

Behavior Analytics in Retail

Growth Hacking for the Physical Store

7 Technologies to Track People

by Ronny Max on July 1, 2015 in Analytics

People Tracking Technologies capture customer and employee activities inside the store, allowing retailers to better understand their traffic patterns, empower in-store marketing, schedule to demand, manage queues, and measure sales conversion.



People Counting versus People Tracking

Behavior Analytics, Location Analytics, In-Store Analytics or whatever from of data and analysis attributed to activities in the physical store, depends on a technology to detect and track people. The primary people counting and tracking technologies are Monocular (Single Lens) and 3D Stereo Video, Thermal Imaging, Infrared Beams, Wi-Fi Tracking, BLE beacons, and the nascent Spatial Learning for your smartphone.

Each technology has its own set of challenges and benefits. For example, Wi-Fi, BLE, NFC, and RFID are based on radio wave technologies, and are distinct by range and the accuracy of the capture process.

The differences are not only in technology. The most pronounced benefit for BLE Beacons is the ability to send “push” notifications to customers. Wi-Fi antennas can track the customer path across great distances. Magnetic Resonance are calibrated with mobile applications. 3D Stereo Video solutions also manage the more complex frontline queues and predictive scheduling.

The difference between the solutions also includes the relationship between the capture technology and data integration requirements. For example, the premise of Beacons is to allow the retailer to directly contact the customer, in real-time. This requires complicated data integration between the beacon antennas in the store, the point of sales system, the customer relationship management platform, and the retailer’s loyalty application.

Moreover, each people tracking solution has its own unique concepts of accuracy and data quality.

Before we delve into the technologies, some definitions:

People Counting: The term is attributed to door-counters (traffic counters), which traditionally include infrared beams, thermal counters, and video sensors. The data

output is simple and consist of how many people enter and exit the store, which is used to calculate Sale Conversion.

Queue Management: Since queue behaviors include both standing and moving, this is a complex form of people counting. The sensors provide data on the number of people waiting in line, and the average wait time. The robust frontline solutions predict how many cashiers should be active in order to prevent the formation of queues.

People Tracking: While people counting measures the number of customers in a specific area, people tracking is about the path inside the store. People Tracking refers to data output from wireless technologies, specifically Wi-Fi, which capture the Customers' Journey — by tracking their mobile phone signals.

Since the nature of the market and the Who's Who in vendors change as fast as these words are written, we will highlight the characteristics of some technologies.

[Growth Ideas with #BehaviorAnalytics](#)

Monocular Video Analytics (Single Lens Sensors)

Video Analytics is a general term for sensors and solutions that capture an image and analyze its content. The range of Video Analytics solutions is far and wide in accuracy and utility. Here, we'll focus on a simple distinction between Monocular Single Lens and 3D Stereo sensors.

Monocular devices capture images through a single lens camera. The image can be processed within the sensor itself, sent to an in-store server for analysis, or processed at a central server. Due to costs and bandwidth requirements, most counters are At-the-Edge (computer and camera) devices and send only metric data to the central server.

In door-counting, monocular devices achieve 90% accuracy in 90% of the stores. The core challenge of monocular devices is their treatment of depth. The presence of shadows and changing ambient conditions during the day impairs the ability of the technology to compare the real-time image to a "baseline" picture. Some vendors compare and "fix" the data to a trend, which happens during the upload to the central server.

Since single lens counters can be accurate for most door-counting situations and due to the variety of vendors, the sensors reached the status of a commodity

3D Stereo Video Sensors

The principle behind 3D Stereo Vision is the assumption that accuracy starts with capturing the most high-resolution camera and creating a three-dimensional view of the tracked object.

The four data points for each image—height, mass, speed and direction—significantly enhances the accuracy of the count. Since sunlight and shadows do not have depth, stereo vision devices can filter out these objects from the counts. This architecture also

allows for individual tracking of the object, as well as the person or shopping cart, for an extended period of time. The ability to define the exact location of an individual person opens the door to continuous tracking along multiple cameras and during abnormal behaviors.

Nomi (formerly Brickstream) defines the advantages of 3D Stereo Video as the ability to detect people versus objects; the ability to achieve accuracy in high volume traffic; the tolerance for variations in the environment (light, heat, shadow); the ability to detect employees and adults versus children; the ability to detect behaviors of interest; and the ability to detect the direction of travel.

The key challenge for stereo vision is cost, since the counting solution requires special devices and cannot use standard cameras. However, the advantages of accuracy for complex behaviors make 3D Stereo the preferred choice for queue management and other solutions.

Thermal Imaging

Thermal imaging works by detecting emissions from moving targets, by locking on to the targets, and then tracking them within the sensor's field of view. Thermal imaging ignores the background features and focuses only on the moving object. As a result, thermal technology is not sensitive to light and allows the sensors to function well in challenging conditions such as the fluctuations from darkness to bright light. Thermal also ignores the impact of shadows on the image.

While accuracy suffers from the "blending" of a person's heat signature into their surroundings, if the person stands too long in the same place, thermal sensors achieve 95% plus accuracy rates in non-fluctuating ambient environments.

Thermal imaging based detectors are relatively easy to install, and unless used for the sophisticated solutions such as queue management, they are easy to calibrate. As low energy appliances, with no privacy issues since no image is taken, thermal sensors are versatile and wide spread.

Irisys, the everlasting leader in thermal sensors, claims over 300,000 sensors installed worldwide.

Infrared Beams

Infrared beams are mounted either sideways on the gate door or top-down from the ceiling. These low-cost devices are simple to install and setup. The device sends a direct infrared beam, and counts the person moving across the doorway once the beam is broken.

The advantage of beam counters is their cost and simplicity. Unfortunately, beam counters suffer from accuracy challenges. First, the sensors cannot recognize the direction of motion, and count both the people entering and the people leaving the store in a single bucket. This requires dividing the counts in half in order to estimate the number of people entering the store.

Second, in wide entrances or in high-traffic entrances, the system tends to under count since it cannot differentiate between groups of people. If the beam is broken the system counts one, whether it is one person, or two or more people passing through the threshold. When customers loiter around the entrances or when shopping carts are within the beams range, the system cannot recognize the different behaviors and over counts. Since the system can easily under-count and over-count, the inconsistencies may render the accuracy rate irrelevant.

Infrared Beams were the cheap choice for door-counting, but the title is now being passed to Wi-Fi Tracking.

Notes on Installation: In addition to the cost of sensors and software applications, the process of installation can significantly increase the total price of the solution. The installation of hardware consumes labor payroll, and if the solution includes real-time or predictive components, then the calibration requires even more time.

Travel costs also play a part if the installation is done in locations far from urban markets, such as North Bay in Canada or the frontiers in China. This is where the vendor's ability to calibrate the sensor remotely becomes more than a marketing slogan.

Overtime pay is also a consideration since some retailers only allow installation outside the store's activity hours, typically after closing. The costs increase if mounting the sensors requires special equipment, for example a lift for ceilings higher than 16 feet, or if the cable run from the sensor to the IT room is longer than 100 yards. There are more challenges if the ceiling is hard or the store has designer-oriented architecture. Anyone who has tackled an installation in a store on Rodeo Drive tends to view Beverly Hills California as the road to perdition.

The final piece in calculating cost is on-going maintenance. This includes repairs, replacements, updates and some upgrades that can easily reach 18 percent of the solution, per year.

The Total Cost of Ownership for a sensor-based people counting solutions has shifted attention to mobile tracking; in other words, using the smartphone to track the individual customer's journey.

Wi-Fi Location Analytics

Wi-Fi is an emerging people tracking technology, which is ideal in unstructured movements and in large venues such as airports and stadiums. The technology's dependency on active Wi-Fi features in the customer's device, limits the data output to a sample out of the total population.

Wi-Fi is the technology standard for exchanging data over a Wireless Local Area Network. The Wi-Fi sensors monitor radio waves from the shoppers' smart phones and tablets, and can cover a range of up to 100,000 square feet. Since the emissions of each device (such as a smart phone) are unique, the system can continuously tracks the customer from entry to exit, and even beyond the store.

Wi-Fi Location Analytics suffers from the challenges of GeoLocation Accuracy because the Cellular Tower Triangulation can be wide as half-mile area. Most vendors who offer Wi-Fi Tracking rely on in-store antennas that identify the location of the smartphone, and therefore the customer's path, inside the store.

The low costs of setup and maintenance, as well as the benefits of detailed data on the behaviors make Wi-Fi a very attractive value proposition. The success of this technology, however, also depends on the activation of the Wi-Fi feature in the shopper's smart phone and addressing privacy concerns.

Wi-Fi (and BLE) Tracking is now build-in with the Apple and Android devices. It means customers do not need to download an application or change the default setup, only to opt-in to "anonymous tracking".

Google's [Store Visits](#) is probably the most visible application for Wi-Fi Geo-Location Tracking.

[Growth Ideas with #BehaviorAnalytics](#)

Bluetooth Low Energy (BLE) Beacons

The promise of "Personalize Marketing" inside the store, in Real-Time, comes with Bluetooth Low Energy (BLE). This is a wireless technology standard that deploys short wave radio transmissions to create Local Area Networks. In essence, beacon solutions allow retailers to directly communicate with their customers.

While Wi-Fi Tracking is about capturing Location coordinates, People Tracking is a side effect in a Beacon Solutions. Since customers opt-in, the core advantage of beacon technology is the ability to provide data on the staying time in the store, the walking path inside the store, visitor frequency, and the interaction with products for individual customers.

BLE Beacon Solutions are ideal for merchandising and marketing activities in close proximity. Their primary objectives are to empower Customer Loyalty, promote Impulse Buying, and increase the Average Basket.

For more see "[3 Surprising Reasons to Deploy Beacons](#)".

3D Spatial Learning (in Your Phone)

Google's [Project Tango](#) is an attempt to bring the store to life through your Android smartphone.

“Project Tango strives to give mobile devices a human-like understanding of space and motion through advanced sensor fusion and computer vision, enabling new and enhanced types of user experiences – including 3D scanning, indoor navigation and immersive gaming. ([ARS Technica](#))”

The new smartphones are packed with motion sensors and machine learning algorithms, which allows the device to build a 3D model of the area within sight. The objective is to allow the device to “learn” how objects are oriented and located. Someday soon, your smartphone will “know” you are in the supermarket shopping for nappies and beer.

Google is not alone. [Facebook](#), [Apple](#), Twitter, Baidu and other Customer-Direct companies are moving fast to learn more from images and video. If we apply Moore’s Law to mobile, the development of the smartphone is exponential, and so are the applications for Spatial Learning.

Notes on Analytics: The important factor to remember about people tracking data from mobile and wireless technologies is that the analytics are based on statistical calculations. For example, Sales Conversation calculated from Wi-Fi data (sample) is not the same as derived from video analytics (all behaviors).

This is the distinction between Location Analytics (tracking the individual customer inside the store) and In-Store Analytics (focusing on all behaviors in the store).

[ShopperTrak](#) is an example for a full-service Location Analytics company for retailers, while [RetailNext](#) is more attuned to In-Store Analytics. Both companies, as well as regional companies such as [Vizualized](#) from Hong Kong and [Headcount](#) from Canada, offer a range of technologies, analytics, and professional services.

The trend in people tracking technologies is the divergence between the focus on personalized marketing to the consumer and empowering the physical store. For retailers, this is the key to the success or failure of a people tracking project

◆ **Accuracy, Beacons, Behavior Analytics, People Tracking, Queue Management**

< 5 Questions to Simplify Location Analytics

10 Seconds to Evaluate Your Startup >



How to Increase ROI from People Tracking

FREE MASTER CLASS
ENROLL NOW!

Women Who Wrote the [Analytics] Book <https://t.co/d6jiVaucom> 2 months ago

[Follow SiliconWaves on Twitter](#)

LATEST POPULAR TAGS

7 Reasons to be Happy from #NRF17
JANUARY 26, 2017

How to Define the Return on Investment (ROI)
NOVEMBER 29, 2016

Confessions on How to Sell Shoes
NOVEMBER 7, 2016

Beware of Heat Map Precision
NOVEMBER 4, 2016

Up Sells to Profits in Retail Banking
NOVEMBER 2, 2016

Accuracy is a Hard Lesson to Learn
NOVEMBER 1, 2016

5/10/2017	7 Technologies to Track People - Behavior Analytics in Retail
The Finances of Warehouses near You OCTOBER 29, 2016	
The Forecast Battle for Black Friday OCTOBER 27, 2016	
How to Spot the Bias in Polls OCTOBER 24, 2016	
The Beauty of Pricing for Value OCTOBER 23, 2016	

