Determination of number and ubication of warehouses of relief goods in Metropolitan Lima

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Introduction: Business Problem

Every year disasters cause suffering in different parts of the world and humanitarian logistic has a vital role in minimizing the suffering of the people. One of the challenges that humanitarian logistic has to face is the uncertainty of the demand, and determine the location of warehouses of relief good is a important work because it will affect directly in the speed of the distribution of relief goods postdisaster, these goood could be water, food, medicines, etc.

Metropolitan Lima, formed by **Lima and Callao**, is **located in the The Pacific Ring of Fire** and an earthquake could happen in anytime. A short term decision to **minimize the suffering** of the possible casualties is to determine the number and best location for warehouses of relief good and data science can help to solve this problem properly using clustering tools considerating that first the relief goods are distributed from the warehouse to each borought.

In this project I will use my data science knowledge to **recommend** to Goverment of Perú **the number and localization of warehouses of relief good in the city of Metropolitan Lima**.

Data

The following data was required to solve the problem:

1
- **List of Boroughs of Lima**
- (available in http://webinei.inei.gob.pe:8080/sisconcode/ubigeo/listaBusquedaUbigeoPorDescripcion.htm?versionCategoriaPK=5-1&nivel=1&descripcion=&strVersion=2016)

2
- **Geodata of each Boroughs**
- (available in http://webinei.inei.gob.pe:8080/sisconcode/ubigeo/listaBusquedaUbigeoPorDescripcion.htm?versionCategoriaPK=5-1&nivel=1&descripcion=&strVersion=2016)

3
- **Population of each Boroughs**
- (available in http://censos2017.inei.gob.pe/redatam/)

Methodology

In this project I will direct our efforts on determiNate the number and best location of warehouses of relief goods in Metropolitan Lima.

I have collected the required **data: location of each bororugh of Metropolitan Lima**.

I will be determinate the optimal **number of warehouses** in Metropolitan Lima using the elbow method for clustering (k-mean).

I will be determinate the optimal **location of each warehouse** using the center of the cluster.

Analysis and Discussion

Elbow Curve
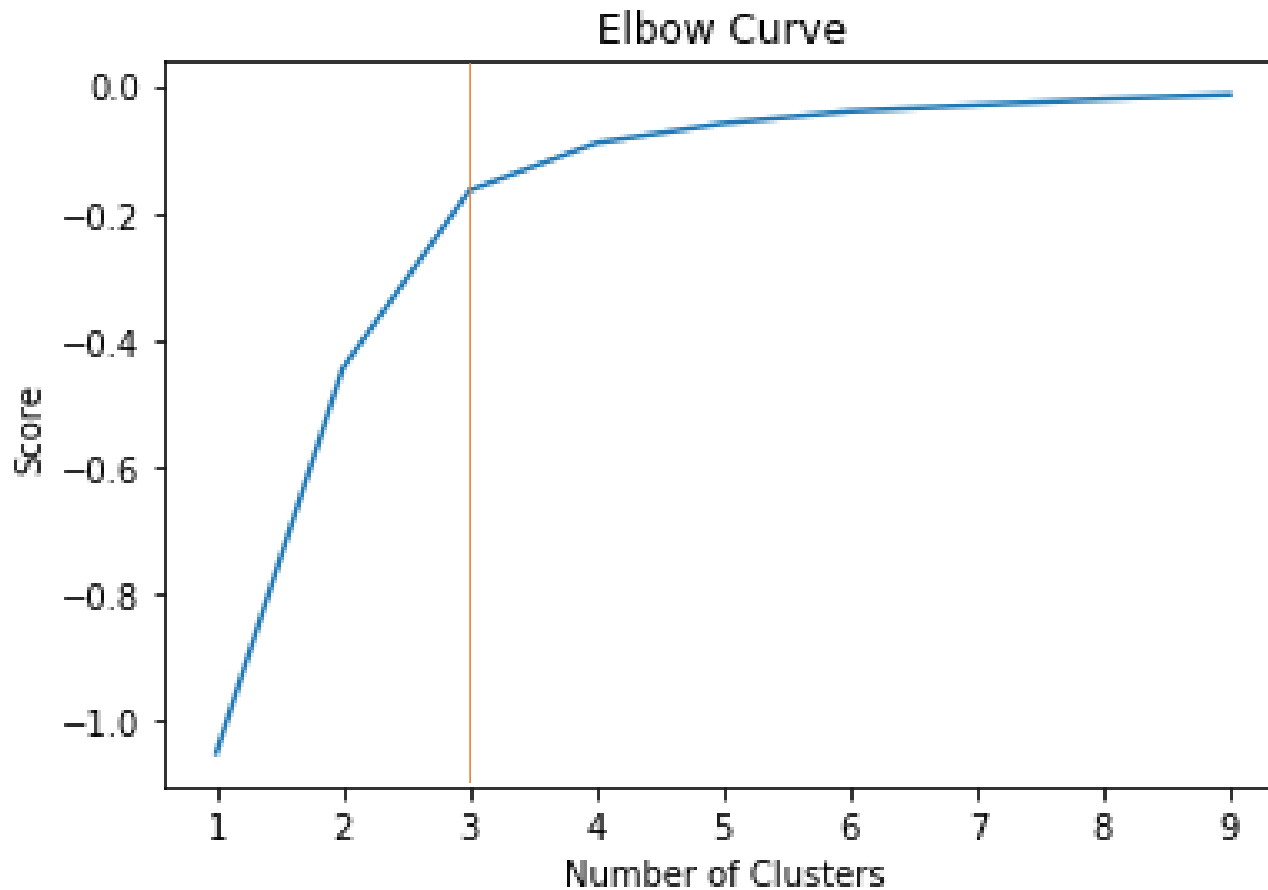
When we graph the plot, we see that the graph levels off slowly after 3 clusters. This implies that addition of more clusters will not help us that much.

Recomendation:
The optimal number of warehouses of relief goods in Metropolitan Lima is 3, in the map we can watch the clusters.
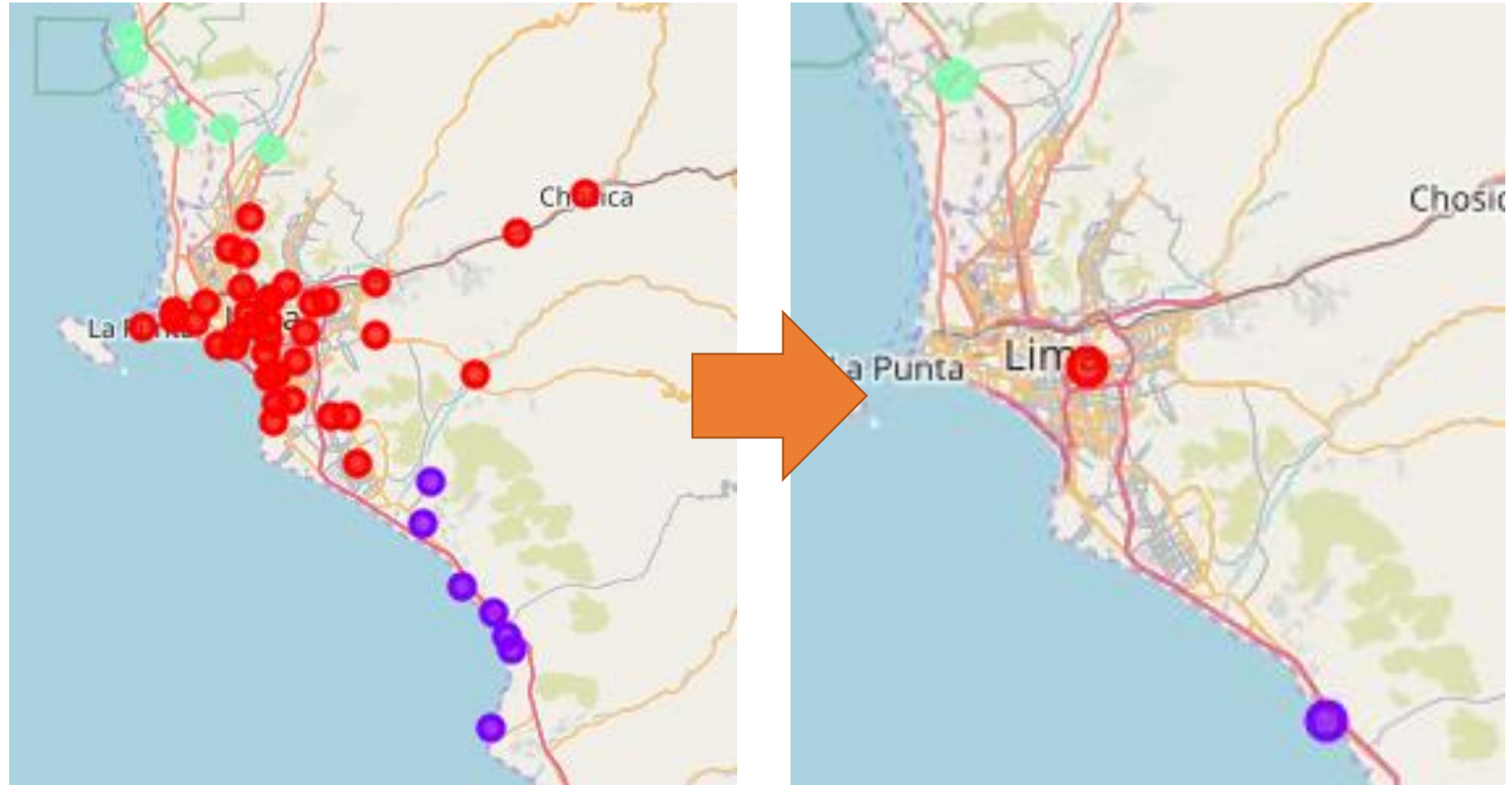
Analysis and Discussion

Recomendation:
The optimal location of warehouses of relief goods in Metropolitan Lima is the center of the cluster

	Cluster	Latitude	Longitude
0	0	-12.072582	-77.009557
1	1	-12.354206	-76.814683
2	2	-11.842132	-77.116295

Conclusion

Based on the elbow curve, in my opinion, the optimal number of warehouses of relief goods in Metropolitan Lima is 3, and it will be built near of the next coordinates:

- 1. Warehouse 1: (-12.072582, -77.009557)

- 2. Warehouse 2: (-12.354206, -76.814683)

- 3. Warehouse 3: (-11.842132, -77.116295)

Final decission of optimal warehouses location will be made by stakeholders based on disponible areas to built the warehouse.