The emerging digital economy of public spaces:

A study of New York's LinkNYC rollout

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Abstract

In this article, I explore the deployment of LinkNYC kiosks across the 5 boroughs of New York City. I argue that the underwhelming distribution of free WiFi kiosks is due to a misalignment between the incentives for the LinkNYC program due to its nature as a for profit data mining project, and its stated mission. Because kiosks are tied to consumer data collection, I argue that this model of public service deployment produces a form of citizenship which hinges on one's status as a consumer. I also argue that City Hall lacks the regulatory instruments to quantify the value of the data being collected on its own citizens.

Background

In 2014, the DeBlasio administration announced that the CityBridge Consortium had won the competition to be granted a concession to install the nodes that would make up the LinkNYC network. The plan was to replace New York City's payphones with free WiFi kiosks. Over the course of the next 12 years, CityBridge would install up to 10,000 "links" to offer New Yorkers in all 5 boroughs access to free high speed internet. The program would not only come at no cost to taxpayers, but would generate up to $500 million to the city. Revenue was to be made through selling advertising space, both physically on the nodes, as well as in users' browsers when connecting to the network. (NYC Office of the Mayor, 2014)

The purpose of LinkNYC would be to extend broadband access to New Yorkers in need, to help bridge the digital divide, and increase access to opportunities. In the words of then Brooklyn borough president Eric Adams:

My administration is enthusiastic about the expansion of free municipal Wi-Fi to

every corner of Brooklyn. Every community must be connected to the information

superhighway, so we can make sure no New Yorker is left behind as we travel

towards progress. (NYC Office of the Mayor, 2014)

The program was launched in early 2016, with the inauguration of the first kiosks. During the

event, city officials reinforced the importance of the initiative for equity and economic progress,

making note of how particularly Black and Latine New Yorkers could benefit from the measure.

In the event, 4500 kiosks in all 5 boroughs were promised by mid 2019. (NYC Office of the

Mayor, 2016)

Falling Behind

LinkNYC has failed to deliver on what was promised. Fewer than 1900 of the promised 4500

kiosks have been installed. Furthermore over 60% of the installed kiosks have been placed in

Manhattan, leaving the outer boroughs and the New Yorkers most in need of access to broadband

in the dark. (DoITT, 2019) Further aggravating the program's offenses, the CityBridge

consortium was found to be nearly $70 million in delinquency with the Department of

Information Technology & Telecommunications (DoITT).

An audit by the Office of the New York State Comptroller found that not only had CityBridge regularly underpaid the DoITT, and under-delivered the deployment of kiosks, but that a significant number of NYC zip codes lack kiosks altogether. In fact, the coverage of LinkNYC is significantly lower than the previous coverage from payphones. The starkest dropoff in coverage can be found in the outer boroughs of The Bronx, which went from 100% of zip codes with pay phones, to 40% with LinkNYC Kiosks; Queens, which went from 95% to 30%; and Staten Island, which went from 92% to 25%. The audit also found the deployment of other forms of infrastructure, like GigaBit centers, to not have kept up with promises. (Office of the New York State Comptroller, 2021)

CityBridge claims the delays in the installation of kiosks are due to conflicts with an unidentified utilities provider, a claim which had been made in the past and dismissed by DoITT. (Office of the New York State Comptroller, 2021) Moreover, according to to the then commissioner of the DoITT (and now commissioner of the Department Sanitation) Jessica Tisch, CityBridge was "crying poor", claiming that it's delinquent payments to the city were due to underwhelming ad revenue. (Deffenbaugh, 2021) These claims, I argue, are misleading, as ad revenue has become a secondary economic activity for CityBridge, after data mining.

The CityBridge Consortium

Originally, the CityBridge consortium was composed of four main players: Qualcomm, Comark, Titan and Control Group. In the consortium, they would be responsible for telecommunications,

hardware, the advertisement and user experience and interface (software), respectively. (NYC Office of the Mayor, 2014)

In June 2015, before the installation of the first LinkNYC kiosk, Titan and Control Group announced they were merging to form Intersection. In fact, this merger came about after both firms were acquired by Sidewalk Labs, a then new venture into urban tech and smart cities by Alphabet; Google's parent company. (Sidewalk Labs, 2015)

Alphabet's acquisition of Titan and Control Group represents a significant shift in the direction of the LinkNYC project. Titan, despite not being free from its controversies, had its business mostly in selling outdoor advertising space in cities. That remained the stated means of revenue for LinkNYC. While Titan had had its efforts in boosting data collection for more advanced advertising practices, these initiatives remained very shy, compared to the work of tech giants, like Alphabet. (Bernstein, Singer-Vine and Ryley, 2014)

Alphabet's business model, however, focuses largely not on selling advertising space directly, but on using vast amounts of data and highly sophisticated computational practices to produce predictions of user behavior, which can then be sold for means like increasing the click-through rates of online advertisement, or increasing the adoption of certain political messaging, etc. The merger meant that Intersection would be responsible both for the user-facing software of LinkNYC kiosks, as well as for advertisement. Thus, it would position it perfectly to test out the application of Alphabet's data mining practices to a physical mesh of urban infrastructure.

The Google Business model

Tech giants like Alphabet have shown how profitable the business of selling prediction products. Using vast amounts of user data along with sophisticated computational processes – most of which fall within the realm of machine learning – they are capable of producing models to predict human behavior. This had been largely and very profitably used for online targeted advertisement.

In this model, users become sources of data, which is then used to train models, which produce the predictive products to be sold by Alphabet:

> *The big pattern here is one of subordination and hierarchy, in which earlier reciprocities between the firm and its users are subordinated to the derivative project of our behavioral surplus captured for others' aims. We are no longer the subjects of value realization. Nor are we, as some have insisted, the "product" of Google's sales. Instead, we are the objects from which raw materials are extracted and expropriated for Google's prediction factories. Predictions about our behavior are Google's products, and they are sold to its actual customers but not to us. We are the means to others' ends.* (Zuboff, 2019 page 183)

In this logic, LinkNYC becomes a means towards experimenting with the extraction of data from hyperlocal spaces. The economic value produced by LinkNYC is no longer generating more advertisement space, but rather *extracting* data from public space and its users. This data is not

sold by Alphabet, but rather used to perfect the products which it sells. Thus, the point of monetization is far removed from the data extraction process.

The Kiosks and How they're capturing data

The way LinkNYC nodes collect data is fairly straightforward. When connecting to the internet through a WiFi network provided by a LinkNYC node, that node collects certain pieces of information regarding that connection. That includes a device's MAC address (a unique device identifier), an IP address (a unique connection identifier), browser type and version, time zone setting, browser plug-in types and versions, operating system and platform, device type, and device identifiers (LinkNYC Privacy Policy). More importantly, however, the nodes collect all the browsing information and clickstream while a user is connected to the network. This is particularly relevant to Alphabet, as it contains a series of behavioral queues, such as what type of content one accesses, how long one may remain in a given page, and how one may react to a given stimulus or piece of information. It is, thus, particularly valuable to Alphabet's business in predicting human behavior.

Figure 1. Diagram of the data collection by LinkNYC nodes.

The duality of LinkNYC

Public good

On the one hand, LinkNYC comes as a public good. With the advent of the digital age,

accelerated by the COVID-19 pandemic, broadband access has quickly become a matter of

equity. Access to fast internet now touches on almost every aspect of day to day life, including –

but not limited to – the need to commute, ability to perform work, educational access and

attainment, healthcare affordability, the dissemination of information, political organization,

access to opportunities, etc. Countless were the stories of students, or young professionals who

would need to study or work from the parking lots of fast food chains, or be forced to expose

themselves to infection at public libraries during the pandemic, due to limited internet access at home.

Thus, LinkNYC's undertaking of providing fast internet access at no cost to users is one of fulfilling a need that is not only an essential equity matter, but one that is fast being recognized as a basic human right. A LinkNYC kiosk then represents a physical node connecting an urban block of NYC to the globalized digital world. It represents a hyperlocal portal into the massive amount of information, opportunity and access represented by the internet in the 21st century.

In this vein, the deployment of the LinkNYC network should prioritize the 18% of New Yorkers who lack both home and mobile broadband access. Broadband access is lowest in the Bronx and parts of Brooklyn, Queens and Staten Island. (Mayor's Office of the Chief Technology Officer, 2020) However, these are some of the areas with the poorest access to LinkNYC, which I argue is not only due to infrastructural challenges, but also because of a mismatch between the stated purpose and the economic incentives of the project.

Private venture

While LinkNYC's stated mission may be to bring a public good to New Yorkers of all five boroughs, it is not a philanthropic undertaking, but a for-profit, commercial venture. Not only does LinkNYC capitalize on exposing the people it's supposed to serve to advertisement, but it functions as one more of Alphabet's ventures to mine the data of its users. As stated previously, this data is used to quantify the human experience of these users, as well as improve Alphabet's

ability to predict and – importantly – to influence their behaviors; primarily in their roles as consumers.

Thus, just as a node in the LinkNYC network connects NYC blocks and New Yorkers to all the opportunity and information of the world-wide web, so does it connect them to Alphabet's data mining practices, and its behavioral futures marketplaces. The nodes then become a physical, hyperlocal form for Alphabet to capitalize on NYC's public space and the daily traffic of New Yorkers through it. They allow Alphabet to make use of public space and its traffic to improve its predictive and manipulative capabilities.

Due to the network's spatial properties, this leads us to ask: who's data is prioritized by Intersection? In deciding on the deployment of new kiosks, how are different parts of NYC valued in terms of the data they can produce? If targeted advertisement is the biggest use of the behavioral predictions being produced by Alphabet, it should follow that it would be more valuable to collect the data from larger consumers. Thus, wealthier neighborhoods would – or at least those with the largest traffic of wealthier individuals – would be more cost effective to deploy kiosks, than less wealthy ones. The same would apply for shopping areas, and those with large flows of tourists.

Of course, many more factors are likely considered in the decision about where to place new kiosks, including – but not limited to – existing infrastructure, absolute amount of foot traffic, regulatory limitations/requirements by the city, and the aforementioned mission of providing internet access to those who need it the most. However, my point is that the incentive to collect

the most valuable data – however that is defined – is largely conflicting with the mission to provide broadband access to the New Yorkers most in need. Thus, if left unchecked, economic pressures would push the deployment of nodes to prioritize wealthier areas over more disadvantaged ones. This, as I've shown, happens to be the current state of the program.

Infrastructural limitations

It is important to note that some of the areas in the outer boroughs which have seen very shy deployment of the LinkNYC network have historically seen divestment and infrastructural challenges. Fiber coverage is still very limited in much of the outer boroughs, and there are limited options of internet service providers. Thus, the same infrastructural issues which aggravate the poor access to broadband in these areas, also make it more difficult to deploy LinkNYC kiosks.

While the LinkNYC project did come about from a desire to increase access to high speed internet for those most in need, bridging the infrastructural difficulties in much of the outer boroughs is a larger challenge, which requires a larger undertaking. Decades of divestment, segregation, and redlining simply could never have been bridged by such a limited undertaking. However, these issues should have been known to the CityBridge consortium, as well as City Hall from the very start of the project in 2014. Thus, it is fair to suppose that many of the promises made in 2014 were empty from the start.

Spatial analysis

As a means of visualizing the deployment of LinkNYC, I produced a simple web map that allows viewers to observe the development of the network over time. The map uses data from the DoITT's *LinkNYC Locations* dataset, from the NYC Open Data Portal. The slider can be used to filter for the situation of the network at any given month since the start of the deployment of nodes. With the map, I hope to give viewers a sense of how limited the deployment of the LinkNYC network has been outside of Manhattan, as well as to highlight how the network has not been expanded at all since 2019. The website can be found at https://officialfred.github.io/capstone/.
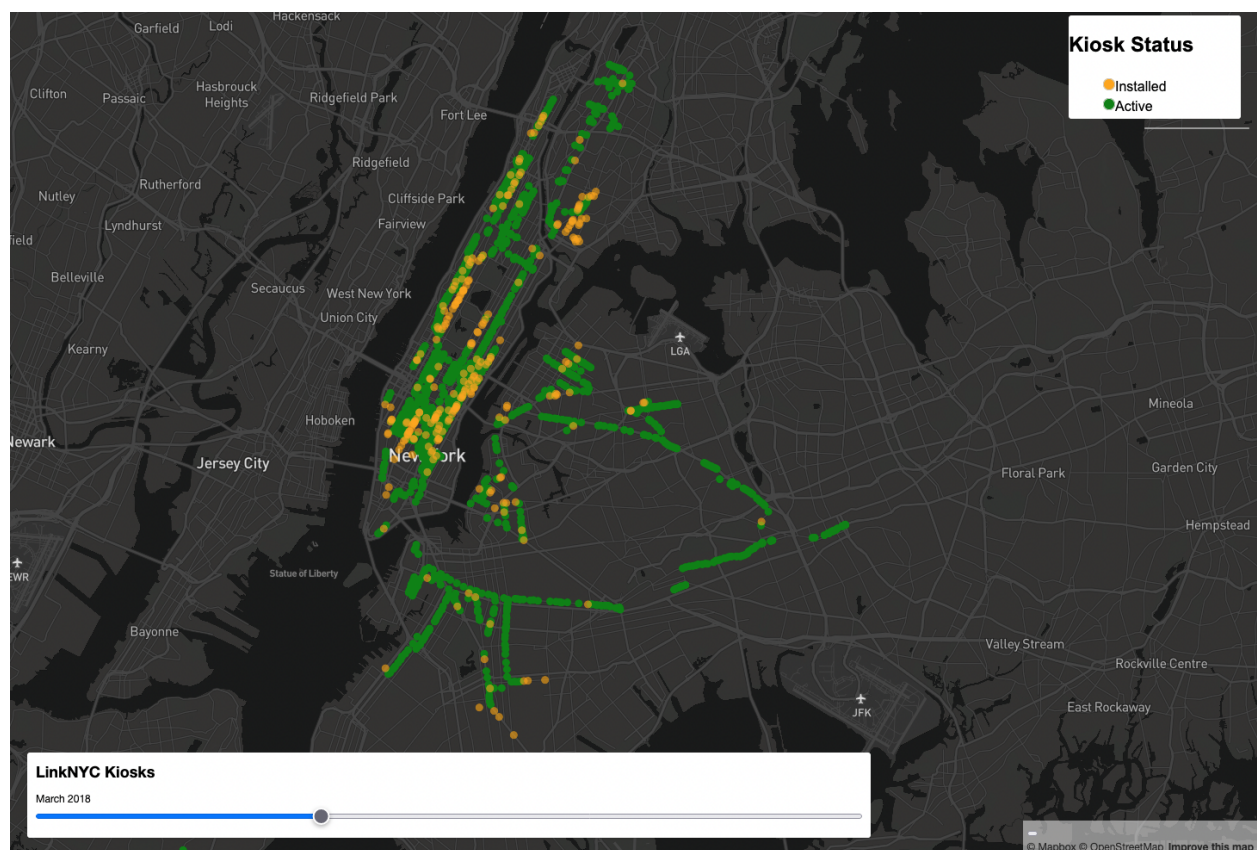

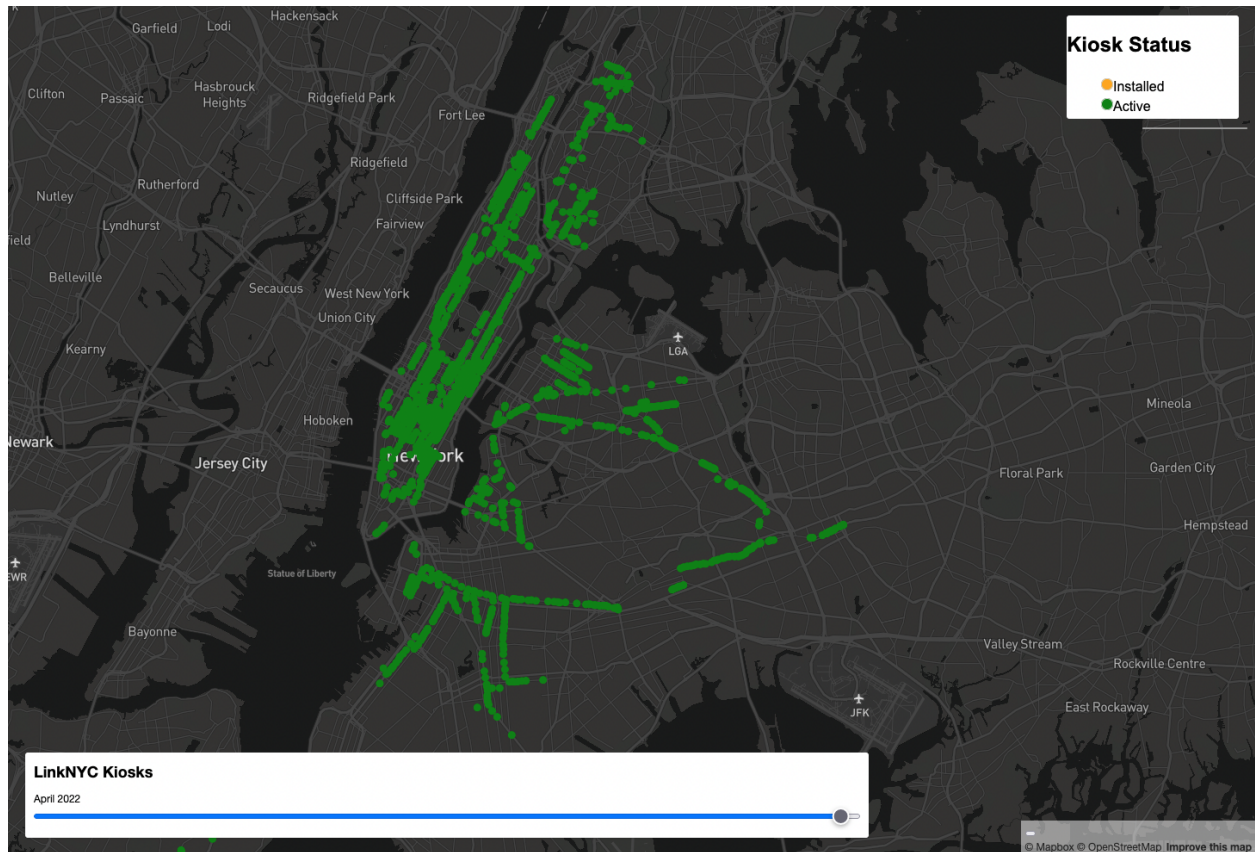Figure 2. Web map produced by the author displaying the situation of the LinkNYC network in March 2018.

Figure 3. Web map produced by the author displaying the situation of the LinkNYC network in April 2022.

In my spatial investigation, I used Geopandas and Plotly, to plot data from the 2020 Census, and Opportunity Atlas's *Neighborhood Characteristics by Census Tract* aggregation of Census data over spatial data about LinkNYC kiosks. My goals were to gain some insights as to what neighborhood characteristics might be most valued by LinkNYC in the deployment of their network. I hoped this could begin to enlighten the question of how data from different areas in the city might be valued differently.

However, what I came to find is how limited traditional means of producing spatially relevant insights are, when studying quite such a complex matter. Any conclusion made from this data would be precipitated at best.
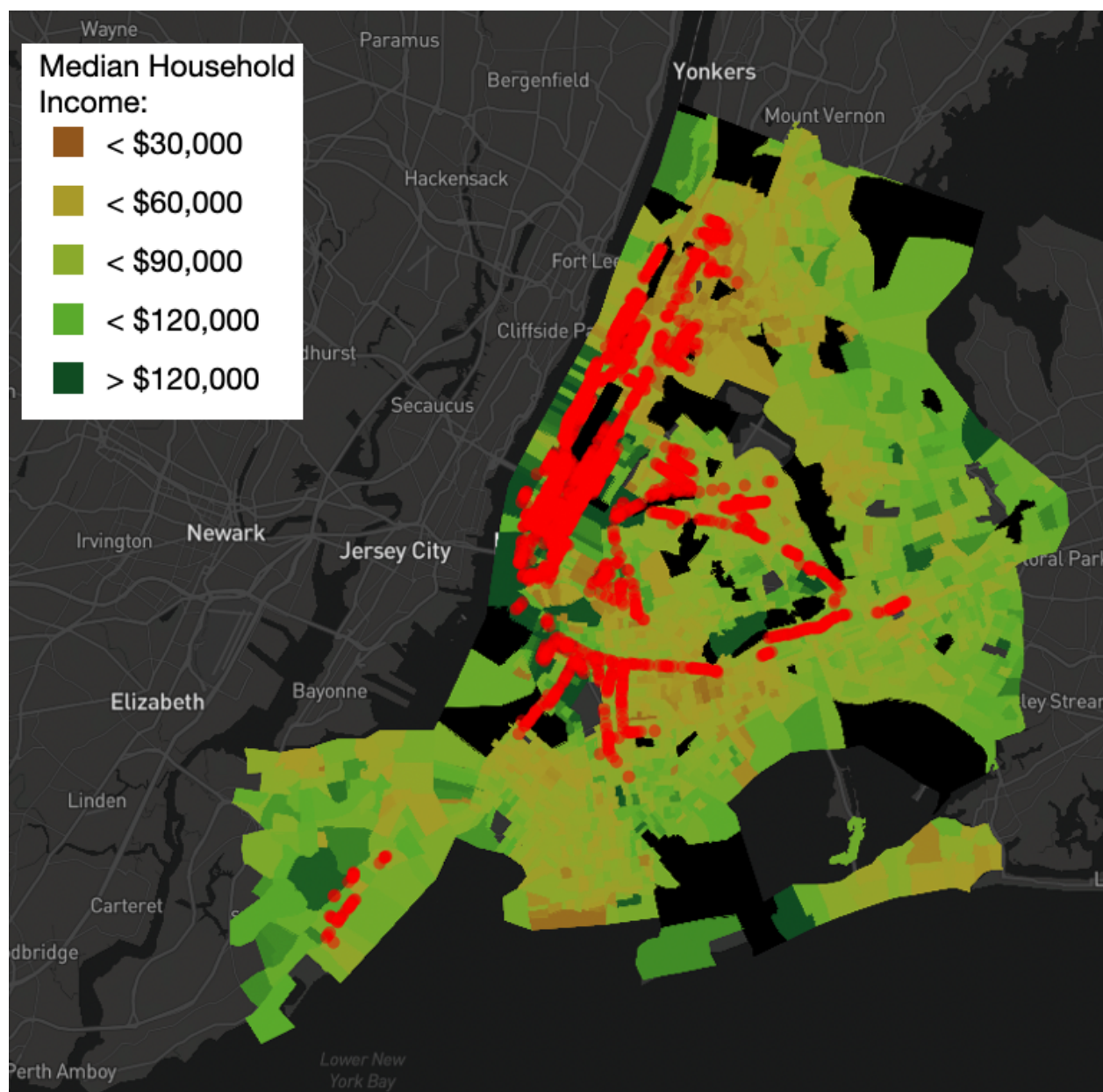
Figure 4. LinkNYC network and median household income per census tract. Source: Opportunity

Atlas, Neighborhood Characteristics by Census Tract.

The Black Box

Many of the most sophisticated algorithms used by the likes of Alphabet and other tech giants are what are called *Black Box* algorithms. What that means is that their decision, or prediction making processes cannot be looked into from the outside, and how a decision came to be made cannot realistically be explained in human-understandable terms. The most known example of black box algorithms are deep learning models, which combine such a large number of data points in such complex mathematical functions, that for a human to understand the process would be realistically infeasible. The assignment of what functions will be applied to the data is executed by the algorithm itself, and not by its programmers, furthering the difficulty of explaining it. However, the use of such a large amount of data, paired with such complex functions can produce powerful predictive models.
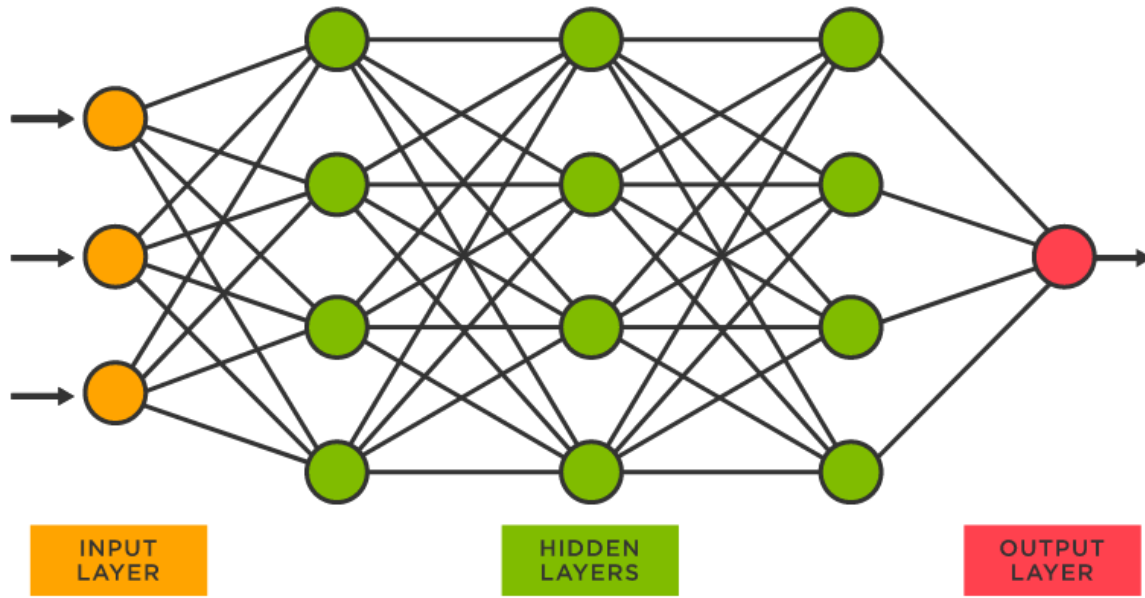
Figure 5. Illustrative chart of a neural network. The data from the input data gets split up and processed in multiple nodes, each containing a unique set of functions. The outputs of each node go through other layers of nodes containing different functions, and so on, to eventually produce an output. The sheer amount of computations to process a given amount of data make the process very difficult to explain in human-understandable terms. Source:

https://www.tibco.com/reference-center/what-is-a-neural-network

Because of this, the deployment of black box algorithms is largely limited to applications where predictive performance of complex systems is paramount, and explainability is less important. The lack of explainability largely excludes the use of such algorithms from government, where auditability and questionability are essential democratic resources. However, for players like Alphabet, the potential performance of such models can be well worth their opacity.

It is likely that the decision of how to value the data to be potentially extracted by LinkNYC nodes in a given location as compared to another, is done with the help of one such algorithm. Such an application could take in not only all the demographic data publicly available about NYC neighborhoods, but also the staggering amount of user data already in the possession of Alphabet. This leaves us questioning then, what is favored in the decision making process, and who is left behind.

Conclusion

Citizenship through consumership

In the duality of its nature as both a public service and a data extraction operation, LinkNYC monetizes citizens' experiences as consumers. New Yorkers' gain access to a basic right by – largely unknowingly – offering up personal data. As LinkNYC prioritizes certain parts of NYC (namely Manhattan) to others, it attributes greater value to some New Yorkers' data and experiences than to others'. Rather than bridge a digital divide, the program doubles down on infrastructure and service inequities within New York.

LinkNYC has been somewhat successful in deploying infrastructure to offer a public good, while not relying on users or the municipality for financing and revenue. However, it has shown how – without stricter contractual guidelines – such models will favor those who already have greater access to services, while disadvantaging historically underserved communities and divested areas.

Regulatory shortcomings

The LinkNYC project shows a number of regulatory shortcomings. First and foremost, there is a lack of transparency requirements on the part of CityBridge. The consortium is allowed to make decisions which impact the infrastructure of the city and the access to service by New Yorkers, as well as extract and monetize data from New Yorkers. Meanwhile, it is not obligated to make public how the decisions to install nodes in a given area are made, how the data being collected is being used, or how it is valued.

As the value extracted from the data collected is monetized elsewhere in Alphabet's pipeline, CityBridge excuses itself by claiming low ad revenue to under-deliver on the promises made to City Hall. As projects carrying this duality of providing a public service, while extracting data from the public will become more popular, municipalities need to update their regulatory framework to take this data into consideration as a primary driver. It is no longer appropriate to merely set limits on what data can or cannot be collected. Instead, clear guidelines must be put in place outlining how that data is to be valued, and how it is to be included in the financial equation of a contract.

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