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## Evidence-based Customer Reviews

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## **Evidence-based Customer Reviews**

### **ABSTRACT**

Online reviews can suffer from certain reliability problems due to reasons such as reviewer bias, lack of reviewer objectivity, insufficient number of reviews, etc. This disclosure describes techniques for generating reviews using evidence gathered from hard data sources rather than from subjective user opinion. Example data sources that can be used to generate evidence-based reviews include IoT sensors internal to the reviewed entity; publicly available information external to the reviewed entity; and data from related reviews applicable to the currently reviewed entity. The evidence-based reviews described herein enable a reader to look beneath the reviews to see the data that led to the review score. The described techniques reduce or eliminate bias in reviews and increase reader confidence in them.

### **KEYWORDS**

- Online reviews
- Review objectivity
- Review bias
- Review reliability
- Internet of things (IoT)
- Evidence-based reviews
- Crowdsourced data
- Heatmap
- Star rating scale

### **BACKGROUND**

Online reviews can suffer from certain reliability problems that affect individual reviews that constitute the final (aggregate) score. Some example factors that can affect an individual review include:

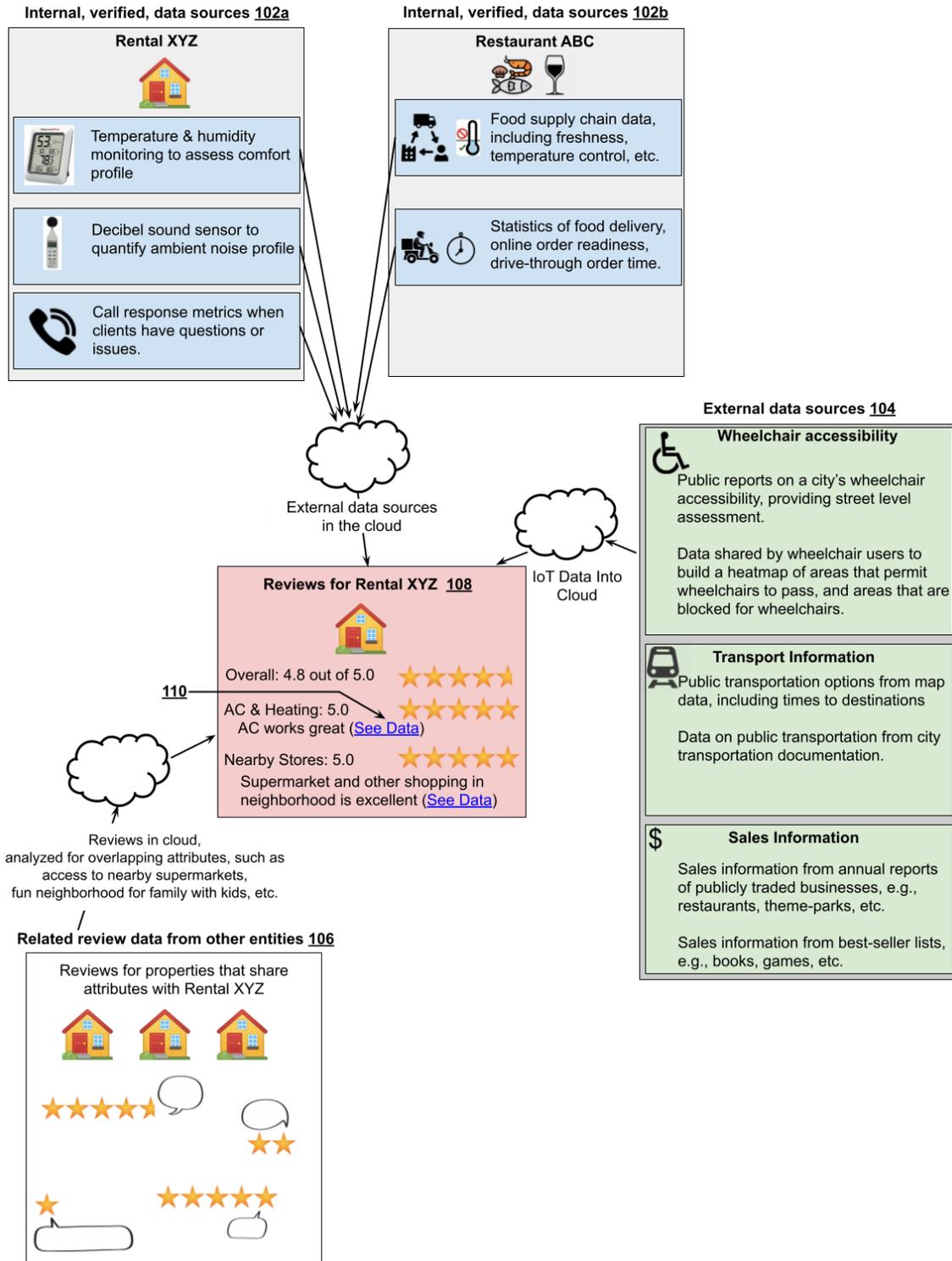
- Reviewer is biased: The reviewer might have a business or personal incentive to tarnish or enhance the reputation of the reviewed entity.

- Reviewer lacks objectivity: The reviewer injects subjective emotion into the review and is unable to be nuanced about their feedback. This often manifests as a reviewer who tends to rate at the extremes of a scale (e.g., a reviewer that only gives 1/5, or 5/5 star reviews).
- Insufficient number of reviews: A newly created entity such as a new short-term rental property may have few reviews.
- Uncovered aspects: Some aspects, important to particular users, e.g., wheelchair accessibility, sensitivity to foods not maintained at the right temperature, etc., may be unreviewed.

Online reviews of restaurants, museums, service personnel (electricians, etc.) rely on humans to submit reviews, which, by their nature, amount to subjective opinions. While valuable, such reviews aren't based on hard evidence, e.g., as derived from internet-of-things (IoT) sensors, publicly available data, or data gathered from neutral sources.

For example, the walkability of a property can be objectively measured as the number of amenities of different types within a mile of the property. However, even if computed, the walkability metric is typically shown as an independent category of the property, unconsolidated into a final score for the property. Similar to walkability, there are objective data points often available about a property, e.g., publicly available sales numbers, wheelchair accessibility, attributes of nearby properties applicable to the property, etc., which don't usually contribute to the final score.

**DESCRIPTION**



**Fig. 1: Evidence-based customer reviews**

Per the techniques of this disclosure, illustrated in Fig. 1, customer reviews for an entity to be reviewed (108, e.g., ‘rental property XYZ’) are based on evidence gathered from hard data sources rather than from subjective user opinions. Some examples of data sources that can be used to generate evidence-based reviews include:

- Data sources internal to the reviewed entity that reflect direct monitoring of the reviewed entity (102a-b).
- Data sources external to the reviewed entity (104, e.g., publicly available information about wheelchair accessibility, sales numbers, transportation, etc.).
- Data from related reviews (106) that apply to the currently reviewed entity (e.g., reviews of shopping options in the neighborhood derived from distinct rental properties in the same building).

As illustrated in the example of Fig. 1, the techniques can provide objective, data-driven answers to customer questions such as:

- Is there good wheelchair accessibility for the street of rental property XYZ?
- Does seafood restaurant ABC keep its food fresh?

Evidence from the above data sources is explained in greater detail below.

### *Internal data sources*

An entity (e.g., restaurant, property, or other business) that permits on-site installation of internet-of-things (IoT) sensors and the sharing of data that flows therefrom can provide monitoring data about itself. Such monitoring can enable documentation and verification of service-levels and commitments implicitly or explicitly made by the entity, e.g., the temperature of the building being within a good range, or noise level of the building below a threshold, phone calls from clients returned within a certain amount of time, etc. Another example can be a

restaurant documenting their supply chain to prove that their produce is as claimed, e.g., organic, kosher, etc., or that their cold chain is unbroken and their produce is as fresh as advertised.

Supply chain integrity can be proven using blockchain to document full provenance. Live monitoring of an entity, as described above, can serve as verified, objective, and trustworthy evidence for a review. Some examples of objective monitoring data include:

- Food-delivery statistics, e.g., the fraction of deliveries that are late, the average delivery times during different times of the day, etc. Such statistics can be derived from online orders, e.g., from the time of placement of an order in a restaurant app and from the time of actual (versus expected) delivery or pickup.
- Customer counts, e.g., trends of customers at a business, e.g., restaurant, theme park, etc. Such data can be factored into a star rating based on popularity among patrons.
- Tracking product freshness and quality from the supply chain all the way to the customer. The tracking of product freshness can be done in a manner similar to current techniques for monitoring beer delivery [1] from a brewery to customer service (or discarding due to age). Such techniques have signals that can be leveraged to score a restaurant along certain dimensions, e.g., food quality, freshness, etc.

### *External Data Sources*

Some examples of external data sources to inform reviews and compute a consolidated rating include:

- Wheelchair accessibility of an entity (restaurant, hotel, etc.) can be determined at a street level (e.g., for the street surrounding the entity), for a particular building in an urban area, for a particular establishment inside the building, etc. Some ways to collect wheelchair accessibility data include:

- Data published by a city on wheelchair accessibility.
- Reviews for the area from the current entity being evaluated, or from nearby entities sharing the same building or street that can be useful for the current review.
- Evaluation of street-level data, e.g., maps, street photos, etc., to assess wheelchair accessibility using computer vision [2].
- Data crowdsourced by wheelchair users, as follows. Wheelchairs are instrumented with GPS. Obstacles, or areas unfriendly to wheelchairs are identified by wheelchair paths (with user permission) that consistently exhibit U-turns or sharp turns. A heat map of paths and regions that are and aren't wheelchair-friendly is developed [3].
- Sales information of an entity, e.g., a restaurant, a theme park, etc., can be determined for entities that are publicly traded and disclose their sales figures, e.g., in annual reports. Sales information for books, games, movies, etc. can be determined from bestseller lists.
- Transport information, including publicly available route maps, schedules, and times-to-destinations published by mapping companies, transportation authorities, city governments, etc.
- The walkability of a property, measured objectively as the number of amenities of different types within a mile of the property.

#### *Related-reviews as data sources*

Review attributes can be shared among multiple entities. For example, multiple rental properties can be located in the same building in the downtown of a large city. Each of these properties would have similar access to neighborhood amenities, e.g., fresh-produce markets,

theatres, public transport hubs, cultural venues, etc., and would have similar character, e.g., appropriate for families with small children versus young adults, etc. If some properties have review data on these items, the same data can be applied to other properties in the same or nearby buildings. In this manner, reviews for a given entity can be derived from reviews of nearby, or related, entities.

The evidence-based reviews described herein enable a reader to look beneath the reviews to see the data and the objective measures that led to the review score. For example, as indicated in the example of Fig. 1, the rating for the air-conditioning at the rental property XYZ includes a link (110) that points the user to temperature-sensor data.

The described techniques reduce or eliminate bias in reviews and increase reader confidence. They are applicable wherever user-generated reviews or star rating scales are in use, e.g., in application stores, in maps, in business/product (restaurant, cafe, etc.) review platforms, in user-experience feedback forms, in e-commerce sites, etc. Evidence-based data can be obtained and utilized for reviews of restaurants, hotels, rental properties, and other entities that have human reviews. Such data can provide objective evidence for the quality of various aspects of a restaurant, hotel, etc. These data-driven review contributions can be used in place of or in conjunction with human-written reviews.

## CONCLUSION

This disclosure describes techniques for generating reviews using evidence gathered from hard data sources rather than from subjective user opinion. Example data sources that can be used to generate evidence-based reviews include IoT sensors internal to the reviewed entity; publicly available information external to the reviewed entity; and data from related reviews applicable to the currently reviewed entity. The evidence-based reviews described herein enable

a reader to look beneath the reviews to see the data that led to the review score. The described techniques reduce or eliminate bias in reviews and increase reader confidence in them.

## REFERENCES

- [1] “SteadyServ: Monitor Inventory/Optimize Operations/Promote Your Lineup” available online at <https://support.steadyserv.com>
- [2] “Predicting Wheelchair Accessibility with Computer Vision Object Recognition” available online at <https://www.youtube.com/watch?v=a9mVIfjE-vs>
- [3] “Connecting wheelchair-accessible maps with GPS tracking” available online at <https://zeroproject.org/practice/pr181234jpn-factsheet/>