Maximizing Benefits via a Scoring Framework for Location-Based Services

Our equations for calculating completeness, correctness and coherence – the 3Cs – of LBS database listings enable service providers to ensure greater relevance and generate enhanced consumer value.

Executive summary

The ubiquity of the Internet in both developed and developing regions has spawned ingenious ways of accessing data. The most popular online search providers in the consumer space are Google, Yahoo! and Bing. However, emerging location-based services (LBS) providers are further disrupting the data access landscape by bridging the gap between instant online need identification and on-field business actualization.

This white paper addresses the product definition and asset measurement needs of LBS providers by answering the following questions:

- What does the consumer expect from location-based online searches?
- What framework should LBS providers deploy to make sure that their business location database results are relevant in delivering consumer and business mindshare?
- What KPIs should they employ to check the efficacy of their business database acquisition efforts?
- What scoring algorithm will help LBS providers to maintain strong data quality and relevant business database insights in real time?

The LBS Industry Landscape

LBS providers develop applications that integrate geographic location information with relevant business details. These platforms create an invaluable user experience for consumers who use technology to explore geography and perform context searches like never before. So, when a consumer uses Google Maps to navigate to a location/business on the map, or when the consumer consults Zomato.com to check the closest top-rated restaurants, they are mining the enormous promise of LBS to enrich their lives. Figure 1 (next page) illustrates a wide variety of applications across an equally wide array of industries.

The LBS industry is growing exponentially, as more and more consumers jump on the smartphone bandwagon. The dollars spent on LBS is expected to soar 491% from 2014 to 2019 (see Figure 2, next page). Increasing competition makes it incumbent on LBS providers to align their data acquisition and maintenance efforts to maximize ROI.
Consumer Expectations of Location-Based Search

When a consumer searches for a business of interest, he expects the search results to return highly accurate information. The information that each consumer may expect to see is likely to vary from one consumer to another. To narrow the exact consumer expectations, we conducted an online survey of about 500 consumers from varying demographics to understand their location-based search requisites (see Appendix for survey details).

Bridging the Consumer Insights and Product Development/Maintenance Divide

After analyzing the data returned from our primary research exercise, we created a comprehensive framework to help LBS providers align their product development strategies along three key parameters (completeness, correctness and coherence) to deliver superior customer satisfaction. Subsequent sections of this white paper lay out the essential components of what we have dubbed the 3C framework.

The 3C Framework to Define the Value of Your Business Listing Asset

There are three parameters that define the value of your business listing:

- Completeness.
- Correctness.
- Coherence.

An evaluation of these three parameters can help determine whether the data acquired by the LBS provider is of business value to the target audience.
Completeness Score

Our survey analysis helped define the parameters of a successful listing. These included:

- Category (business description).
- Name.
- Phone number.
- Marker location.
- Address.
- Web site.
- Business hours.
- User reviews.

However, based on the preferences set by business managers responsible for data acquisition, these parameters can be further prioritized to achieve listing completeness.

Assuming the following variables for the presence of the required fields:

- If category is present, then $c = 1$; else, $c = 0$.
- If phone number is present, then $p = 1$; else, $p = 0$.
- If name is present, then $n = 1$; else, $n = 0$.
- If marker location is present, then $m = 1$; else, $m = 0$.
- If address (to the detail level of street name) is present, then $a = 1$; else, $a = 0$.
- If Web site is present, then $w = 1$; else, $w = 0$.
- If user review is available, then $r = 1$; else, $r = 0$.
- If business hours are available, then $h = 1$; else, $h = 0$.

Thus,

**Data Completeness Score** ($C_{mS}$) = 

\[ c + 0.96(p) + (n) + 0.91(m) + 0.94(a) + 0.84(w) + 0.83(r) + 0.87(h))/8 \]

**Therefore** 0 ≤ $C_{mS}$ ≤ 1

Note: The above equation was arrived at using multinomial logistic regression for the segment of users who are regular users of business listing searches on the Internet. All these coefficients are statistically significant to a confidence level of 5%.

Correctness score

Here we evaluate the correctness of data in LBS providers’ databases vis-à-vis actual on-field data. The simplest approach to test data accuracy is by deploying a team of on-field research analysts to evaluate a representative sample to assess data quality.

The LBS provider must set a number on how much of the data from the total collected should be checked for quality. The value of $x\%$ can be set based on the cost/quality trade-off.

Assume that the following variables represent the quality score of the attributes in a sample:

- $c =$ Percentage of listings with correct category.
- $p =$ Percentage of listings with correct phone number.
- $n =$ Percentage of listings with correct business name.
- $m =$ Percentage of listings with correct location on map.
- $a =$ Percentage of listings with correct address.
- $w =$ Percentage of listings with correct Web site.
- $h =$ Percentage of listings with correct business hours.
- $r =$ Percentage of listings with reliable reviews.

For each listing collected in that batch, the correctness score can be found by using the following formula:

**Data Correctness Score** ($C_{rS}$) = 

\[ ((c) + (p) + (n) + (m) + (a) + (w) + (r) + (h))/8 \]

**Therefore** 0 ≤ $C_{rS}$ ≤ 1

Note: The above equation is applicable for a generic LBS platform. Equation is arrived at using Delphi technique and coefficients assigned based on experts view of attribute necessity and practical feasibility. For simplicity’s sake, kept the coefficient 1 for each attribute. It can be changed as per the LBS provider, nature of business and region of operation.
Coherence Score

The coherence score explains the relevance of your data collection efforts in terms of inviting consumer traffic. Each LBS provider will attach a different weighted score to what it considers to be relevant for its business model. (Example: A vertical focused company will lay 100% emphasis on its market focus.) Similarly, data maintenance efforts will need to be planned in accordance with the provider’s data recency requirement. However, this model looks at the general search appetite of consumers and their preference of relevant businesses in search.

Factors affecting coherence of business data are:

- Listing category relevance to general search behavior.
- Age of the business listing.

Listings Category Relevance

Based on the survey results, search results were categorized in the following three buckets:

- **High importance**: Restaurants, cafés, theaters, clothing stores, hospitals, etc.
- **Medium importance**: Clinics, market areas, supermarkets, bars, government buildings, etc.
- **Low importance**: All other listing categories including hardware stores, metal supply shops, etc.

Each acquired listing will fall in one of the three buckets and is awarded a score (CR) based on the LBS providers’ focus. For example:

- High importance: CR = 1.
- Medium importance: CR = 0.5.
- Low importance: CR = 0.

Age of Business Listing

This is the only parameter of our scoring framework that is dynamic over a period of time. As time elapses, business churn occurs. While the churn in businesses is dependent on macro factors such as the economy, population demographics, etc., we set an acceptable weight to this attribute based on market churn observations across multiple cities:

\[
\text{Age Relevance (AR)} = \left(\frac{\text{Current Date} - \text{Date of Collection}}{365}\right) \times \text{[Target Market Churn Rate per Annum]}
\]

Thus, we calculate the final piece, the coherence score, as follows:

\[
\text{Data Coherence Score (ChS)} = CR \cdot AR
\]

\[0 \leq ChS \leq 1\]

The 3C Score for Your Business

Based on the above identified parameters and individual score allocations, the final score for each listing collected can be calculated as follows:

\[
3C = \frac{x(CmS) + y(CrS) + z(ChS))/(x+y+z)}
\]

Where \(x = \text{importance of data completeness}; y = \text{importance of data correctness}; z = \text{importance of listing relevance based on your business objectives needed from the business listing database.}\) And \(0 \leq (x,y,z) \leq 1\)

Example: A generic LBS provider that addresses 0 market search trends and cares equally about completeness, correctness and coherence will evaluate the 3C score as follows:

\[
3C = (CmS + CrS + ChS)/3
\]

The 3C View: Spatial Visualization of Business Listing Database

Now that a numerical score for each listing is defined, we can tap into big data and data mining techniques to utilize the spatial location information available for each listing and present a picture of the usefulness of the database (see Figure 4).

A weighted combination of our 3Cs will define the quality of the business listing assets of the LBS provider. The benefit of visualization is to focus on the specific area to focus on to improve business listing data quality to ensure that business goals are met.

Looking Ahead

Business listings are considered both the asset and the currency in the location-based industry. As technology commoditizes, the quality of data contained within business databases is the only differentiating factor for LBS providers. Hence, it is paramount for providers to acquire, manage and update their business databases after regularly evaluating the changing needs of their target audience. Our 3C framework offers a way for LBS providers to effectively manage and maintain the
quality of their business listing databases as a result of the following inherent features:

• **Comprehensiveness.** It offers a way to measure efficacy of an LBS provider’s database as well as to strategize the product definition for related businesses. It relies on measuring the correctness, completeness and coherence of the business data acquired.

  ▶ Data Completeness Score (CmS) = \( c + 0.96(p) + (n) + 0.91(m) + 0.94(a) + 0.84(w) + 0.83(r) + 0.87(h)/8 \).

  ▶ Data Correctness Score (CrS) = \( (c) + (p) + (n) + (m) + (a) + (w) + (r) + (h))/8 \).

  ▶ Data Coherence score (ChS) = Cr – Ar.

\[
3C = (x(CmS) + y(CrS) + z(ChS))/(x+y+z)
\]

where \( x = \text{importance of data completeness; } y = \text{importance of data correctness; } z = \text{importance of listing relevance based on your business objectives needed from the business listing database.} \)

And \( 0 \leq (x,y,z) \leq 1 \)

• **Customizability:** It can be easily leveraged by any LBS provider.

  ▶ Its robust KPIs can be developed to further detail the coherence score. Beware: Consumer needs will drive the attribute types and coefficients of correctness and completeness scores.

• **Ease of deployment:** The data can be used for daily acquisition/maintenance plan development and project management by leveraging visualization of the spatial location of business listings acquired through the use of visual dashboards.
A descriptive research design was chosen to understand customer preferences for business listing products. The primary questions the survey was designed to answer include:

- What information does the consumer like to see when searching for a business listing online?
- What is the relative importance of one information attribute over another for consumers?
- What kinds of business does the consumer search for online?
- What is the ideal proportion of attributes of a business listing that appeals to regular users of business listings search?
- What are the consumer demographics of business listing searches conducted over the Internet?

Figure 5 reveals some of the survey findings. The responses were run through a regression analysis to capture the relative importance of each attribute based on consumer preferences (see Figure 6).

### Result Highlights

1. **Consumers seek specific parameters from the business listings.** These parameters are listed here in descending order of importance:
   - Category
   - Name
   - Phone Number
   - Marker location
   - Address
   - Web site
   - Business Image
   - User Reviews

2. **Searches vary based on categories.** These are mentioned below in their descending order of importance:
   - Restaurants
   - Cafés
   - Movie Theaters
   - Retail Stores – Clothing
   - Hospitals and Clinics
   - Supermarkets and Marketing Areas
Thus, it can be inferred that the business can grab consumer mind-share in terms of search impressions and product usage on mobile phones/desktops by defining its product on the above parameters and categories. This method of customer actuation is shown graphically in Figure 7.

Footnotes
1 Location-based services players include companies such as Pinterest, Zomato, etc.
3 This data was arrived at by conducting a business survey of 495 business using qualified market researchers who tried gathering business information during the business’s working hours.
4 This paper does not deal with the operations or business model of deploying such a task force. It simply assumes that the quality check process involves checking the correctness of each attribute of a sample of the listings.
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