Data science could take beacon technology to a new dimension

Since Apple launched its iBeacon technology in 2013, followed by Google's Eddystone last year, location-based services (LBS) have popped up everywhere. By using real-time geo-data and GPS coordinates from mobile devices, beacon technologies have empowered brands and brick-and-mortar stores to reach new levels of ultra-personalised customer experiences, writes **Susan Brown.**

For example, retailers now provide 'store locators' as tools for customers to quickly find the nearest purchasing point. It is also now possible to use a mobile app to automatically send a drone to nearby beacons. A new tracking technology uses smartphone Bluetooth connectivity with small battery-powered beacons to keep tabs on mobile assets or goods in transit. Insurance and road assistance companies are also improving their emergency services by tracking customers' exact locations without the need for directions from the customer in the case of a road accident. Meanwhile, niche marketing agencies are delivering new models of ultra-targeted ads to individuals in the same geographic location.

In Australia, Adelaide Zoo recently implemented iBeacon and eLocker technologies to enhance visitor and student experience, by alerting them to points of interest around the zoo and providing interesting and practical information such as species facts, the location of the closest facilities and educational tools. Sydney Airport is now using Bluetooth and Wi-Fi technologies with beacons to optimise passengers' 'leisure time' and increase retail spend.

While beacon technologies have clearly helped brands (especially retailers and marketers) enter a new age, there are still various challenges businesses need to overcome. Unlike outdoor scenarios, where there are few obstructions between the satellite and mobile device, indoor scenarios can be thwarted by numerous obstructions. They present two types of problems in the form of blocking objects and reflecting objects.

Bringing location-based services indoors

We are all familiar with GPS technology and how it calculates a user's location when outdoors. You would most likely use this when using your smartphone as a navigation system to drive/walk to a specific location. It is a satellite-based navigation system made up of a network of satellites. With the reliance of satellites, GPS signals can easily be obstructed once you step indoors.

Beacon technology was developed to overcome the inherent limitations of satellite-based location information where smartphones are primarily used indoors. Beacons work by using Bluetooth transceivers that can run on a small coin battery. They can broadcast and receive Bluetooth Low Energy (BLE) signals from a range of two inches to 70 metres. Smartphones can pick up these signals and calculate the distance to each beacon in range. They can then trigger an app to perform various functions that can be helpful when trying to market to consumers on premise.

A key driver of commercial success with location-aware applications is real-time tracking, which involves using the triangulation method of measuring distance and angle to determine the position of users. The challenge lies around the ability to determine positions within a limited space and address blocking and reflecting objects in indoor locations.

As a result of these various challenges, many businesses are awaiting a technological breakthrough to take their LBS projects indoors. The opportunities leveraged by analytic technologies could be the answer.

Using big data and predictive analytics

To apply beacon technology to sophisticated indoor

scenarios, IT engineers need to switch to a statistical approach. This could involve recording RSSI (Received Signal Strength Indicator) at different physical points to predict the position of mobile devices using machine learning algorithms.

This approach consists of four key steps:

- **User adoption:** Beacon-powered apps can collect valuable data on consumers' in-store activity if they provide a personalised and targeted offer. In order for customers to adopt technologies like beacon technology, retailers using these technologies must identify and satisfy customer needs and provide true, actionable, customer value.
- **Data acquisition:** This exercise starts by deploying beacons in different parts of the floor—choosing locations that will have minimum interference. Then, the signal strength is recorded at various points at particular intervals — that is, every one metre apart. This will create a location points database that can be applied to smart analytics models.
- **Training the model:** The acquired data is fed into machine-learning algorithms to train the model on a signal pattern. The resultant signal pattern will be unique for each floor. Among several machine-learning algorithms available, two show promise for this class of problem: Bayesian Inference and natural cubic spline. A third option is to use the brute-force approach, as embodied in the Nearest Neighbour algorithm.
- **Real-time prediction:** After training the model, businesses can reap the benefits of these efforts — the prediction. Take, for example, geo-fencing. When users walk into a building, their mobile devices receive signals from beacons. The RSSI of these signals is then fed into the app running on the device, which uses fingerprint generation and recognition to predict their current location. Once these locations are made known, businesses and marketers can then harness this real-time information to deliver highly targeted and personalised retail experiences as users peruse a store, shopping centre or marketplace.

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With proximity marketing set to be a US $52.46 billion market by 2022, there's a clear and significant opportunity for retailers and marketers to take customer experiences to the next level for real gains. Those able to overcome the barriers of indoor LBS, and take advantage of data science technologies will be the ones ruling this space and earning the loyalty of consumers before competitors. PACE

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