Development of a **spatial and temporal** based **COVID-19** predictor for **Pakistan**

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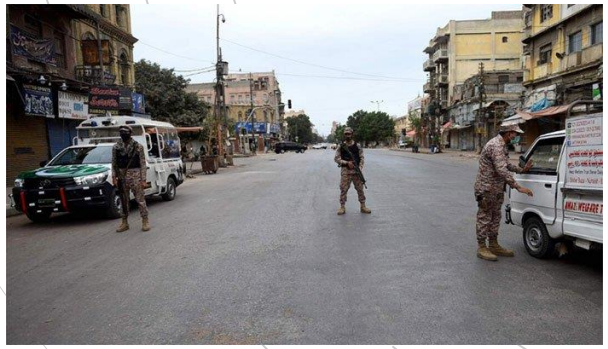
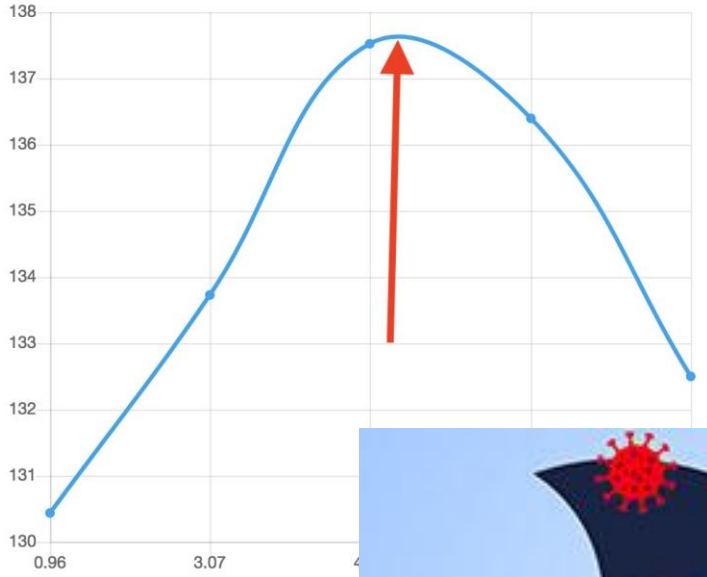
Problem Statement

Pakistan has seen a large-scale spread of COVID-19 with **unusual patterns** across the country. Hence, the need for a strong **national coordinating level** for uniform implementation of control measures, as well as the relevance of local forecasting is inevitable now. In this research, we would develop a **spatial and temporal** based **COVID-19** predictor for **Pakistan,** to predict which regions will be most affected and when. Moreover, this predictor would provide decision-makers with enough time to intervene in the local policy.



Motivation

- **Differences** in epidemic dynamics.
- Spatial-Temporal based predictors are highly **successful** (So far, not implemented for Pakistan)
- Determining the **peak**.
- Provide **a clear picture** of which regions will be most affected and when.
- Assist public **decision-makers** in better planning health policy.



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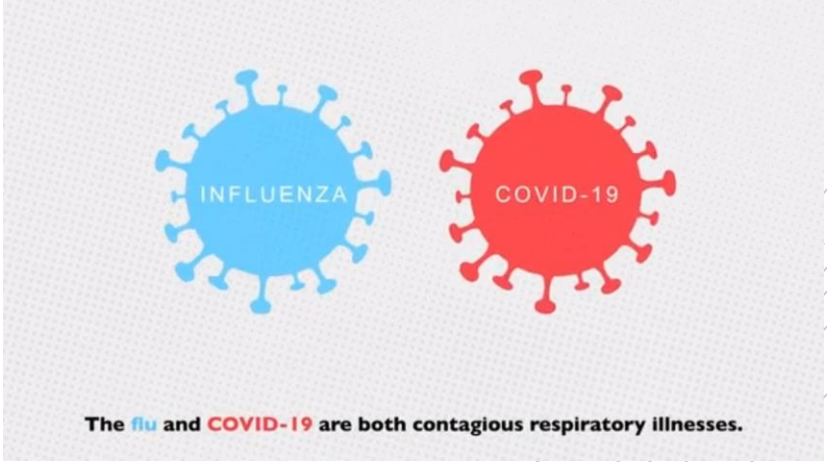
NCOC
Government of Pakistan

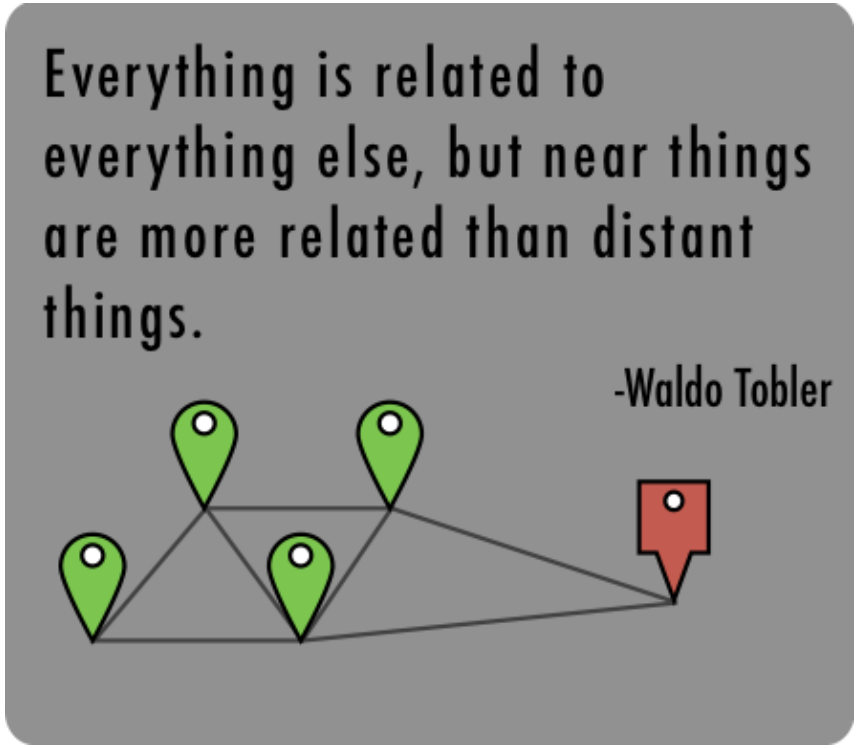
Background

- Spread of COVID-19 is following **geographic pattern**.
- High probability that COVID-19 also follows **spatial pattern** like Influenza, malaria, dengue and etc.
- Infectious diseases have a **specific geography** too.
- Infectious diseases are strongly correlated with **human mobility**.



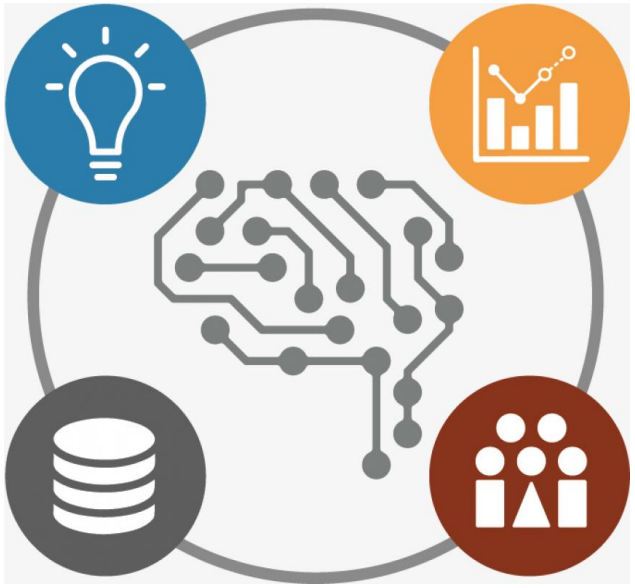
Literature Review

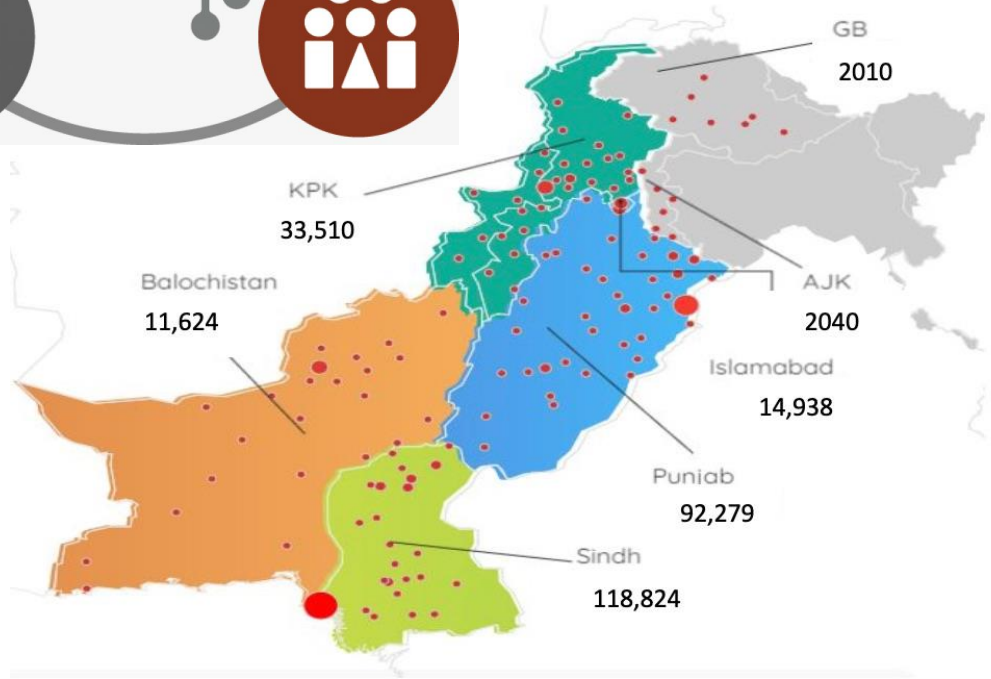
- Spatial-temporal spread pattern was found using **geographic clustering and hotspot identification** methods ("Space-Specific").
- **Tobler's 1st law** of geography depicts, "where is the disease concentrating and in which direction it is spreading ?"
- Spatial prediction is based on **demographic variables** like total population, health infrastructure and etc.



Project Objectives

- To determine the **influencing factors** which can increase or decrease the rate of spread of COVID-19 in Pakistan.
- To develop a **machine learning based spatial-temporal predictor** for forecasting the rate of COVID-19 spread in Pakistan.





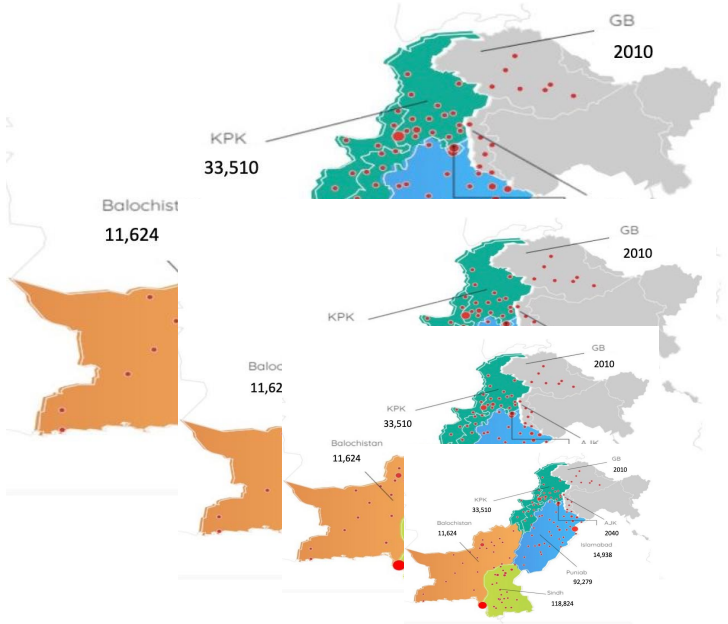
Methodology

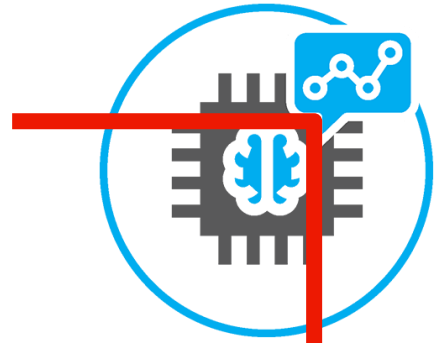
1. FYP-I
    1. Data Collection
    2. Data Analysis
2. FYP-II
    1. Design Model for Prediction
    2. Testing

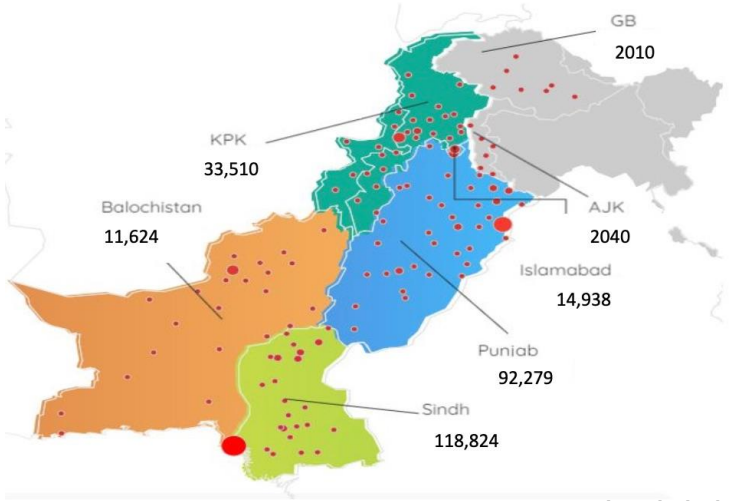
PREDICTION

Final Deliverable

Predictor for forecasting the rate of COVID-19 spread in different regions of Pakistan.







Features for Data Collection (Tentative)

1. Number of doctors/frontline workers available
2. Number of Beds/Ventilator available in the hospitals.
3. Occasions (Jalsa/Festivals/National Days)
4. Airport policies, bus stand traffic.
5. Population density
6. Pollution
7. Climate/weather (Temperature, Humidity)
8. Implementation of social distancing
9. Employment rate & Unemployment rate
10. Amount of COVID testing
11. Timely response/Policies of government

References

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2. Bag, Rakhohori et al. “Understanding the spatio-temporal pattern of COVID-19 outbreak in India using GIS and India's response in managing the Pandemic.” *Regional Science Policy & Practice* 10.1111/rsp3.12359. 6 Oct. 2020, doi:10.1111/rsp3.12359

3. Hazbavi, Z., Mostfazadeh, R., Alaei, N. et al. “Spatial and temporal analysis of the COVID-19 incidence pattern in Iran”. Environ Sci Pollut Res 28, 13605–13615 (2021).

4. Huang, R., M. Liu, and Y. Ding. “Spatial-Temporal Distribution of COVID-19 in China and Its Prediction: A Data-Driven Modeling Analysis”. *The Journal of Infection in Developing Countries*, Vol. 14, no. 03, Mar. 2020, pp. 246-53, doi:10.3855/jidc.12585.

References for Dataset

1. Centre for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)
2. Institute for Health Metrics and Evaluation (IHME)
3. Timeanddate.com (T&D)

Thank
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