



Valassis

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LOCATION ACCURACY

BETTER PREDICTION,
STRONGER RESULTS

BETTER PREDICTION STRONGER RESULTS

INTRODUCTION

Location intelligence reveals a great deal about people's routines and what they care about. By observing the stores people visit, where they live and work, and how far they commute, marketers gain insight into consumer preferences and intent to buy. When connected with online behavior data, this real-world location intelligence provides a key element to building a more complete consumer identity and driving advertising effectiveness.

However, marketers are often faced with the challenge of how to access

privacy-compliant location data in order to deliver effective, personalized advertising with fewer wasted ad dollars. According to Forrester, 34% of marketers surveyed in March 2017 cited inaccurate location data as a key marketing challenge.¹ Location-based advertising is very powerful, but only if the right data protocols are in place to ensure the accuracy and validity of the location data.

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¹. Forrester Consulting, "Pursuing the Mobile Moment," commissioned by Verve June 27, 2017.

Data from mobile devices is highly indicative of consumer behavior. When marketers better understand a consumer's movement through the real world, it becomes a valuable metric for improving audience targeting and advertising performance. Accurate location intelligence fuels:

Advanced Personalization - Location intelligence gives marketers an offline picture of their consumers, enabling more relevant and customized messaging

Location-Based Targeting - Understanding where devices live and where they travel allows marketers to deliver ads based on a device's real-time location, as well as predict visit likelihood

Look-a-like Audiences for Scale - Identifying consumers who share shopping patterns, offline behaviors, and preferences allows marketers to expand an audience to find others who look like them

Audience Prediction - Combining online and offline signals paints a picture of people's interests and needs to help determine intent and meet them at precise moments

Cross-Channel Engagement - Connecting where devices live with physical addresses allows marketers to reach consumers across print and digital media and engage them in their preferred environment

Real-World Attribution - Location intelligence is critical to understanding the ROI of a campaign, including how many exposed consumers visited, how far they traveled, where else they shopped, and how their visits impacted store sales

Every stage of a media effort, from targeting consumers to delivering personalized ads to measuring impact, relies heavily on the accuracy and sophistication of the location platform. The ad tech landscape is filled with many providers and platforms that claim to provide accurate location data. However, building an accurate and trustworthy location intelligence platform is not easy. It requires a significant investment in technology and data science to analyze massive amounts of data across diverse sources. It also involves filtering out fraudulent information and removing Personally Identifiable Information (PII).

At Valassis, we have an always-on approach to data analysis comprised of very experienced people, empowered by sophisticated technology. Adding human oversight to machine-led safeguards allows us to discover and flag unreliable data, as well as protect against accidentally removing trustworthy locations in order to achieve better results for our clients.

CHALLENGES AFFECTING LOCATION ACCURACY

DATA SOURCES

Location data comes from a variety of sources including IP addresses, GPS coordinates, Wi-Fi signals, and app and beacon data. Each source faces distinct challenges that influence the accuracy of the signals it provides. These include physical barriers, inactive location services, and inherent technology limitations. Understanding these limitations enables marketers to design better performing marketing initiatives.

Data Source	Location Identifier	Challenges
IP Address	Reveals location of a device that is accessing the internet through cellular networks and Wi-Fi access points	<ul style="list-style-type: none"> • Data not reliably accurate or precise • IP addresses rotate as often as 30 days • Device location can be determined by an app server in another location
Wi-Fi	Wi-Fi networks assign IP addresses to devices connected to them	<ul style="list-style-type: none"> • Data is accurate and precise due to stable Wi-Fi connection • Added complexity from devices moving between hubs can result in latent data
GPS (Lat/Long)	When an advertisement appears in an app, the mobile device sends GPS coordinates via cell towers and Wi-Fi hubs	<ul style="list-style-type: none"> • Data is accurate and precise • Subject to environmental conditions and user-determined device settings
Cell Triangulation	Multiple cell towers track location by measuring time for a signal to return to towers from a mobile device	<ul style="list-style-type: none"> • Accurate to the ZIP Code or neighborhood level, but not precise
Beacons	Small devices that detect when a mobile device is nearby in order to understand movement patterns inside a store	<ul style="list-style-type: none"> • Data is accurate and precise • Requires app to be downloaded on a device with location services enabled by user

IP ADDRESS & WI-FI

An IP, or Internet Protocol, address is a unique string of numbers that is linked to your online activity. The IP address reveals the location of the device that is accessing the internet. Just as someone needs your mailing address to send you a letter, other computers need your IP address in order to communicate with it via the internet.

Wi-Fi hubs and access points act as channels to connect a device to an IP address. They are available in public places, homes, and on the go. Unlike cellular network connections, which may bounce a device randomly through non-fixed IPs, devices connected to IPs through Wi-Fi allow a stable location to be determined.

Challenges: IP addresses rotate, sometimes as often as every 30 days, which makes it difficult to match a device to a location over an extended period of time. For example, if a marketer is targeting a device with a specific IP address for a two-month campaign, a portion of the audience may disappear when the IP address changes.

An IP address can be determined by an app server, which may vary from a device's actual location. For example, a user's favorite game app could have a server in New York. So even though they're playing the game in New Jersey, their IP address could register as being currently located in New York.

Wi-Fi networks assign IP addresses to devices that are connected to them. Devices can move between different access points that are part of the Wi-Fi network. Determining location using Wi-Fi is complex and requires more processing time, which often results in latent data.

For the advertiser, these examples show that using IP address data alone to determine location can result in their ad being shown to an audience in the wrong location, which wastes impressions and decreases their return on ad spend (ROAS).

APPS AND LATITUDE AND LONGITUDE COORDINATES (GPS DATA)

When an advertisement appears in an app, the mobile device sends GPS coordinates via cell towers and Wi-Fi hubs.

Challenges: User-determined device settings and activities influence when signals are available for detection. These settings primarily include options for location services, background app refresh, and the length of time an app has been open.

- Enabling location services allows for the capture of GPS coordinates. Recently, mobile operating systems updated the “always” or “never” options for tracking services, allowing a user the option to go into settings and choose “while using” for each app. This means their location information is available only when they are using the app.
- If an app doesn’t have access to quickly refreshing location information, the data available will be stale and not a true representation of current movement. Background refresh is important for apps; it enables them to keep content current. However, background app refresh is a power-hungry feature and is often turned off in order to prolong battery life.
- App providers receive higher CPMs for impressions with location data attached. Some providers who do not have location-sensing technology include generic, centroid-based coordinates in order to receive more revenue for their inventory. These centroids represent center-points of a geographic area, such as ZIP Codes, DMAs, or states, and may not accurately reflect location information.

When location services are enabled, mobile devices need a clear line of sight to GPS satellites to send and receive information accurately. The location signal can reflect off of physical structures, such as buildings or bridges, inaccurately placing a device at point A when it’s actually at point B. This is often called the “urban canyon” effect. As an example, if a consumer is walking in downtown Boston among several high-rise buildings, GPS signals may get caught between structures, diluting the user’s location accuracy.

Sending and receiving signals indoors is also a challenge. The signal degrades considerably as it passes through different barriers, such as walls or windows. While a device near a high-rise window will likely have a strong signal, that same device on the first floor near the center of the building will have a much weaker signal or not be detectable at all.

The amount of location data available from apps may be small, inaccurate, and influenced significantly by user settings. As a result, advertisers may miss a significant portion of their audience if they rely solely on app data to understand location. Additionally, relying on GPS signals in urban areas could mean a diminished ability to reach consumers due to physical barriers interrupting the path between satellite and device.

BEACONS

Beacons are small devices that detect when a mobile device is nearby in order to determine how a device moves inside a store.

Challenges: Beacons require the user to download an app on their device. In order for the beacons inside a retailer to track a consumer's movement throughout the store, their device must have the downloaded retailer app and their "location services" settings must be set to "while using the app" or "always."

This allows the beacons inside a retailer's store to trigger the app when a device is within range. The "always" setting triggers the app when it is open but not being used at the moment or closed completely. When "while using the app" is enabled, a beacon can trigger the app only when the user is actively engaging with it. If the app is not being used, it will not connect with the beacon.

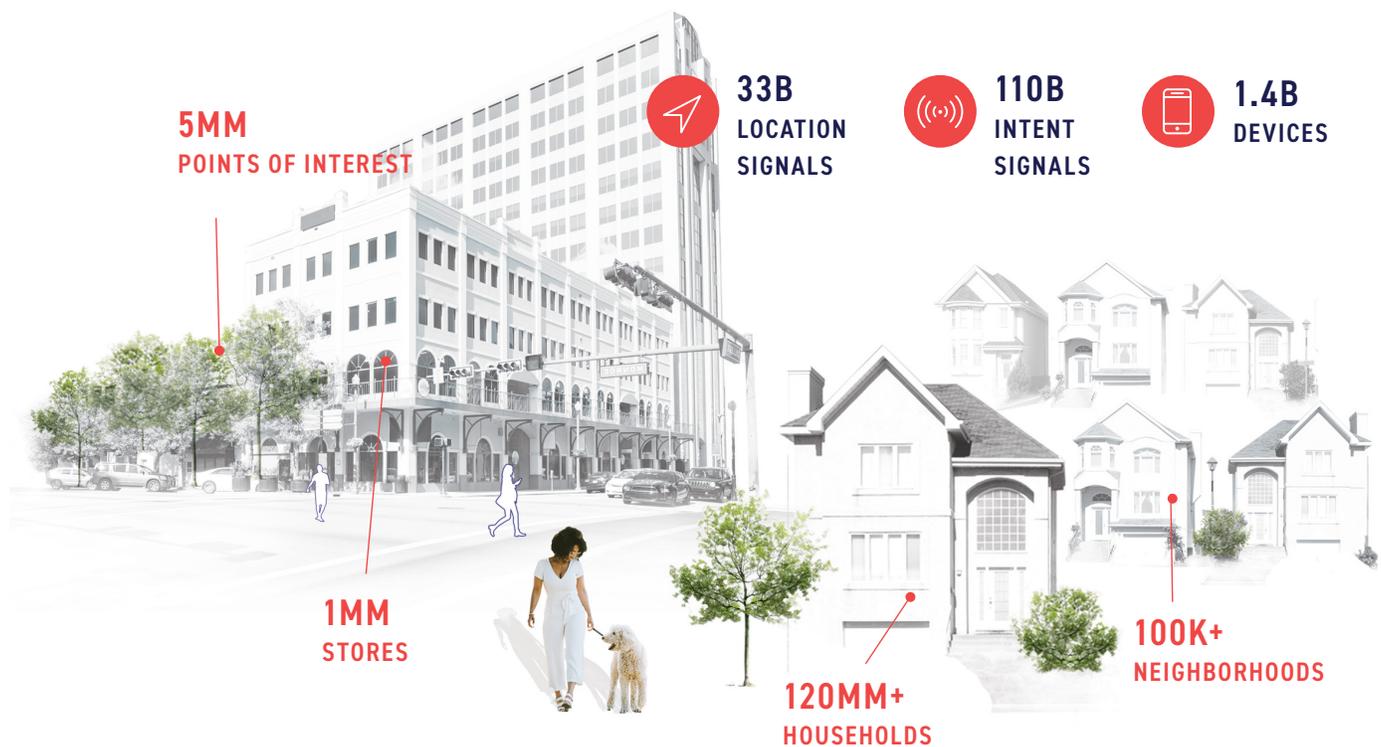
Additionally, in order for a beacon to sense a device near it, it must have a clear line of sight. If a display, promotional sign, or stock cart is in the way, the beacon may not be able to reach the device with a signal.

Many customers who visit a store will not meet all of the device requirements in order for beacons to track movement in a store. As a result, beacons are not effective in reaching every customer who visits a store. For advertisers, this means that even though beacons offer location accuracy, they often don't capture location data and may miss a significant portion of their audience.

Relying on GPS signals in urban areas could mean a diminished ability to reach consumers due to physical barriers interrupting the path between satellite and device.

THE VALASSIS DIFFERENCE

Working with experts who know how to extract the most value from location signals results in more relevant audiences and more accurate measurement. At Valassis, we have more than ten years experience understanding location signals and investing in state-of-the-art methods to ensure our intelligence is more insightful and our targeting is more relevant and precise.



Access to location data today is a common feature within many ad tech platforms, so what really sets providers apart? First-rate players access large volumes of data across varied sources, invest in data science and technology to overcome inherent limitations of each source, and filter out bad data to provide meaningful intelligence for advertisers.

In order for location data to be meaningful for marketing, it must be mapped to locations that are the union of consumer intent and real-world behavior. The Valassis Consumer Graph™ ties devices and associated behavioral data to a base map of over 120 million households, or parcels, in the US. Tax jurisdiction and land assessments define these granular plots of land. Our advanced techniques map observed locations and connect those location points to households, stores, and other points of interest.

In order to attribute GPS signals to geographic areas, in volume and over time, one approach companies use is to divide their base map into squares or other uniform shapes. When a device is found within the boundaries of one of those shapes, a visit is attributed. As device activity is seen across squares, patterns of visitation and location behavior are established.

However, a world divided into uniform squares has no correlation with the communities and the people inside them. By adding a behavioral component to our map, we understand a community or a neighborhood and the people who live there. For marketers, this allows for intelligent modeling; you not only understand the characteristics of people seen, but you apply what you learn to people around them. As a container of people with similar interests and traits, neighborhoods afford marketers the opportunity to find more consumers like those who are in-market to buy.

Valassis has been mapping, filtering, and interpreting location data for more than ten years while concurrently deepening our knowledge of neighborhoods and households. Our foundational experience continues to expand with layers of new data to create an unequalled, behaviorally informed base map - the Valassis Consumer Graph.



The Valassis Consumer Graph contextualizes location into a larger set of meaning. When we see a device in a specific place, we know:

- Whether the place is a home, store, or another point of interest
- What physical address is associated with that location
- Where residents who live in that place work
- Where people in and around that place shop and visit
- What people in and around that place browse online
- What the behaviors are of people who live in that neighborhood

With this data, marketers have the missing links that connect the online and offline worlds. Using a broader picture of location activity allows marketers to target, for example, individuals who live near a Best Buy, frequently go to the Apple store, and live in areas that enjoy buying new technology, as well as other people who look like them.

To ensure this location data stays current, Valassis updates the Valassis Consumer Graph utilizing a variety of sources, including a Point of Interest (POI) service, panel data, and proprietary data, as well as USPS® addresses.

Our team validates these updates via a manual and an automated process. We manually review information to identify changes. For example, if Business A has closed and Business B has opened in the same parcel, we make sure the Valassis Consumer Graph reflects that change.

For marketers, this process ensures the information used to make each decision is based on the most current, accurate data available.



HOW VALASSIS ENSURES MORE PRECISE LOCATION DATA

01

MASSIVE AMOUNTS OF OBSERVED DATA

At Valassis, the way we match devices to households and other points of interest is deterministic – we directly observe the relationship between devices and the places they visit.

Some companies only utilize data provided by a panel for their analysis. This method requires a group of users to sign up in an app or service allowing marketers to observe their behavior and extrapolate insights to inform their marketing decisions. While panels offer unique information, the insights gathered are directional and limited in scale.

Valassis analyzes data from a broad device population, observing 33 billion daily location signals from 1.4 billion unique devices. Instead of monitoring a small number of panel devices, tracking behavior, and applying a projection factor or multiplier to account for devices outside the panel, Valassis examines behavior from a broad population. Our observations and analyses provide a better representation of how consumers move throughout their day.

02

DIVERSIFIED SOURCES²

Beyond the ad network space, Valassis receives location data from varied sources. These include apps that don't offer advertising, such as navigation and subscription apps, or beacon networks that provide signals when a device is seen in a retail location.

Diversified sources provide validation and a more complete data set. We use multiple sources to cross-check location data points and confirm their validity. If more than two sources report a location data signal at the same coordinate, we have a basis to believe that point is accurate.

More data sources deliver a larger inclusive sample and a comprehensive view of location behavior. Each source sees how a segment of devices appears to move over time. Combining these views across sources deepens our knowledge of consumer behavior, including where consumers shop, how often, and where else they spend their time. The larger number of sources and signals creates a stable base set of data to analyze, which isn't affected by outliers or consumer usage fluctuation.

To further improve the stability of our data, we have access to and alignment with the largest and most accurate mailing file on the market. By continuously anchoring an individual's data to a household and its physical address, we form a more stable, long-term view of an individual's location and behavior. This allows us to map longer periods of data for increased relevance and prediction and easily connect campaigns across print and digital channels.

Diversified sources of location data give marketers a larger pool of verified geographic signals. This results in greater confidence of consumer location, more usable data points, and it eliminates the need for a projection or multiplier. Projections are often employed to make up for the lack of scale of a sample size and reduce the confidence interval of data or insights.

² Valassis takes its privacy obligations very seriously. Consistent with our commitment to protecting personal data and the rights of data subjects, we continually monitor legal and regulatory developments related to privacy to stay ahead of changes that may affect our business.

03

EXTENSIVE LOOK-BACK TIME

A look-back window refers to historical location data stored by a location provider. If a marketer wants to see behavior over time to inform campaign decisions, they may request the previous six months of information. Companies vary in the amount of historical data they keep, but Valassis' look-back window is one year. It's important to have at least one year's worth of historical data to see how seasonal trends, weather, holidays, and events impact the way consumers spend their time.

Valassis uses historical information to deepen our knowledge of device movement, influence our filtering practices, enhance our understanding of device trajectories, and inform product development.

04

PROPRIETARY DATA FILTERS

The advertising ecosystem is saturated with fraudulent data. According to MarTechAdvisor, ad fraud cost the industry \$15 billion in 2018, representing 13% of digital advertising spend.³

This inaccurate information could lead to missed opportunities, and wasted spend, focusing impressions away from the in-market audience. Valassis removes this data because it hinders the real consumer journey by falsely attributing a visit to a location.

A thorough filter is critical to remove bad information and to protect advertiser investment. Valassis ignores reported locations for 50% to 70% of our data signals to improve accuracy of our location intelligence. We leverage more than ten years of experience to create the most stringent quality control measures on location data available today. Our proprietary multi-layered filtering system ensures marketers are working with the most current and precise location data, so they can focus spend on the right audiences at the right time and increase ROAS.

3. MarTechAdvisor, "How Blockchain Can Help Solve Ad Fraud," March 2019.

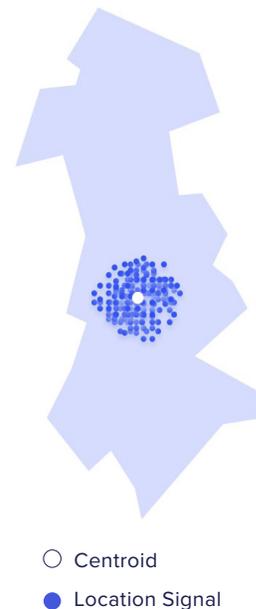
Our meticulous approach to filtering out ill-formed or fraudulent data follows a two-step process:

Suspicious-location Analytics: In order to filter out fraudulent data, we apply a complex set of heuristics to identify unrealistic location patterns. Valassis knows how a device typically behaves and identifies points that look abnormal. This benefits marketers because it establishes patterns of normalcy, so when signals appear outside of that pattern, they are recognized and removed. Understanding these movements further refines the data, making it more likely to be accurate.

In addition, rather than solely identifying understood types of fraudulent location data, our heuristics discover a wide variety of “dumping ground” coordinates, filtering out fraudulent data that other providers may be missing and further improving the accuracy of our location intelligence.

Some of the unrealistic location patterns we find include:

- **Centroids.** Often location signals default to a known centroid (center of an area, such as a country, state, postal code, etc.), either because that is the most accurate location a publisher has, or because publishers receive greater revenue for opportunities that have location data attached. So even if no location is precisely known, they may assign the coordinates to the nearest known centroid.
- **Mobile-signal gridding.** When high buildings of multiple conflicting signals make it difficult to get a good GPS reading, many phones will revert to an older, less-precise method of location reporting. This results in a scatter of location signals in a grid pattern that may be up to 100 meters away from the actual location of the device.
- **Weather meshes.** Many weather apps rely on location data from a service that bins weather forecasts into hexagons which can vary in size and dimensions depending on how precise of a forecast is needed. These apps report the center of the hexagon instead of the actual location of the device.
- **Other causes.** The locations we flag as suspicious are not all centroids, gridding, or weather meshes. We use methods that don't rely upon understanding why a location is untrustworthy in order to flag it as unreliable data.



Location Trust Score: Our heuristic methods catch a lot of problematic locations, but heuristics are practical techniques based on rules, and rules can have exceptions. To make sure we catch as many untrustworthy locations as we can, and to safeguard against accidentally removing trustworthy locations, we use machine learning to double-check and expand our heuristics.

Our machine learning model measures signal locations, coordinate precision, and the distance, speed, and angle of movements of individual devices to predict the probability that a particular record has reported an untrustworthy location. The model considers the interactions among all of these variables to output a Location Trust Score that gives us flexibility in deciding how much noise we want to accept for a particular advertising campaign. For example, a campaign that wants to target consumers within a single city can tolerate a lot more device location uncertainty than a campaign that wants to target particular homes. Our unique Location Trust Scores allow us to remove fraudulent data with more accuracy, while allowing data with varying levels of trustworthiness to be retained for scale, supporting higher ROI.

05

FOCUS ON INNOVATION

Because there is such a strong economic incentive for publishers to game the system, there must be an equally strong focus on innovation to counter those defrauding strategies on behalf of advertisers. Valassis is constantly innovating and testing new ways to stay on top of emerging counterfeit tactics in order to protect advertisers and correct bad location data patterns.

Examples include:

- Dynamic models that reclaim locations previously considered untrustworthy
- Smart location tethering to determine location visitation even when signals do not fall within a brick and mortar store
- Machine learning models to determine location visits with partial or incomplete data

SUMMARY

Sophisticated location providers have access to the same data sources and receive similar signals. What separates great partners from good ones is their ability to synthesize large amounts of data from diversified sources, accurately filter out fraudulent signals, and interpret the remaining information in the context of a map.

Valassis' unique approach to accurate location data is a highly deterministic way of understanding behavior. This approach, built with the challenges of mobile in mind, allows marketers to:

- Engage with consumers ready to purchase with personalized messages
- Reach them where they are in real time, not where they were three hours ago
- Find other consumers who look like those in-market to achieve scale
- Connect intent with location for a more complete consumer view
- Measure the impact of their efforts

To accomplish this, a location data provider must have access to a large volume of diverse signals, employ a rigorous filter to remove the fraudulent information, capture historical behavior trends, and apply these learnings to stay ahead in an ecosystem incentivized to defraud advertisers.

When selecting a partner, ask:

- How do they determine a device's location?
- What methodologies do they employ to remove bad data?
- Do they have the scale to execute your program?
- How do they tie location signals to online consumer behavior?
- Do they develop their own proprietary technology in-house to ensure best-in-class approaches?

Accurate location intelligence is one of the most crucial components for mobile advertisers to improve audience targeting and advertising performance. To learn more about how your programs can benefit from Valassis' expertise, please visit valassis.com.



TAKING
MARKETING TO
THE NEXT LEVEL.
