Turning online restaurant reviews into strategic Data for competitive analysis

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Who am I ?

I am a lecturer and consultant in Artificial Intelligence and Entrepreneurship.

I focus on the practical integration of AI in business and educational contexts, applying these technologies in a strategic and ethical way.

I'm the author of "Generative AI with Confidence" and co-author of "AI as a Copilot", and creator of projects such as IA Hoje and AQIA, focused on AI literacy and training in Portugal.

Context (1/2)

- The restaurant sector is highly competitive, with a high business turnover rate (INE - PORDATA);

- Selecting a restaurant among unfamiliar options often relies on recommendation systems, especially for tourists (Asani et al., 2021);

- Customer reviews function as word-of-mouth (WOM), providing valuable insights for restaurant owners to monitor consumer perceptions (Amaral et al., 2014);

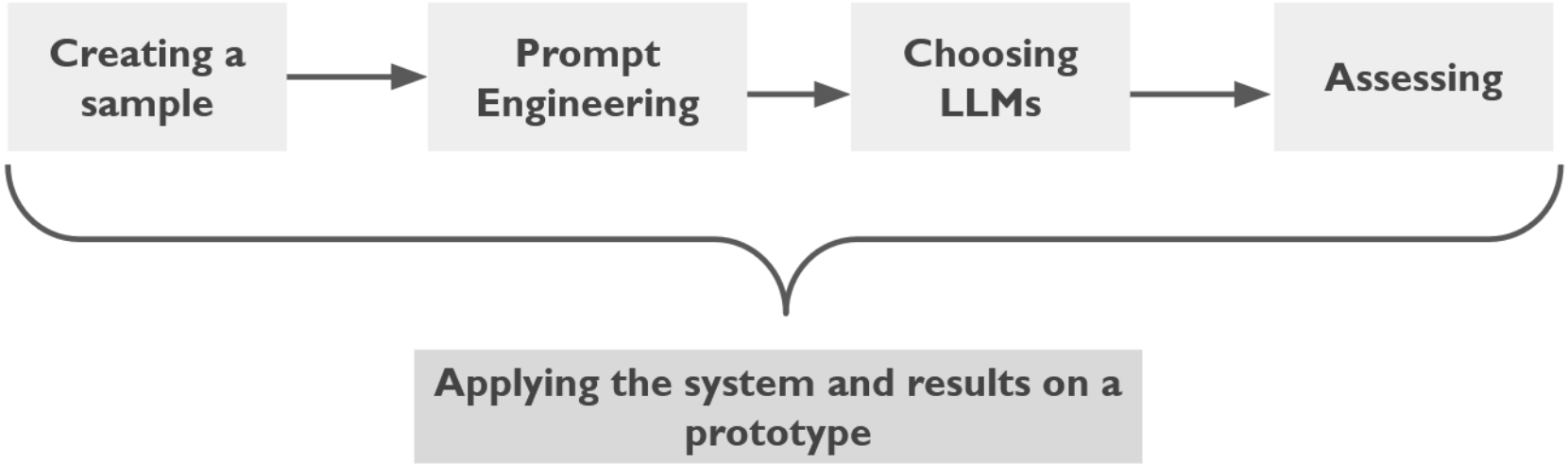
Context (2/2)

- Business owners can analyze competitors' online profiles to assess customer satisfaction levels;

- Sentiment analysis determines whether comments are positive, neutral, or negative (Ahmed et al., 2023);

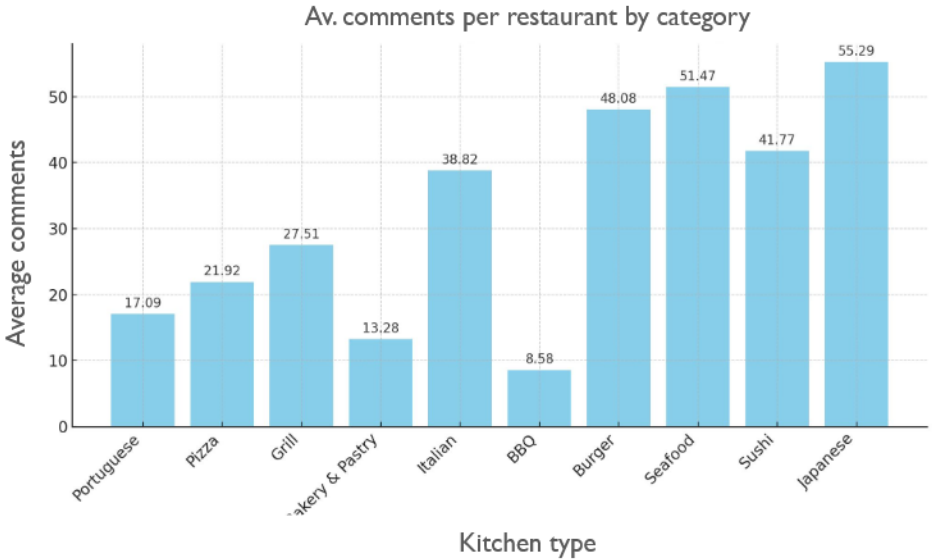
- Natural language processing (NLP) and generative AI enable faster processing of large volumes of comments (Jim et al., 2024).

Process


Creating a sample
Prompt Engineering
Choosing LLMs
Assessing
Applying the system and results on a prototype

Sampling

From a total of 15.892 restaurants



- **Comments per restaurant**: The **"Italian"** category has an average of **38.82 comments** across **115 restaurants**, ensuring a good density of opinions.
- **Representativeness**: Categories such as **"Seafood"**, **"Sushi"**, and **"Japanese"** have fewer than **100 restaurants**, which limits the analysis.
- **Processing costs**: The **"Burger"** category, with **48.08 comments** across **333 restaurants**, was excluded due to high computational costs.

Prompt Engineering

Crafting a prompt (instrução)

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"

Tu és um avaliador de reviews de restaurantes.

Objetivo: Classificar a experiência em restaurantes com base em comentários escritos por utilizadores.

Atributos de Avaliação:

1. Sabor da Comida: Avalia a qualidade do sabor dos alimentos, incluindo autenticidade e equilíbrio de ingredientes;

2. Porção de Comida: Refere-se à quantidade servida, considerando adequação ao preço e expectativas;

3. Serviço: Procura rapidez, eficiência, cordialidade e profissionalismo dos empregados;

4. Preço: Avalia a adequação dos preços à qualidade dos pratos e ao serviço;

5. Ambiente/Atmosfera: Considera a decoração, iluminação, música e a disposição do espaço;

6. Apresentação da Comida: Observa a preparação visual, cuidado e criatividade na apresentação dos pratos;

7. Comida Nutritiva: Analisa a qualidade nutritiva das opções alimentares, como o uso de ingredientes frescos e os métodos de preparação;

8. Reputação do Restaurante: Baseia-se em críticas, recomendações, prémios recebidos e conhecimento público do restaurante;
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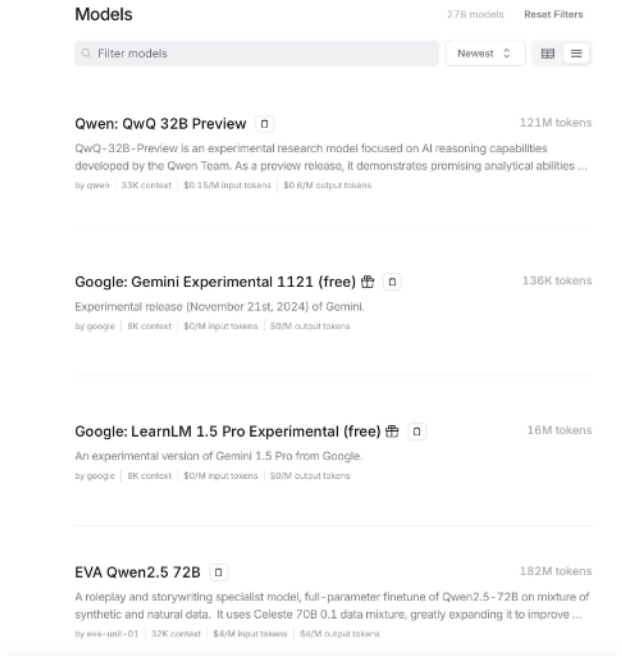
- **Focus on aspects related to the restaurant**: The analysis focuses solely on aspects mentioned by customers, such as the quality of service, food, ambiance, among others.
- **Polarity of discourse**: Sentiment identification is based on detecting words that express strong emotions or judgments, such as "extremely" or "very," indicating the intensity of customer satisfaction or dissatisfaction.
- **Classification method**: A 1-to-5 rating scale is used for each dimension under evaluation.

Choosing LLMs

Choice & testing of LLMs (Language models)



- **ChatGPT 3.5 Turbo**: Chosen for its balance between cost and efficiency.
- **ChatGPT 4o_2024-05-13**: Used for testing evaluation capabilities.
- **Mistral 7B Instruct (free)**: Offers relevant performance, although inferior to paid models.

The **Openrouter.ai** platform was used to facilitate the integration and simultaneous use of different models, thanks to its simple and efficient API for accessing the models.

The goal was to balance costs and performance, ensuring efficiency in data processing and the quality of sentiment analysis in restaurant reviews.

Assessing

Analysis & validation

The goal was to assess the agreement between the model (ChatGPT 4o_2024-05-13) and humans.

Absence agreement

The model and the human agree that the attribute is **not mentioned** and do not assign a classification.

Polarity agreement

Negative polarity: Ratings of 1 and 2 indicate negative sentiments.
Positive polarity: Ratings of 3, 4, and 5 indicate positive sentiments.

Assessing

Analysis & validation

F1 SCORE	Human 1	Human 2	Human 3
Human 1	1.0	0.83	0.91
Human 2	0.83	1.0	0.92
Human 3	0.91	0.92	1.0

"Human ratings of the same set of reviews are subjective and may vary, as evidenced by an F1 Score ranging from 0.83 to 0.92." (Carrasco & Dias, 2024)

Applying the system and results

Building a prototype

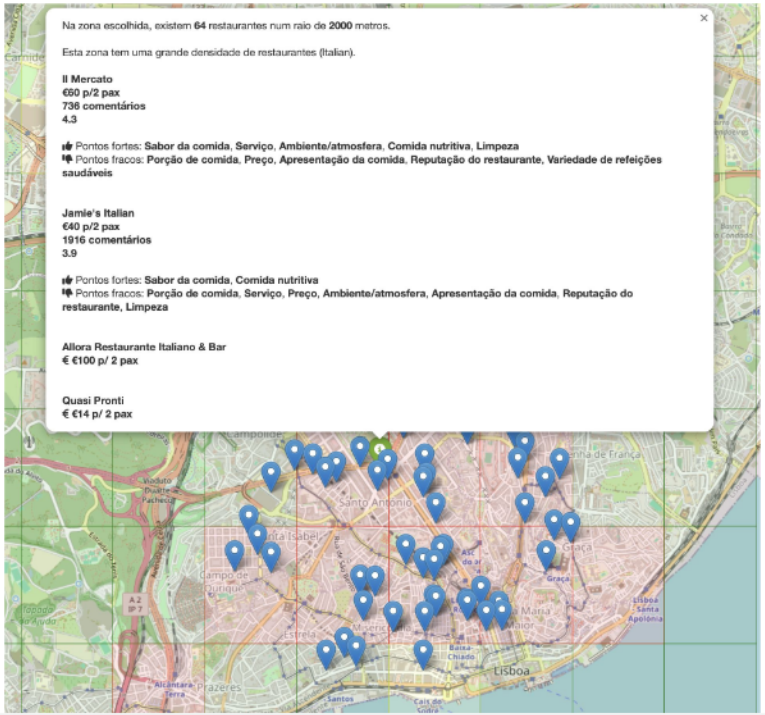
Prototype Objective

To be a practical and interactive tool for investors in the restaurant sector, helping them analyze locations to support their investment decisions and/or the creation of competitive advantages.

Based on customers' opinions about their competition, i.e., their reviews.

Applying the system and results

Building a prototype



In the chosen area, there are 64 restaurants within a radius of 2000 meters.

This area has a high density of restaurants (Italian).

Il Mercato
€60 per 2 pax
736 reviews
4.3
Strengths: Taste of the food, Service, Ambiance/Atmosphere, Nutritious food, Cleanliness
Weaknesses: Portion size, Price, Food presentation, Restaurant reputation, Variety of healthy meals

Jamie's Italian
€40 per 2 pax
1916 reviews
3.9
Strengths: Taste of the food, Nutritious food
Weaknesses: Portion size, Service, Price, Ambiance/Atmosphere, Food presentation, Restaurant reputation, Cleanliness

Allora Restaurante Italiano & Bar
€100 per 2 pax

Quasi Pronti
€14 per 2 pax

Applying the system and results

Building a prototype

Prototype Features

An **Interactive Map** that identifies areas with higher or lower saturation of competitors using a color grid (red to green) and allows users to explore restaurants in the selected category through clickable "pins."

Competitor Performance, with radar charts displaying sentiment analysis of reviews, making it easier to visually understand the performance of each restaurant.

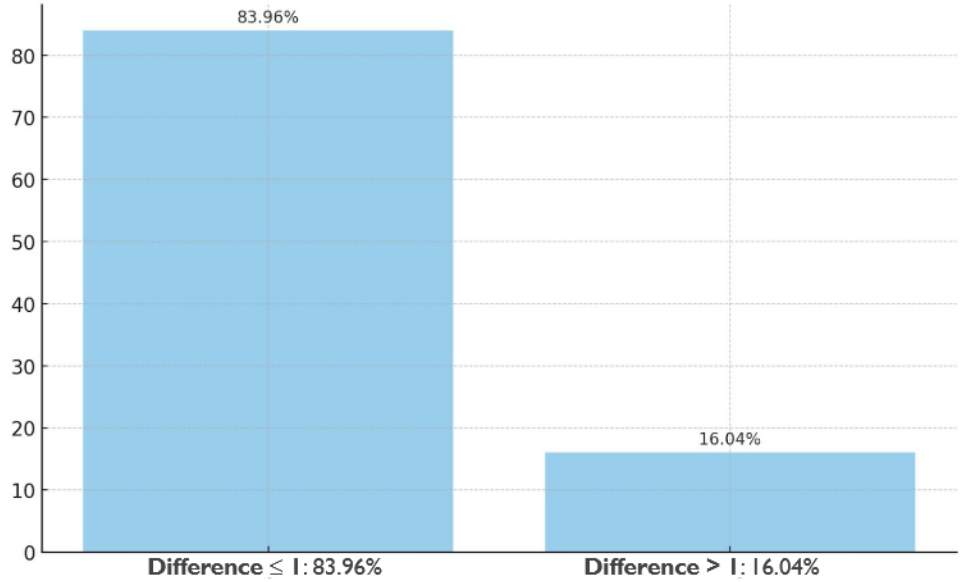
Applying the system and results

Building a prototype

Bistro Gato Pardo | Ginos | Il Mercato di Pasta

Results discussion

Agreement between the LLM (Language Model) and Humans



Results discussion

Relevance of the Tool for Investors

- The tool organizes information about competitors, such as prices and ratings;
- It focuses on sentiment analysis of reviews to identify market gaps and opportunities;
- It offers a differentiated approach by exploring customer perceptions as a basis for creating competitive advantages or other strategies.

Conclusion

In the academic field	In the business field
A new method for sentiment analysis in reviews was developed; It was demonstrated that LLMs (Language Models) are reliable for sentiment analysis.	A prototype was created that can be tested in the market and, if validated, commercialized; https://inteligenciaartificialhoje.pt/ferramenta-de-analise-da-concorrencia-para-restaurantes/ A simple methodology was developed, making it easier to teach.

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