

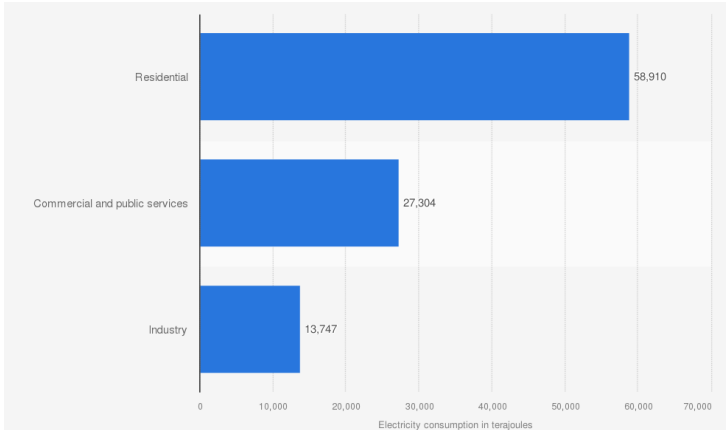
Electricity Demand Forecasting Electricity Demand Forecasting, Coverage Estimation, and Distribution Planning using Mobile phone Call Data Record (CDR)

Ololade Anjuwon, Opeduwa Iwashokun, Olubayo Adekanmbi, Anthony Soronnadi, Soufiane Hourri

Brief Introduction

The engine for a country's development is electricity. Businesses and infrastructural facilities in a country need electricity, however, this resource is limited. There is an increase in the global energy consumption. It is increasing at a 1.6% annual rate. The demand for electricity has increased, as have the challenges related with power storage, generation, and distribution. To support climate change initiatives and build more resilient and sustainable cities, it is essential to understand and regulate urban energy usage. This is one of the many problems affecting the world today. The goal of this study is to explore how Call Detail Records (CDR) can be used in Forecasting, Coverage Estimation, and Distribution planning. This was done by establishing a relationship between the frequency of calls to energy use in a particular area.

Electricity Consumption In Nigeria



ELECTRICITY CONSUMPTION IN NIGERIA SOURCE [1]

This trend can be attributed to the insufficient power supply, as explained by Ekpo et al[2], which has compelled manufacturers to rely on privately generated electricity to power their production processes. This establishes the fact that electricity consumption in Nigeria is mostly done by the people in their houses.

Factors Affecting Electricity In Nigeria

From the review of various papers we found out that the most common factors influencing electricity consumption is

The Gross Domestic Product per capital (GDPC).

$$GDPC = \frac{GDP}{Population}$$

GDP = Gross Domestic Product.

Other factors found in research are mainly a derivative of this.

Conclusion

The paper explores using Call Detail Records (CDRs) as an indicator for electricity consumption in Nigeria. It identifies Gross Domestic Product per capita (GDPC) as the primary factor influencing electricity usage in the local context. CDRs can be employed to estimate electricity consumption in the studied areas. The study encourages the release of anonymized CDR data by Mobile Network Operators (MNOs) and the government to gain valuable insights for society. However, the research's main limitation is the use of simulated data, urging further empirical testing with real datasets.

Call Detail Records

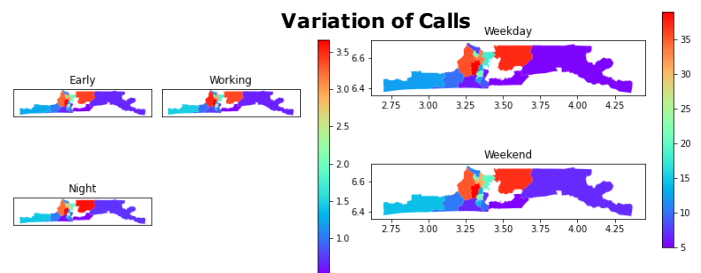
Call Detail Records (CDR) is a collection of the detail of calls made by subscribers of a particular mobile network provider (MNO).

A typical Call Detail Record

id	outgoing	datetime	duration	network	msisdn	msisdn_c	location	imsi	imei	tac	call_date
0	b8963c37-t	2016-01-0	1646		6599b02ff	56622a73d	95cc6baf4	255f3890d	ab2eb3bd	17	1/1/2016
1	28934c1f-t	2016-01-0	872		271d0f97	1499602a7	1a09a6aff	458e7ffc5	4366e901c	9	1/1/2016
2	02160a87-t	2016-01-0	1486		9b636b3b	db981384d	f09543b19	ccb87090d	19d9c2f47	13	1/1/2016
3	93e9ef42-t	2016-01-0	1554		9c5c42f26	ecf35b00d	d690bc731	d7ec6e06d	14edb480	10	1/1/2016
4	4aa156be-t	2016-01-0	2281		fab01ef9f	ecf35b00d	2f178be63	24e3ca50d	3b7c61584	12	1/1/2016
5	21550db4-t	2016-01-0	2308		d75bec4c	49f77a7aa	70889e0e3	d8052920f	ff1f2eb7a	10	1/1/2016
6	b2132993-t	2016-01-0	1665		2b52a89a	49f77a7aa	bd0daa83	75a3f09cd	f11b91cb7	16	1/1/2016
7	a50b2ac4-t	2016-01-0	2405		d6ead980	2933f37b9	f64f95cc9	35c7ebcd3	c2374476c	8	1/1/2016
8	aa7e4c6a-t	2016-01-0	865		5c16d9fa4	7fa877223	55006fe21	3c272327d	7252f5911	14	1/1/2016
9	a774b63e-t	2016-01-0	1395		93df3275	7fa877223	5cabaa0dc	e417c0f7d	13cb6280f	16	1/1/2016

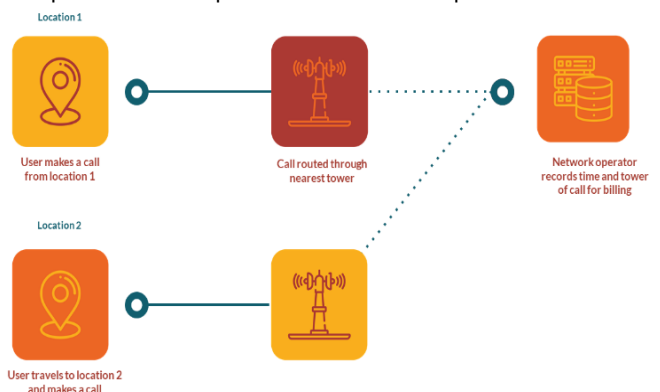
CDR and GDP

The extraction of the GDP was done based on Dong et al. [3] which involved calculating the area where calls were made during work hours 9:00 a.m. to around 6:00pm, and outside work hours activities that occur outside this hours. Then clustering the found location using DBSCAN. A density based clustering technique. This can then be used has a amount places where economic activities occur. We can then calculate the amount of commercial activities using the amount of calls that occur in that area for more than 10 minutes to avoid noise.



CDR and Population

The extraction of the population was done by selecting the number of unique callers in a particular area over a period of time.



References

- [1] Statista. Electricity consumption in nigeria by sector, 2023. URL <https://www.statista.com/statistics/1307456/electricity-consumption-in-nigeria-by-sector/>.
- [2] U. Ekpo, C. Chuku, and E. Effiong. The dynamics of electricity demand and consumption in nigeria: Application of the bounds testing approach. Current Research Journal of Economic Theory, 3, 08 2011
- [3] L. Dong, S. Chen, Y. Cheng, Z. Wu, C. Li, and H. Wu. Measuring economic activities of china with mobile big data. EPJ Data Science, 6, 07 2016. doi: 10.1140/epjds/s13688-017-0125-5