SEVEN
publicações acadêmicas

FEEDBACKINSIGHT-AI: A SYSTEM FOR TRIAGE, CLASSIFICATION, AND SUMMARIZATION OF CUSTOMER FEEDBACK USING ARTIFICIAL INTELLIGENCE

FEEDBACKINSIGHT-AI; SISTEMA DE TRIAGEM, CLASSIFICAÇÃO E SUMARIZAÇÃO DE FEEDBACK DE CLIENTES COM INTELIGÊNCIA ARTIFICIAL

FEEDBACKINSIGHT-AI: SISTEMA DE TRIAJE, CLASIFICACIÓN Y RESUMEN DE COMENTARIOS DE CLIENTES CON INTELIGENCIA ARTIFICIAL

https://doi.org/10.56238/sevened2025.036-074

Filipe Magalhães[1], Matheus Marques[2], Ricardo Marciano dos Santos[3], Alfredo Nazareno Pereira Boente[4], Vinícius Marques da Silva Ferreira[5], Miguel Gabriel P. de Carvalho[6], Thiago Silva da Conceição[7], Rosangela de Sena Almeida[8]

ABSTRACT

This article proposes FeedbackInsight-AI, an automated system for triaging, classifying, and summarizing customer feedback using Artificial Intelligence (AI) and Natural Language Processing (NLP) techniques. The objective is to optimize the handling of large volumes of messages received by companies, reducing response time and enabling more efficient information analysis. The study is based on a qualitative and descriptive approach, using machine learning models applied to sentiment analysis and text categorization. The methodology involves integration between communication (Gmail), management (Trello), and data analysis (Google Sheets) APIs, utilizing state-of-the-art language models (like GPT-4). The proposal aims to contribute to the advancement of intelligent automation in customer service processes and data-driven decision-making in organizations.

[1] Undergraduated student in Systems Analysis and Development. Faculdade de Educação Tecnológica do Estado do Rio de Janeiro (FAETERJ). E-mail: filipe.23104708360062@faeterj-rio.edu.br
[2] Undergraduated student in Systems Analysis and Development. Faculdade de Educação Tecnológica do Estado do Rio de Janeiro (FAETERJ). E-mail: matheus.23204708360056@faeterj-rio.edu.br
[3] Dr. in History of Sciences and Techniques and Epistemology. Universidade Federal do Rio de Janeiro (UFRJ). E-mail: rms221070@gmail.com Orcid: https://orcid.org/0000-0002-9031-1608
Lattes: http://lattes.cnpq.br/6329550960331880
[4] Dr. in Production Engineering. Universidade Federal do Rio de Janeiro (UFRJ).
E-mail: boente@nce.ufrj.br Orcid: https://orcid.org/0000-0002-2718-4917
Lattes: http://lattes.cnpq.br/7741044822342404
[5] Dr. in Production Engineering. Universidade Federal do Rio de Janeiro (UFRJ).
E-mail: vinicius.ferreira@pep.ufrj.br Orcid: https://orcid.org/0000-0003-3664-3510
Lattes: http://lattes.cnpq.br/6490780573139543
[6] Master's Degree in Informatics. Universidade Federal do Rio de Janeiro (UFRJ). Rio de Janeiro, Brazil.
E-mail: mgpc10@gmail.com Orcid: https://orcid.org/0009-0000-6691-9990
Lattes: http://lattes.cnpq.br/3964775530688287
[7] Professional Master's in Business Administration, with a concentration in Innovation and Digital Business Transformation. UNESA. E-mail: Thiago.s.conceicao@gmail.com
Orcid: https://orcid.org/0009-0005-6371-4902 Lattes: https://lattes.cnpq.br/6477700441587978
[8] Dr. in Social Memory. Universidade Federal do Estado do Rio de Janeiro (UNIRIO).
E-mail: dra.rosangelasena@gmail.com Orcid: https:// orcid.org/0009-0006-8728-5601
Lattes: http://lattes.cnpq.br/4932401660106541

Keywords: Artificial Intelligence. Automation. Customer Feedback. Natural Language Processing. Sentiment Analysis.

RESUMO
O presente artigo propõe o FeedbackInsight-AI, um sistema automatizado de triagem, classificação e sumarização de feedbacks de clientes por meio de técnicas de Inteligência Artificial (IA) e Processamento de Linguagem Natural (PLN). O objetivo é otimizar o tratamento de grandes volumes de mensagens recebidas por empresas, reduzindo o tempo de resposta e permitindo uma análise mais eficiente das informações. O estudo parte de uma abordagem qualitativa e descritiva, com base em modelos de aprendizado de máquina aplicados à análise de sentimentos e categorização textual. A metodologia envolve a integração entre APIs de comunicação (Gmail), gestão (Trello) e análise de dados (Google Sheets), utilizando modelos de linguagem de última geração (como GPT-4). A proposta visa contribuir com o avanço da automação inteligente de processos de atendimento e tomada de decisão em organizações orientadas por dados.

Palavras-chave: Inteligência Artificial. Automação. Feedback de Clientes. Processamento de Linguagem Natural. Análise de Sentimentos.

RESUMEN
Este artículo propone FeedbackInsight-AI, un sistema automatizado de triaje, clasificación y resumen de comentarios de clientes mediante técnicas de Inteligencia Artificial (IA) y Procesamiento de Lenguaje Natural (PLN). El objetivo es optimizar el manejo de grandes volúmenes de mensajes recibidos por empresas, reduciendo el tiempo de respuesta y permitiendo un análisis más eficiente de la información. El estudio parte de un enfoque cualitativo y descriptivo, basado en modelos de aprendizaje automático aplicados al análisis de sentimientos y categorización textual. La metodología implica la integración entre APIs de comunicación (Gmail), gestión (Trello) y análisis de datos (Google Sheets), utilizando modelos de lenguaje de última generación (como GPT-4). La propuesta busca contribuir al avance de la automatización inteligente en los procesos de atención al cliente y toma de decisiones basada en datos en las organizaciones.

Palabras clave: Inteligencia Artificial. Automatización. Feedback de Clientes. Procesamiento de Lenguaje Natural. Análisis de Sentimientos.

1 INTRODUCTION

The growing digitalization of relationships between companies and consumers generates a significant volume of unstructured data, especially in communication channels such as emails and online forms. Such data contains valuable information about user satisfaction, criticism, and suggestions, but manual analysis of this content is often unfeasible and inefficient (FERREIRA, 2025).

According to Boente (2025), the adoption of AI-based automation systems allows you to reduce operational bottlenecks and increase accuracy in message screening. Dos Santos (2025) reinforces this perspective by proposing human-computer interaction models that balance logical reasoning and cognitive adaptation, based on fuzzy logic.

Several studies point to the potential of AI in automated text processing. Russell and Norvig (2022) highlight that intelligent systems are capable of inferring human intentions and classifying language patterns with a high degree of accuracy. Goodfellow, Bengio, and Courville (2016) define deep learning as an essential tool for capturing complex semantic nuances. LeCun, Bengio, and Hinton (2015) demonstrate that convolutional neural networks and transformers have extended the reach of AI in linguistic interpretation tasks.

In addition, Domingos (2015) explains that the success of intelligent systems depends on the quality of the training data and the integration architecture between analysis layers. Haenlein et al. (2019) add that in the business context, AI not only processes information but redefines the way decisions are made. Marr (2020) emphasizes the importance of explainable and ethical systems that ensure transparency and reliability. Finally, Nielsen (2020) argues that automation should be accompanied by feedback mechanisms, allowing humans to maintain control over decision-making processes.

Given this scenario, the FeedbackInsight-AI project emerges as an innovative proposal to automate the processing of customer feedback, classifying them according to category and sentiment, generating automatic summaries, and integrating the results into organizational management platforms. This article describes the design, methodology and development of the system, highlighting its applicability in corporate and academic environments.

1.1 GOALS

This subsection details the objectives that guided the development of the project.

1.1.1 General Objectives

Develop an automated system for screening and analyzing customer feedback using Artificial Intelligence, focusing on textual classification, sentiment analysis and automatic summarization, integrating the results with data management and analysis tools.

1.1.2 Specific Objectives

a) connect the system to the corporate email inbox via Gmail API;
b) automatically process the textual content of incoming emails;
c) apply generative AI models to classify messages and generate summaries;
d) automatically record the results in Google Sheets;
e) create corresponding tasks in Trello, allowing you to track the resolution;
f) ensure security and scalability of the system in a cloud environment (GCP or AWS).

2 THEORETICAL FRAMEWORK

This section presents the fundamentals Conceptual than Support or development of FeedbackInsight-AI, addressing the main areas of knowledge that converge in the project: Natural Language Processing (NLP), Sentiment Analysis and Process Automation based on APIs.

2.1 NATURAL LANGUAGE PROCESSING (NLP) AND LANGUAGE MODELS

Natural Language Processing (NLP) is a field of Artificial Intelligence focused on the interaction between computers and human language. The goal is to enable machines to "understand", interpret and generate language effectively (RUSSELL; NORVIG, 2022).

To address the complexity and nuances of human communication, such as those found in customer feedback, NLP has evolved significantly with the advent of deep learning. As detailed by Goodfellow, Bengio, and Courville (2016), deep neural network architectures are essential for capturing complex semantic patterns.

In this context, Large-Scale Language Models (LLMs) stand out, such as Transformer (LECUN; BENGIO; HINTON, 2015), which are the basis of tools such as GPT-4. These models are trained on vast textual datasets, allowing them to perform sophisticated tasks such as intent classification, abstract generation, and pattern inference with high accuracy, being the core technological foundation of FeedbackInsight-AI.

2.2 SENTIMENT ANALYSIS IN THE BUSINESS CONTEXT

Customer feedback management is a pillar for strategic decision-making. However, the large volume of unstructured data (emails, comments, forms) makes manual analysis unfeasible (FERREIRA, 2025). Sentiment Analysis, a sub-area of NLP, is the computational technique used to extract and classify opinions, emotions, and attitudes (positive, negative, or neutral) present in texts.

In the business landscape, AI is not limited to processing information; it redefines how decisions are made (HAENLEIN et al., 2019). By applying Sentiment Analysis, FeedbackInsight-AI allows the organization to identify automatically the polarity of a message, prioritizing critical cases (negative sentiment) or identifying strengths (positive sentiment) immediately.

2.3 PROCESS AUTOMATION AND SYSTEM INTEGRATION (APIS)

The value of AI data processing is maximized when its results are integrated directly into operational workflows. Automation, in this project, is what connects textual analysis to practical action. According to Boente (2025), the adoption of automated systems allows the reduction of operational bottlenecks and increases accuracy in task screening.

This integration is technically made possible by the use of Application Programming Interfaces (APIs). FeedbackInsight-AI uses an ecosystem of APIs (Gmail, Trello, Google Sheets) that allows disparate systems to communicate in a standardized way. AI acts as the central "brain" that, after processing information (email), triggers events on other platforms (creating a card in Trello and registering in Sheets), establishing a cohesive and automated workflow.

This system aligns with Nielsen's (2020) vision of Human-AI interaction, where automation does not replace the human, but provides the feedback mechanisms (the card in Trello) for humans to maintain control and supervision over decision-making processes.

3 METHODOLOGY

The methodology used is based on an agile and interactive approach, structured in four main steps: a) Data Collection and Extraction: Gmail API is used for continuous monitoring of messages in specific folders; b) pre-processing: The textual content is cleaned and tokenized, removing noise and metadata; c) Intelligent analysis: AI models (such as GPT-4 and Gemini) are used for semantic classification, identification of sentiments (positive,

neutral or negative) and summarization; d) Integration and Storage: Results are automatically sent to Google Sheets, while tasks are created in Trello for tracking.

The development was conducted in a cloud environment, with unit tests and integration testing at each delivery sprint. This methodology ensures robustness and scalability, as proposed by Nielsen (2020) and Boente (2025).

3.1 PROMPT ENGINEERING AND FLOW ORCHESTRATION

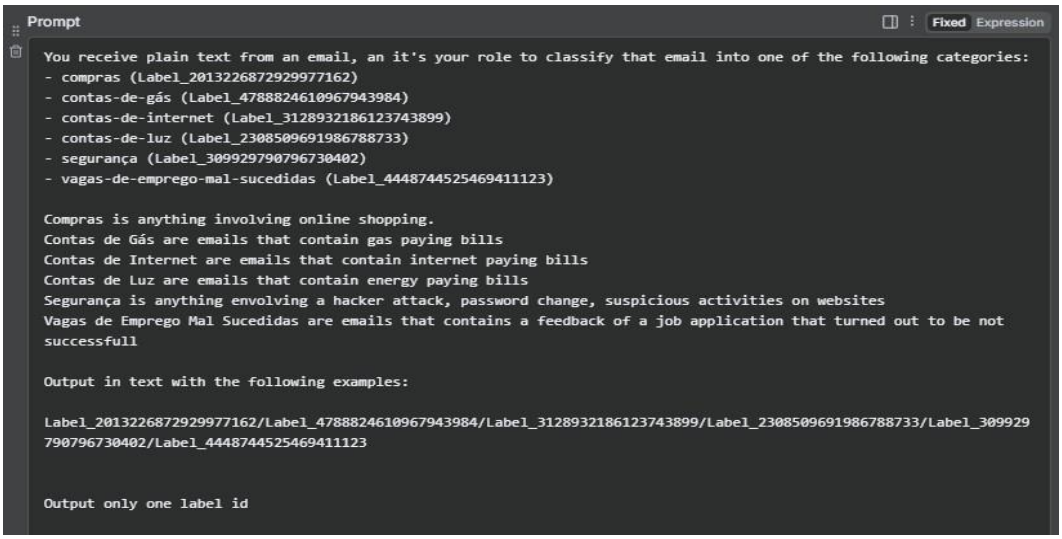
The effectiveness of Large-Scale Language Models (LLMs) in enterprise tasks depends directly on the quality of the instructions provided, a discipline known as Prompt Engineering. In the development of FeedbackInsight-AI, the interaction with the Gemini model was orchestrated through the n8n automation platform, which allows the construction of visual workflows and the manipulation of data between APIs.

For the task of sorting emails, it is not enough to ask the AI to "read the message". It was necessary to build a structured prompt that acts as a translation layer between the natural language of the customer's email and the technical structure of Gmail (which uses numeric IDs for labels).

Figure 1 shows the configuration of the worker node on n8n, where the system prompt is set.

Figure 1

Classification Prompt structure in n8n



Source: Prepared by the authors (2025).

As noted in Figure 2, the prompt strategy used three fundamental techniques to ensure response accuracy:

a) Role-Playing Definition: The initial statement "You receive plain text from an email, and it's your role to classify..." contextualizes the model, restricting its scope of action to a specific classification task.
b) Label ID Mapping: One of the technical challenges of the Gmail API is that it does not accept label names (such as "Purchases"), but rather unique identifiers (e.g., Label_2013...). To avoid an extra code processing step, the prompt instructs the AI to associate the semantic concept directly with the technical ID. For example, you define "Shopping is anything involving online shopping" and associate that with the corresponding ID.
c) Output Constraint: The final statement "Output only one label id" is critical for automation. It prevents the AI from generating conversational text (such as "Here's the ID you asked for..."), ensuring that the response is only the raw data needed for the next step in the automation flow.

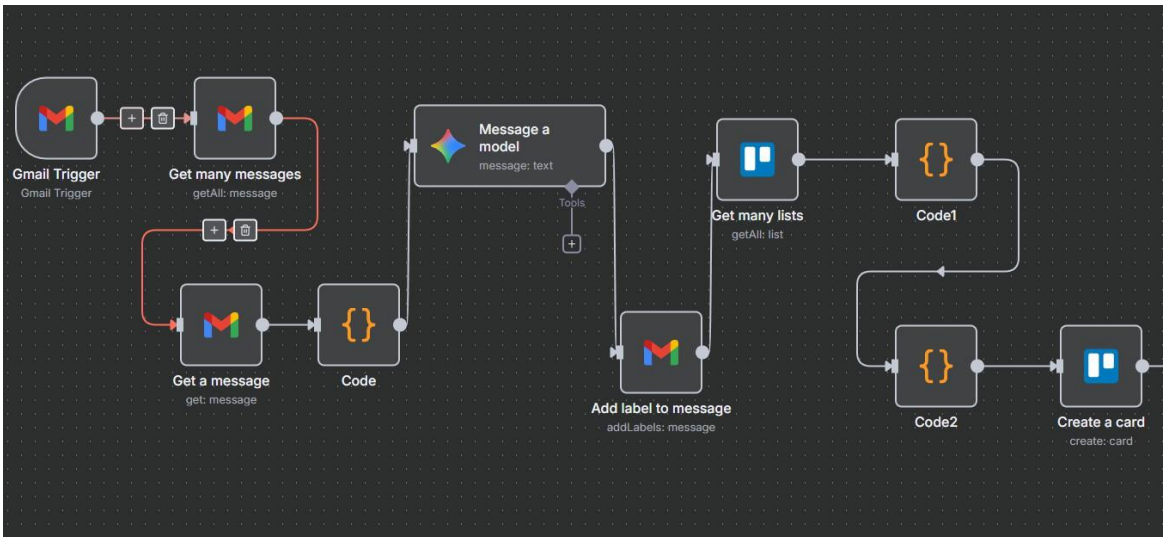
This hybrid approach, where the prompt in English is used to process intents (even from emails in Portuguese) and return structured data, optimized response time and reduced system misinterpretation.

3.2 IMPLEMENTATION FROMALGORITHMS FROM TREATMENT AND INTEGRATION

The orchestration between the email services, artificial intelligence and the management tool (Trello) required the development of custom JavaScript scripts (Node.js) within the n8n automation platform. The architecture of the solution was designed in a linear and modular way, as illustrated in Figure 2.

Figure 2

Workflow Implemented in n8n



Source: Prepared by the authors (2025).

The flow starts with a trigger in Gmail and goes through stages of extraction, cleaning, classification via AI and, finally, the creation of the management artifact (Card). Below are detailed the critical algorithms developed to ensure data integrity.

3.2.1 Sanitization and pre-processing of text

Corporate emails often contain HTML formatting, scripts, and metadata that constitute "noise" for the language model. Sending this raw content would increase token consumption (cost) and could degrade the quality of AI interpretation.

To solve this, a cleaning algorithm via Regular Expressions (Regex) was implemented, responsible for removing HTML tags, styles and excess spaces, extracting only the relevant plain text.

Figure 3

Text Cleaning and Extraction Algorithm

```
Function executed on n8n 'Code' node
return $input.all().map((item) => {
 Retrieves the email's HTML body or empty string
 let html = item.json.html || '';
 Removes style blocks (<style>) and scripts (<script>)
 html = html.replace(/<style[\s\S]*?<\/style>/gi, '');
 html = html.replace(/<script[\s\S]*?<\/script>/gi, '');
 html = html.replace(//g, '');
 Removes all remaining HTML tags, keeping only the text
 let plainText = html.replace(/<\/?[ ^>]+(>|$)/g, ' ');
 Removes duplicate whitespace and normalizes plainText =
 plainText.replace(/\s+/g, ' ').trim();

 Preserves the original subject
 let subject = item.json.subject;
 item.json.plainText = plainText;
 Returns the cleaned object to the next node
 return { json: { plainText, subject } };
});
```

Source: Prepared by the authors (2025).

3.2.2 Logical Routing and Trello Integration

After the classification performed by the Gemini model, the system receives a Label ID from Gmail. The next technical challenge is to translate this ID from the

Google ecosystem for a corresponding List ID in the Trello ecosystem, where the card will be created.

A mapping algorithm (Hash Map) was developed that associates the sort keys with the destination columns, ensuring that an email classified as "Security", for example, is routed to the correct list in the management board.

Figure 4

Mapping and Payload Creation Algorithm

```
Retrieves the data from the original email and the AI
response const emails = $('Code').all();
const labels = $("Message a model").all();
return emails.map((email, index) => {
 Extracts the text from the AI's suggested
 label const label =
labels[index].json.content.parts[0].text.replaceAll('"',
'').toString();
 Mapping (From-To): Gmail Label ID -> Trello List ID
 const labelToList = {
  'Label_2013226872929977162': '68e7405b209733f7edd0c81d',
Shopping
  'Label_2308509691986788733': '68e7409c37f2490ab9f95823',
Electricity Bills
  'Label_309929790796730402' : '68e740a4943635c9f7cf3d1c',
Safety

  'Label_3128932186123743899': '68e74096a0f2485b05c08a6c',
Internet Accounts
  'Label_4448744525469411123': '68e740b57db269eb7bd4107b',
Job Vacancies
  'Label_4788824610967943984': '68e7409197c3a647a9c43e86',
Gas Bills
 }
 Select the corresponding list ID const
 listId = labelToList[label];
 Returns the formatted payload to the Trello API return
 {
  plainText: email.json.plainText,
  title: email.json.subject,
  listId: listId
 }
``
```

Source: Prepared by the authors (2025).

This middleware code layer ensures interoperability between APIs, allowing the decision made by Artificial Intelligence to become a practical organization action without human intervention.

4 RESULTS AND DISCUSSIONS

The results of the project are presented through the development artifacts that define the system: the functional and non-functional requirements, the execution schedule and the use case diagram that illustrates the interaction of users and systems.

4.1 SYSTEM REQUIREMENTS

The requirements gathering defined the scope of the system, separating its functionalities (RF) and its operating restrictions (RNF).

4.1.1 Functional requirements

Table 1

Details the functions that the system must perform

Code	Description
RF01	Connect to Gmail via API.
RF02	Identify new emails in a specific folder.
RF03	Submit content for AI analysis.
RF04	Return category, sentiment and summary.
RF05	Automatically create a card in Trello.
RF06	Record the results in Google Sheets.
RF07	Mark emails as processed.

Source: Prepared by the authors (2025).

4.1.2 Non-functional requirements

Table 2

Lists the RNFs that define the quality and performance criteria of the system

Code	Description
RNF01	Execution in Cloud environment (GCP or AWS).
RNF02	Time processing ≤ 10s by email.
RNF03	Secure authentication via OAuth2.
RNF04	Scalability towards until 10,000 emails/month.
RNF05	Records of error and status logs.

Source: Prepared by the authors (2025).

4.2 DEVELOPMENT TIMELINE

The project was executed in eight weeks, following the planning detailed in Table 3.

Table 3

Development Schedule

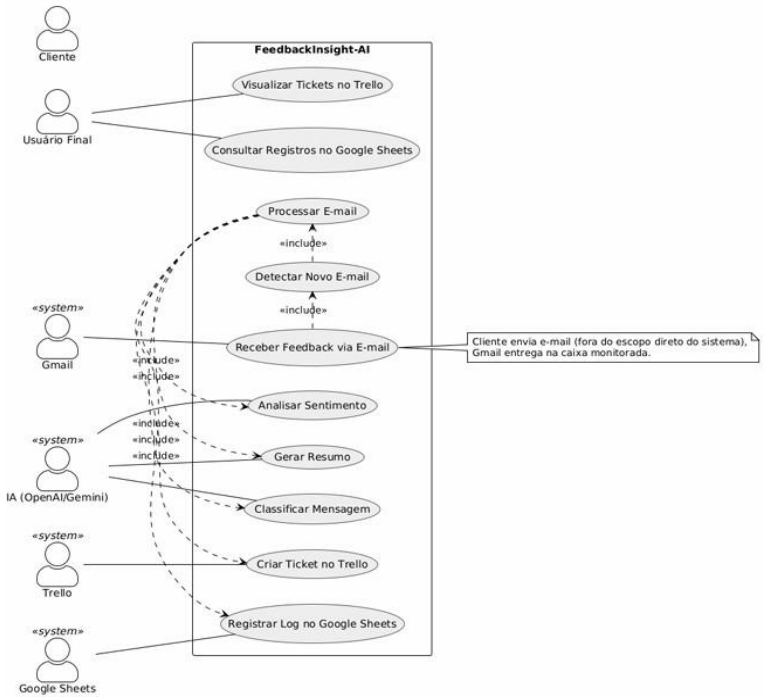
Week	Activity	Accountable	Deliverable
1	Definition of scope and requirements	Team	Requirements document
2	Environment configuration (APIs and cloud)	Philip	Environme nt ready
3	Gmail API integration	Matheus	Functional extraction
4	Implementing AI analytics	Philip	Rating and summary
5	Trello API Integration	Matheus	Tickets Automatic
6	Integration with Google Sheets API	Team	Logging
7	Unit and integration testing	Team	Test Report
8	Cloud deployment and final documentation	Team	Active system

Source: Prepared by the authors (2025).

4.3 USE CASE DIAGRAM

Figure 5

Use Case



5 CONCLUSION

The FeedbackInsight-AI project demonstrated the technical and practical feasibility of applying AI models in corporate feedback analysis and management processes. The integration between communication APIs, advanced language models, and productivity platforms represents a significant advance for companies that deal with a high volume of textual information.

As a result, the system contributes to reducing response time, improving demand prioritization, and data-driven decision-making. In future work, it is recommended to include continuous learning modules (supervised machine learning) and analytical dashboards for real-time visualization.

Thus, FeedbackInsight-AI consolidates itself as an innovative and scalable tool, aligned with contemporary demands for intelligent automation and digital transformation.

ACKNOWLEDGMENT

I want to leave here my gratitude to everyone who was part of this journey — which was intense, full of ups and downs, but totally transformative.

I thank my advisor professor, Ricardo Marciano, for his patience, for his accurate guidance and for always showing the way when everything seemed to be chaos.

To my co-worker, Matheus Marques, for being a key player in this project — both helping in the development and having the very idea that gave rise to everything. It was very much worth the partnership.

To my girlfriend, Ana Clara Gonçalves, who has always supported me, believed in me and reminded me, on the most complicated days, that my dreams are worth the effort. Without you, I wouldn't have held on tight.

And, of course, to my father. Even though I was stubborn as hell and made some very dubious decisions along the way, he never stopped supporting me for a second. This support was essential for me to get here.

To all of you: thank you very much. You were part of this tour in a way that I will carry with me for the rest of my life.

REFERENCES

Atlassian. (2025). Trello developers. https://developer.atlassian.com/cloud/trello/

Boente, A. N. P. (2025). [Título completo do artigo não informado]. Archives of Advanced Research in Computer Engineering and Applied Science, 7(10), Article e8856. https://doi.org/10.56238/arev7n10-149

Domingos, P. (2015). The master algorithm: How the quest for the ultimate learning machine will remake our world. Basic Books.

Dos Santos, R. M. (2020). Proposição de um modelo de interação humano-computador baseado em lógica fuzzy para aferição de dados biofísicos [Dissertação de mestrado ou tese – nível não especificado]. Local da instituição não informado.

Ferreira, V. M. da S. (2025). [Título completo do artigo não informado]. Archives of Advanced Research in Computer Engineering and Applied Science, 7(10), Article e8856. https://doi.org/10.56238/arev7n10-149

Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press. https://www.deeplearningbook.org

Google. (2025a). Gmail API documentation. https://developers.google.com/gmail/api

Google. (2025b). Google Sheets API documentation. https://developers.google.com/sheets/api

Haenlein, M., Kaplan, A., & outros. (2019). Artificial intelligence and the future of marketing: A review and research agenda. Journal of Business Research, 116, 263–271. https://doi.org/10.1016/j.jbusres.2019.09.019

LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. Nature, 521(7553), 436–444. https://doi.org/10.1038/nature14539

Marr, B. (2020). Artificial intelligence in practice: How 50 successful companies used AI and machine learning to solve problems. Wiley.

Nielsen, J. (2020). Human–AI interaction guidelines. Nielsen Norman Group. https://www.nngroup.com/articles/human-ai-interaction/

OpenAI. (2025). API reference. https://platform.openai.com/docs/

Russell, S., & Norvig, P. (2022). Artificial intelligence: A modern approach (4th ed.). Pearson.