Cellular and Wi-Fi Triangulation

Business challenge

Our client had millions of anonymized cellular coverage signal strength data along with their location and network identification numbers. The challenge was to identify the cell tower locations from these signal details. Similarly, we were required to find Wifi hotspots. Using these details, our client wanted to identify the density of coverage and help understand business hotspots.
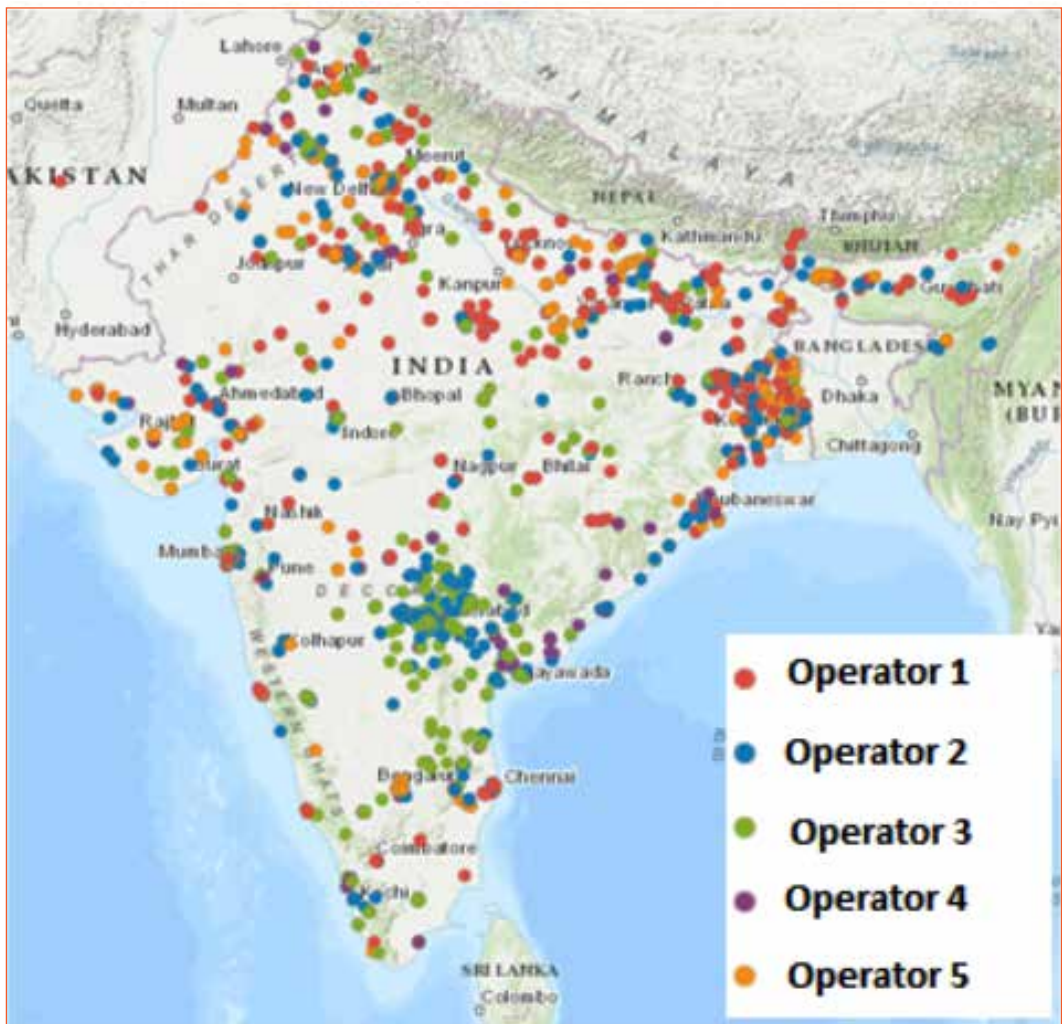
Approach and Solution

Our Client stored all the data in Google BigQuery Tables. Our approach was to extract the data from BigQuery Table, process the data using the Google cloud platform, push the results back into another BigQuery Table and also generate a Map file in KMZ format.

The first step was to clean up the data and use our cellular network domain knowledge to map the data into a usable format. This involved segregating technologies like 2G, 3G, 4G, Wi-Fi network types, countries and regions. Signal strength scales of each technology are different and hence had to be treated separately. Cellular networks work on a sector concept unlike Wi-Fi, and hence the algorithm was designed to understand these differences. Once the cleaning and preprocessing was done, we clustered the data based on geospatial parameters using unsupervised Machine learning. This data was then used to infer the network location using a triangulation algorithm. Based on the relative signal strength and number of records available for inference, we also arrived at a confidence radius of the inferred location.

The outcome was a list of cell towers with location and a confidence radius for each country. This was benchmarked against publicly available data of certain cellular operators and we have seen quite good accuracy for the inferred locations.

| Data extraction & Cleaning | Clustering using geospatial parameters | Triangulation | Export data (KMZ/Big Query) |

Legend:
- Operator 1
- Operator 2
- Operator 3
- Operator 4
- Operator 5

Benefits

- The data helps understand the coverage not only based on sample locations, but of the entire coverage area inferred cell towers.

- The Cellular and Wi-Fi density also helps understand high business concentration and population density in various parts of a city.