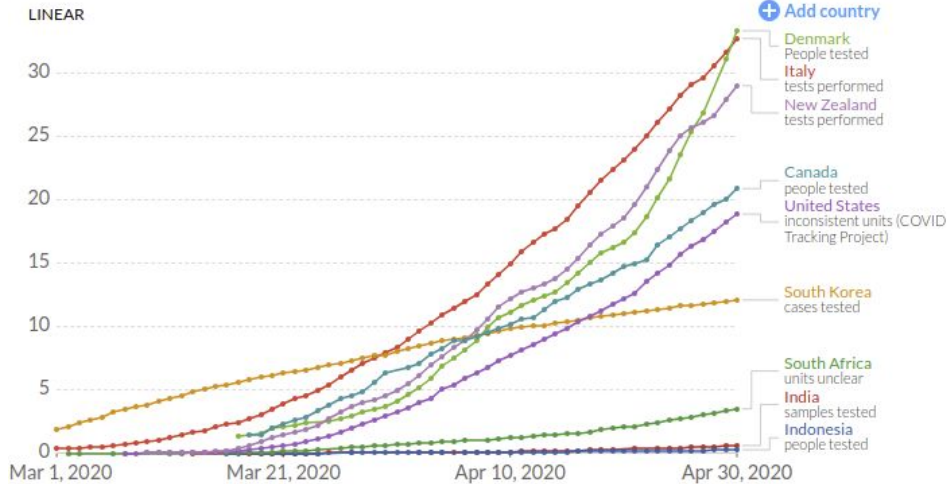


Visual Analysis



Visual Analysis

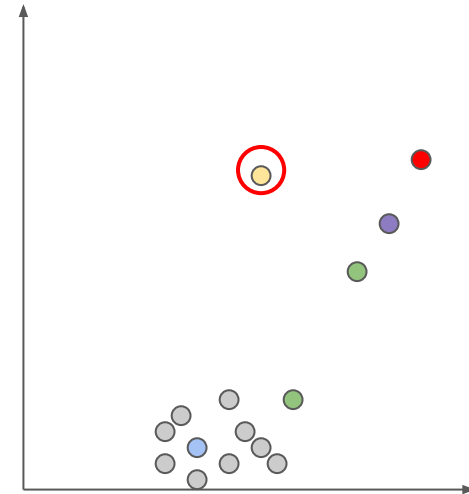
Total COVID-19 tests per 1,000 people



Source: Official sources collated by Our World in Data

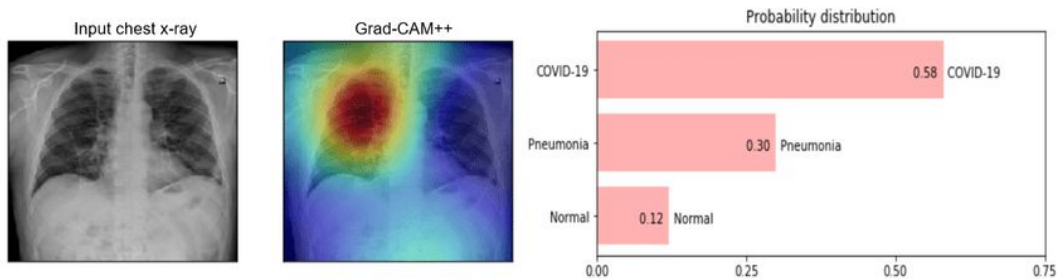
Note: For testing figures, there are substantial differences across countries in terms of the units, whether or not all labs are included, the extent to which negative and pending tests are included and other aspects. Details for each country can be found at the linked page.

CC BY



Data Source CNN

- rsna-pneumonia-detection-challenge*



Sample of simple output of our expected classifier

Source:

- * <https://www.kaggle.com/c/rsna-pneumonia-detection-challenge>
- <https://arxiv.org/pdf/2004.04582.pdf>

Visualization System

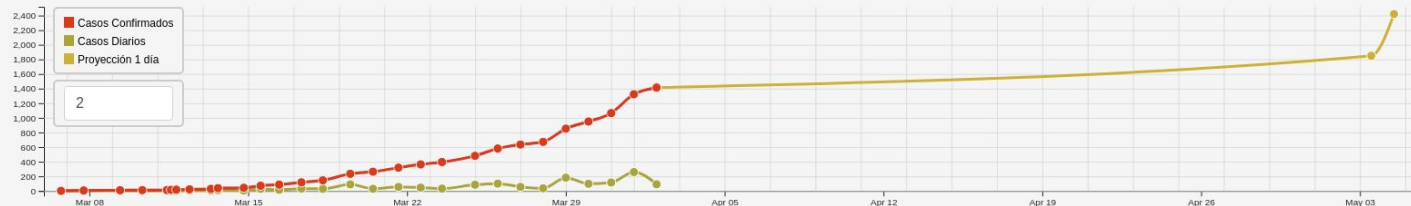
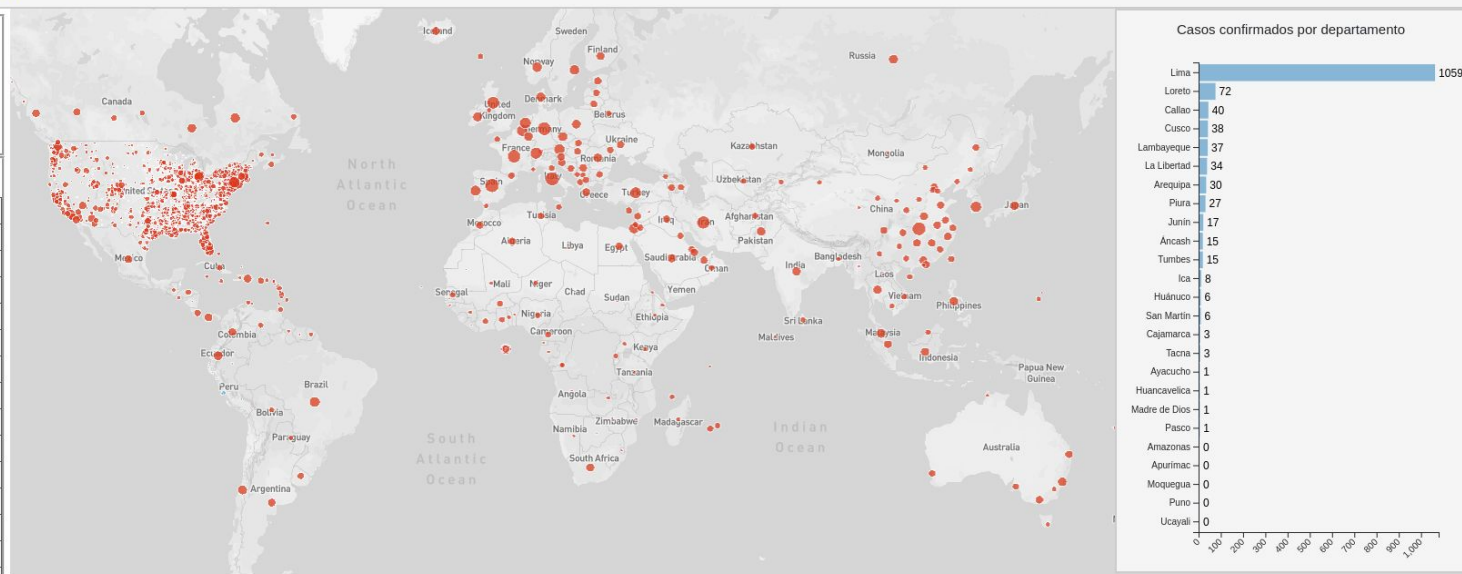
Coronavirus en Perú By wzuniga and fmorenovr

Total Confirmados

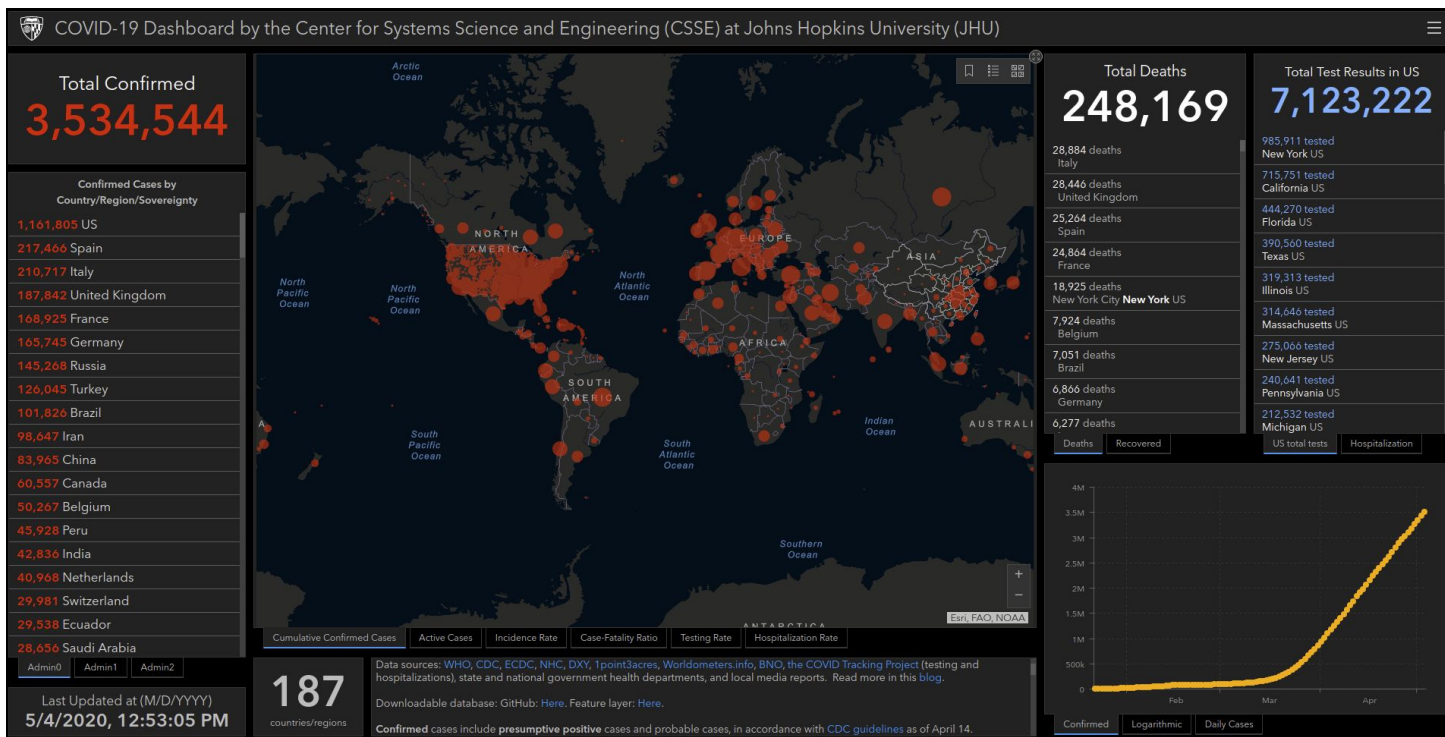
1414

Casos confirmados por departamento

1059	Lima
72	Loreto
40	Callao
38	Cusco
37	Lambayeque
34	La Libertad
30	Arequipa
27	Piura
17	Junín
15	Áncash
15	Tumbes
8	Ica
6	Huánuco
6	San Martín
3	Cajamarca
3	Tacna
1	Ayacucho
1	Huancavelica
1	Madre de Dios
1	Pasco
0	Amazonas
0	Apurímac
0	Moquegua
0	Puno

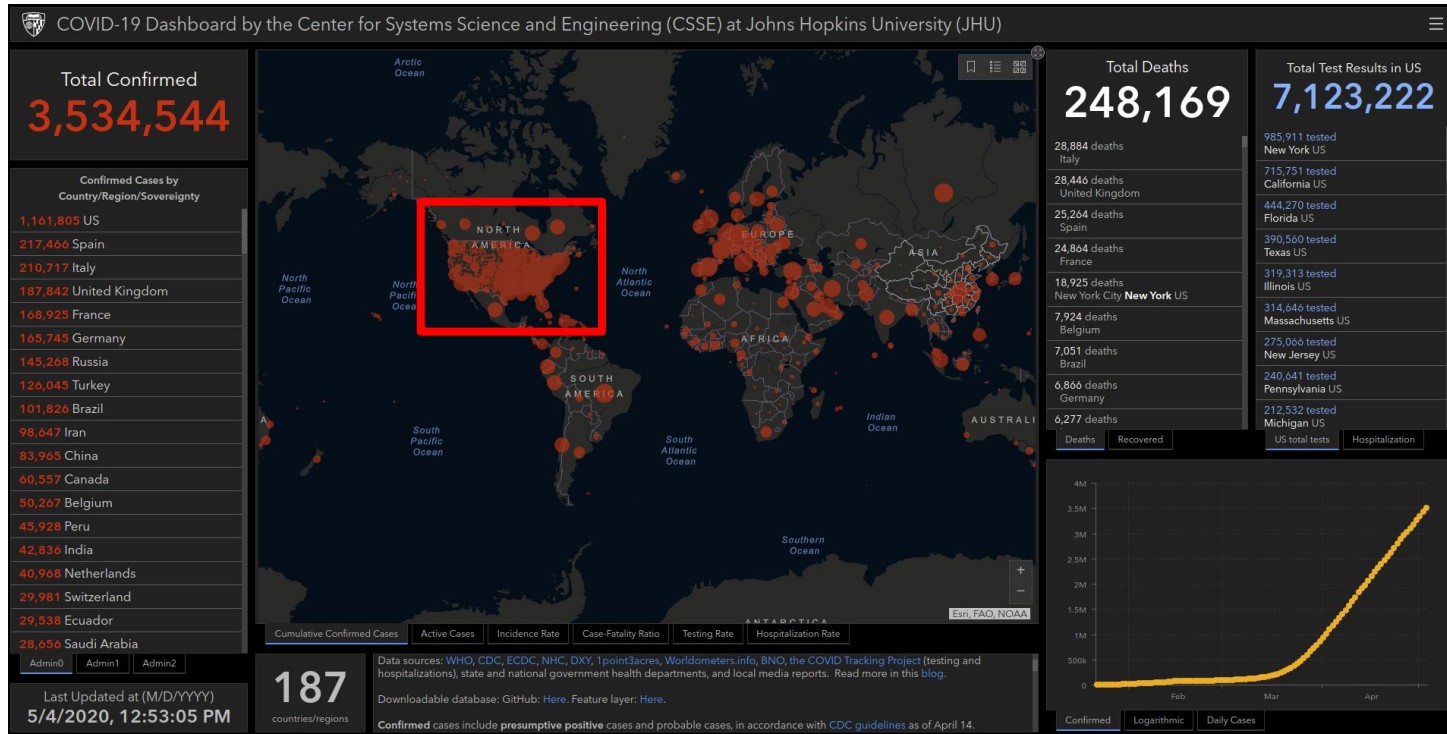


Visualization Problems



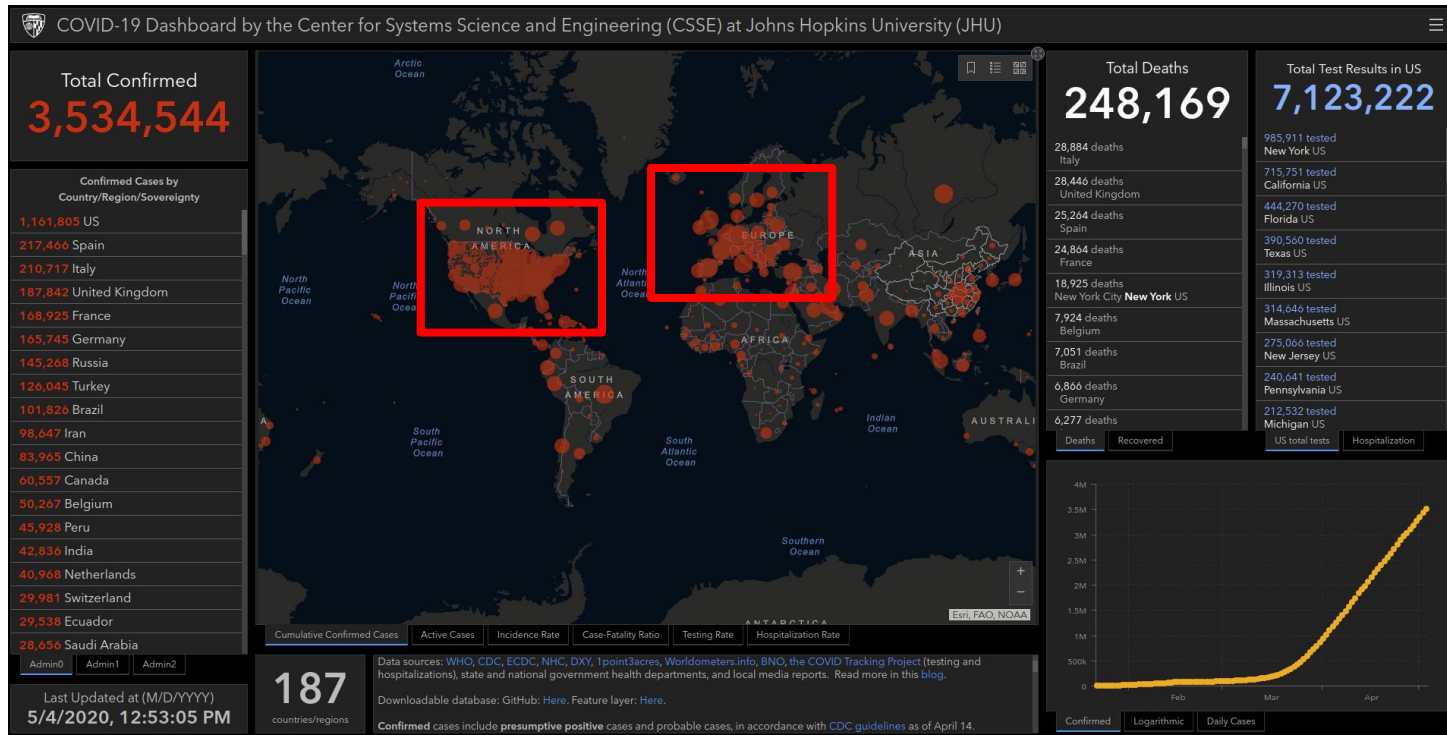
Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Visualization Problems



Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Visualization Problems



Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Visualization System

Coronavirus en Perú By wzuniga and fmorenovr

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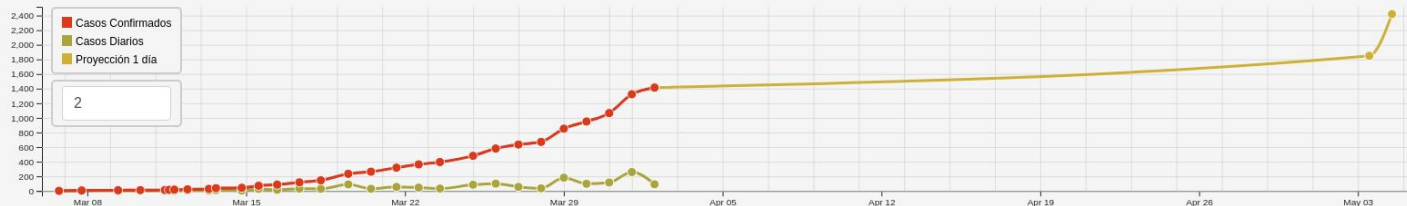
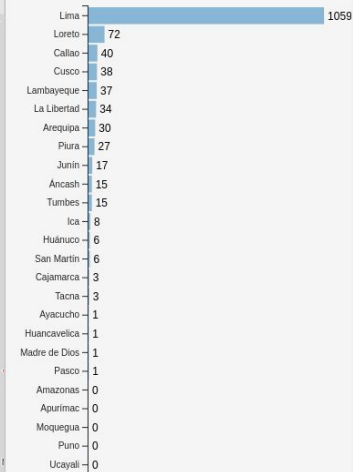
0 Amazonas

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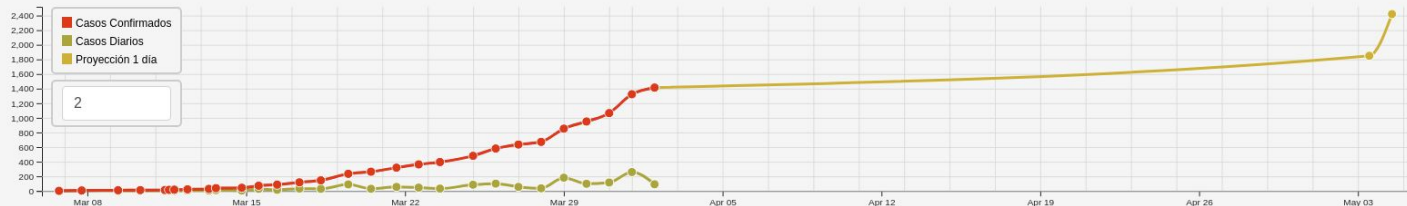
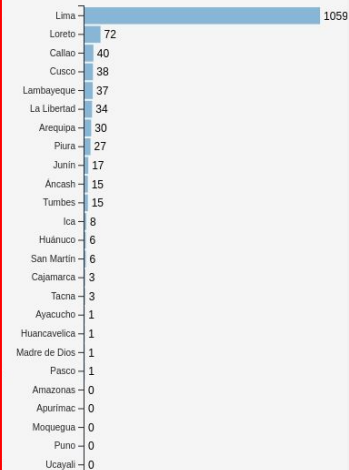
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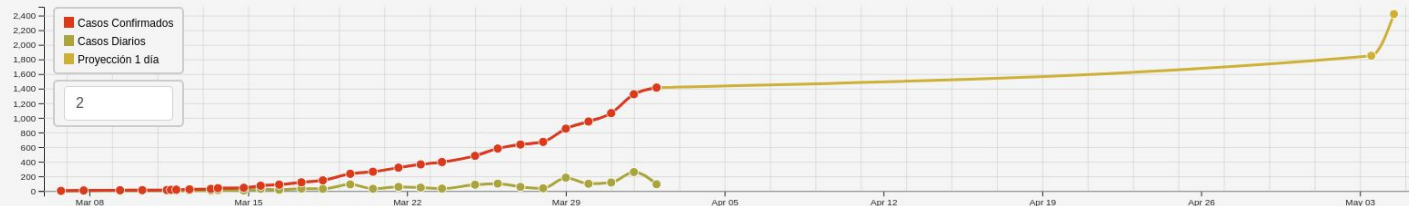
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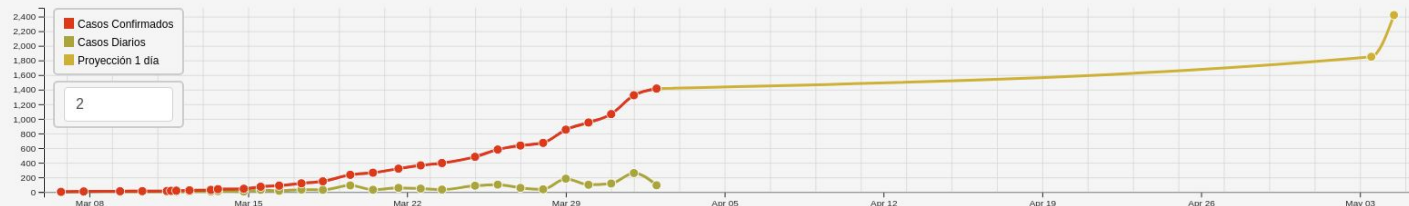
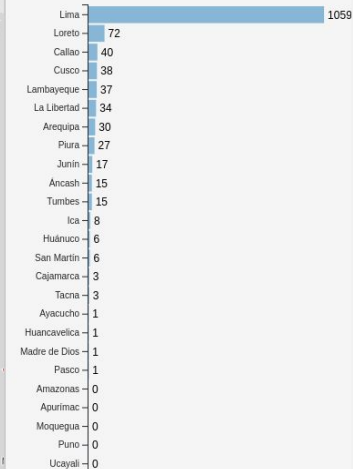
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0 Puno

Casos confirmados por departamento



Visualization System

Coronavirus en Perú By wzuniga and fmorenovr

Total Confirmados

1414

Casos confirmados por departamento

1059 Lima

72 Loreto

40 Callao

38 Cusco

37 Lambayeque

34 La Libertad

30 Arequipa

27 Piura

17 Junín

15 Áncash

15 Tumbes

8 Ica

6 Huánuco

6 San Martín

3 Cajamarca

3 Tacna

1 Ayacucho

1 Huancavelica

1 Madre de Dios

1 Pasco

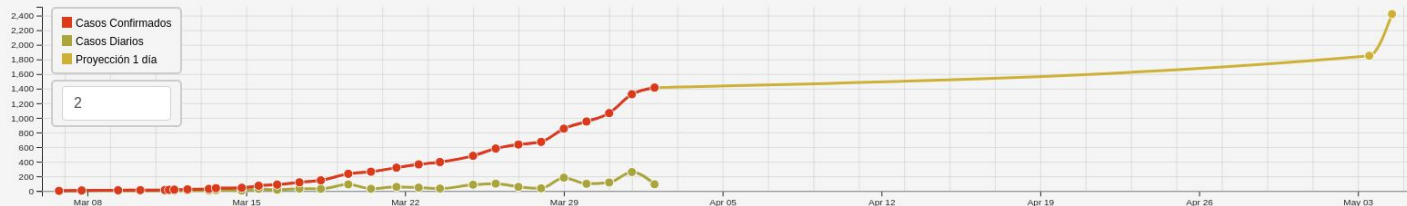
0 Amazonas

0 Apurímac

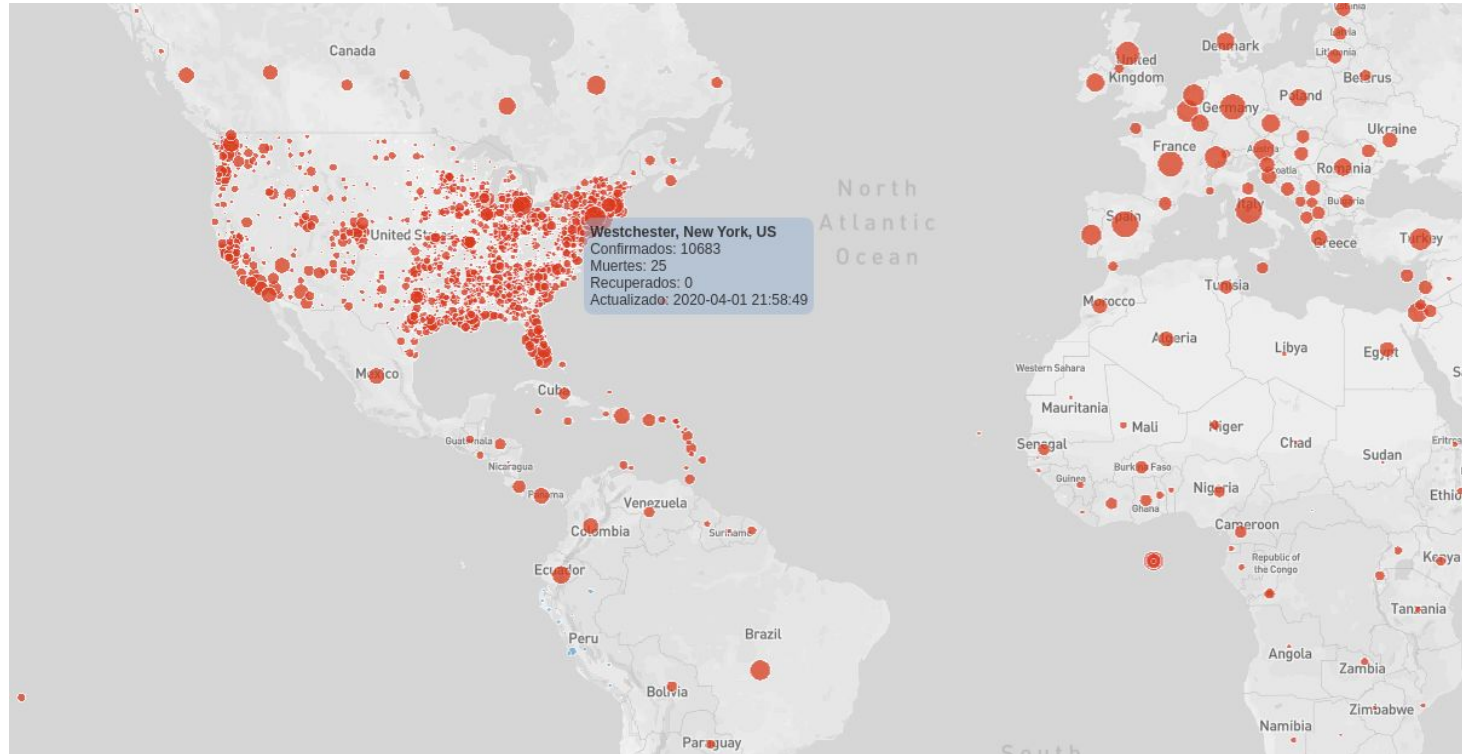
0 Moquegua

0 Puno

Casos confirmados por departamento



Show data



Show data

