

ARTIFICIAL INTELLIGENCE INTEGRATION IN SPREADSHEET ENVIRONMENTS: A CASE STUDY OF MS EXCEL

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Abstract: This article explores the integration of Artificial Intelligence (AI) into Microsoft Excel through tools such as ChatGPT, Numerous AI, and GPT for Excel. By leveraging natural language processing and machine learning, users can enhance productivity and automate tasks that traditionally require manual input or advanced formula knowledge. The paper presents categorized examples of AI-powered functions, including content generation, grammar correction, sentiment analysis, data translation, and formula assistance. Designed for both beginner and advanced users, this guide demonstrates how AI can transform Excel into a smarter, more intuitive tool for data management, reporting, and everyday tasks.

Keywords: ChatGPT, Numerous AI, GPT for Excel, Functions **Jel Classification:** [C88]

1. Introduction

Artificial Intelligence has become a powerful tool across industries, and Microsoft Excel is no exception. With AI integrations such as ChatGPT, Numerous AI, or GPT for Excel, users can now automate complex tasks, generate content, analyze text, and build smart tables directly within cells — no advanced formulas or coding required.

From creating fictional student databases and translating text instantly, to detecting sentiment, summarizing content, or rewriting text professionally, AI brings new capabilities to everyday spreadsheets.

In this paper, we'll explore some of the most practical and powerful **AI functions in Excel, grouped by category**, complete with real examples to help we unlock the full potential of intelligent automation in the workflow.

2. State of the Art

Artificial Intelligence (AI) is increasingly integrated into Microsoft Excel, revolutionizing how users analyze and manage data. Microsoft's **365 Copilot** uses large language models to enable natural language interaction, allowing users to generate formulas, summaries, and visualizations without deep Excel expertise (Microsoft 2023). This AI-powered assistant simplifies complex tasks, making Excel more accessible.

Researchers have explored augmenting Excel's automation with AI-enhanced **VBA scripting**, which improves decision-making and workflow automation

(Thiruvankadam 2023). Additionally, third-party tools like **Numerous AI** provide AI-driven formula generation and data interpretation via natural language prompts, reducing technical barriers (Numerous.ai 2024).

On the academic front, Microsoft's **SpreadsheetLLM** helps extract insights from complex spreadsheets, boosting enterprise productivity (Davis et al. 2024). The **InstructExcel** benchmark evaluates AI models' ability to convert natural language instructions into Excel commands (Payan et al., 2023). Meanwhile, **ExcelLint** applies machine learning to detect and fix formula errors automatically (Barowy et al., 2019).

Together, these advances highlight AI's growing role in transforming Excel from a manual tool into an intelligent assistant that enhances accuracy and efficiency.

3. What Is ChatGPT for Excel?

Microsoft Excel does not have native ChatGPT integration, but there are third-party add-ins that allow to use ChatGPT's capabilities directly within Excel. These extensions can transform how the work with data, formulas, and text.

Essentially, ChatGPT for Excel refers to tools that integrate OpenAI's language model into Excel, enabling we to use natural language to perform various tasks—such as generating formulas, explaining existing ones, auto-completing cells, summarizing or translating text, and even performing content analysis like sentiment detection or automatic classification.

There are several ways to use ChatGPT in Excel. One popular option is the “GPT for Sheets and Docs” add-in (originally for Google Sheets, but also functional in Excel via the web), developed by Talarian. It allows users to write formulas like `=GPT("Write a formula to calculate 19% VAT")`, and it requires an OpenAI API key, which usually comes with a cost.

Another widely used tool is ChatGPT in Excel by Numerous AI, a more visual and user-friendly add-in that lets we select cells and generate or rewrite content using predefined functions such as `=AI()`, `=SUMMARIZE()`, or `=TRANSLATE()`. This is especially helpful for non-programmers.

For advanced users, it's also possible to connect Excel directly to the OpenAI API using Power Query or VBA. This setup allows to send data from cells to ChatGPT and receive responses—like summaries or suggestions—directly into the spreadsheet.

In practice, ChatGPT in Excel can help with a wide variety of tasks. If we don't know the right formula, we can simply write a plain-language request like `=GPT("calculate the average without zeros")` and get the correct formula. We can summarize long texts in a cell using `=SUMMARIZE(A1)`, translate text with `=TRANSLATE(A1, "ro", "en")`, analyze reviews or comments for sentiment, and even fill in missing data or reorganize tables based on suggestions.

These tools are developed by third parties, not Microsoft. While some features are free, others may require a subscription or paid API access. Also, since the data may be transmitted to external servers, it's important to avoid sending sensitive information unless it has the proper permissions.

4. Excel functions with AI integrated

We can create a short list of Excel functions and categorize them according to their intended use. This feature is an application where the URL AI add-in is equipped with AI features, ChatGPT for Excel, and personalization integration with the OpenAI API.

1. Content Generation (Text, Ideas, Tables)

Function	Example Usage
=AI ("...")	=AI("Create a list of 5 fictional students with majors")
=GENERATE (...)	=GENERATE("Business slogan for a bakery")
=EXPAND (A2)	Expands or elaborates on a sentence or idea in cell A2

2. Rewriting and Grammar Correction

Function	Description
=REWRITE (A2)	Rewrites the text in A2 for clarity or professionalism
=CORRECT (A2)	Fixes grammar and spelling mistakes in the text
=SIMPLIFY (A2)	Simplifies technical or complex language
=FORMALIZE (A2)	Converts casual language to a formal tone

3. Text Analysis (Sentiment, Classification, Summary)

Function	Description
=SUMMARIZE (A2)	Summarizes long text in A2
=CLASSIFY (A2)	Classifies text by topic, intent, or category
=DETECT_SENTIMENT (A2)	Returns the sentiment: Positive, Neutral, or Negative
=KEYWORDS (A2)	Extracts keywords from the text

4. Language and Translation

Function	Description
=TRANSLATE (A2, "ro", "en")	Translates from Romanian to English
=DETECT_LANGUAGE (A2)	Detects the language of the text
=TRANSLATE_AUTO (A2, "en")	Automatically translates to English

5. Working with Formulas and Data

Function	Example and description
=AI("Write an Excel formula to...")	=AI("Write an Excel formula to calculate VAT at 19%")
=EXPLAIN_FORMULA (A2)	Explains what the formula in A2 does

Function`=CLEAN_DATA (A2)``=FILL_MISSING (A1:A10)`**Example and description**

Cleans or normalizes inconsistent data

Suggests on how to fill in missing values

6. Education and Student Examples**Function**`=AI ("Generate 5 quiz questions on biology")``=AI ("Explain photosynthesis in simple terms")``=AI ("Generate a student table with name, group, major")`**Description**

Creates practice questions or quizzes

Simplifies academic concepts

Generates demo student tables

7. Advanced / Custom AI Functions (API-based or LAMBDA)**Function**`=GPT_PROMPT (...)``=LAMBDA_GPT (...)`**Description**

(prompt, Sends a custom prompt to OpenAI and returns the result

Custom Excel LAMBDA functions powered by GPT

5. Case Study: Some examples of using AI with Microsoft Excel

The first step are described, in order to use AI in Excel is the install ChatGPT (Numerous AI).

- ◆ 1. Open Excel (Microsoft 365 version recommended). Add-ins work best in the web version of Excel or the latest desktop version.
- ◆ 2. Go to *Insert > Get Add-ins*
- ◆ 3. Search for "Numerous AI" or "GPT"
 - Find the add-in called "Numerous AI" or "GPT for Excel & Sheets"
 - Click **Add** to install it.

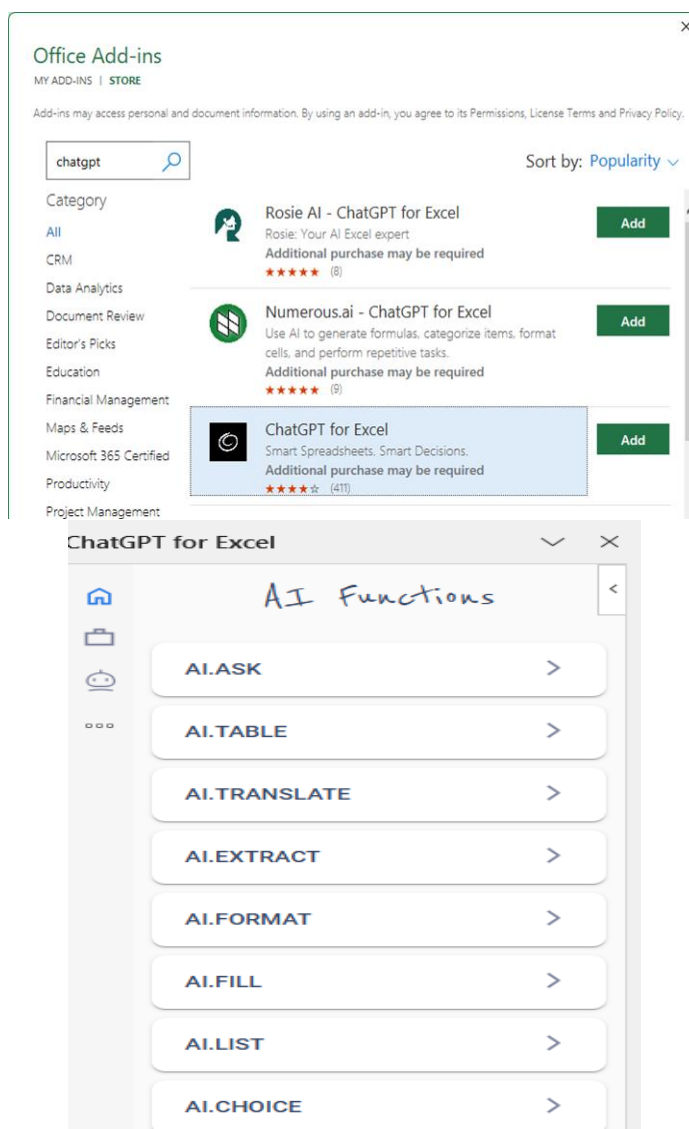


Figure 1. How to install AI for Excel

ChatGPT add-ins for Excel can help perform a variety of tasks using natural language. For example, if we don't know how to write a specific formula, we can simply describe what we need, and ChatGPT will generate = GPT("calculate the average excluding zeros").

If we have a long block of text in a cell, we can summarize it instantly with =SUMMARIZE(A1). Need to translate text automatically? Use a function like =TRANSLATE(A1, "ro", "en") to convert content from Romanian to English. When working with product reviews or user comments, the tool can perform sentiment analysis to identify whether feedback is positive or negative. ChatGPT

can also suggest missing data entries or corrections, and assist with table organization by recommending how to structure or analyze data more effectively.

Example1: The AI.TABLE creates a table with a specific dataset using AI's capabilities. Just provide a prompt and optionally include a header, source data, creativity level, and the desired AI model.

```
=AI.TABLE("Generate a table with 10 fictional university students.  
Include columns: First Name, Last Name, Group, and Major.")
```

First Name	Last Name	Group	Major
Alice	Johnson	A1	Computer Science
Bob	Smith	A1	Mathematics
Charlie	Brown	B2	Physics
Diana	White	B2	Biology
Ethan	Davis	C3	Chemistry
Fiona	Garcia	C3	Psychology
George	Martinez	D4	History
Hannah	Lopez	D4	Literature
Ian	Wilson	E5	Engineering
Jasmine	Anderson	E5	Art

Figure 1. An example of using AI.Table

Example2: The build of a tabel that contains Top 10 movies of all times, with release year and main actor.

	A	B	C	D	F
1	Function	AI.FORMAT			
2	Syntax	=AI.FORMAT(value,format)			
3					
4					
5	FORMAT DATA IN TABLE				
6	Format product name and status in the table below				
7					
8	Table with Unformatted Data				
9	Product ID	Product Name	Cost (\$)	Date Added	Quantity
10	1	laptop. ,	1200	5/1/2022	15
11	2	Head-phones	\$250.50	12/15/2021	200
12	3	Mobile Phone	750.75	15-Jul-22	35
13	4	Television	1420	8/20/2022	20
14	5	Smart-Watch	199.99	2/11/2023	505
15	6	Tablet	\$329.50	1/23/2021	110
16					
17					
18	Table with Formatted Data (Product name and Status)				
19	Product ID	Product Name	Cost (\$)	Date Added	Quantity
20	1	Laptop	\$ 1,200.00	5/1/2022	15
21	2	Headphones	\$ 250.50	12/15/2021	200
22	3	Mobile Phone	\$ 750.75	7/15/2022	35
23	4	Television	\$ 1,420.00	8/20/2022	20
24	5	Smart Watch	\$ 199.99	2/11/2023	505
25	6	Tablet	\$ 329.50	1/23/2021	110

Figure 2. Another example of using AI.Table

Example 3: The AI. FORMAT function converts a text to a specified format. Provide the text range and the desired format range. This function standardizes and structures the data efficiently.

Rank	Movie Title	Release Year
1	The Shawshank Re	1994
2	The Godfather	1972
3	The Dark Knight	2008
4	Schindler's List	1993
5	Pulp Fiction	1994
6	The Lord of the Rin	2003
7	Forrest Gump	1994
8	Fight Club	1999
9	Inception	2010
10	The Matrix	1999

Figure 3. An example of AI.Format function

Example 4. The AI.TRANSLATE function helps translate the content into multiple languages directly from the workbook. Simply provide the text, target language, and any optional instructions.

=AI.TRANSLATE("Also since wer datawe may be transmitted to external servers, it's important to avoid sending sensitive information unless we have proper permissions", "German")

Da Ihre Daten möglicherweise an externe Server übertragen werden, ist es wichtig, sensible Informationen zu vermeiden, es sei denn, Sie haben die entsprechenden Berechtigungen.

Figure 4. An example of AI.Translate function

Example 5. AI.LIST generate list outputs in separate rows to keep your thoughts organized.

=AI.LIST("give me 5 email subject ideas for a workshop in Informatics")

Unlocking the Power of Data: Join Our Informatics Workshop!
 Enhance Your Skills: Informatics Workshop Registration Open
 Dive into Informatics: Hands-On Workshop Experience
 Transform Your Career with Our Informatics Workshop
 Explore the Future of Technology: Informatics Workshop Invitation

Figure 5. An example of AI.List function

Example 6. The AI.FILL function fills an incomplete range by analyzing a provided example range to understand the pattern. Specify the example range

with complete data, the partial range to be filled, and optionally, adjust the creativity level.

=AI.FILL(Q21:R23,Q24:Q28)

=AI.FILL(G10:H12,G13:G23)

Country	Country Code
United States	US
China	CN
India	IN
Brazil	BR
Australia	AU
New Zealand	NZ
United Kingdom	GB
Germany	DE
France	FR
Italy	IT
Russia	RU
China	CN
Japan	JP

District	Abbreviation
Cluj	CJ
Alba	AB
Sibiu	Q24:Q28)
Brasov	BV
Mures	MS
Ilfov	IF
Bihor	BH

Figure 6. An example of AI.FILL function

6. Built-in AI Features in Excel (Microsoft 365 / Excel Online)

Artificial Intelligence is becoming an integral part of office tools, and Microsoft Excel already includes smart features that make it easier to analyze data, visualize patterns, and support decision-making—even without programming skills. Here's how we can benefit from AI directly within Excel.

Linked Data Types (Smart Data Categories)

Excel can recognize certain words, such as “France” or “Apple,” as entities like a country or a company. Once recognized, we can extract structured data such as population, GDP, stock price, CEO, etc. To use this feature, we have to type a word into a cell (e.g., "Apple"), then go to the **Data** tab, choose **Data Type**, and select **Automatic** or a specific type (like *Company* or *Geography*). Excel will link the word to a data entity, allowing us to pull structured fields related to it.

Analyze Data (formerly called "Ideas")

This feature helps explore the dataset quickly by suggesting relevant charts, detecting trends, and highlighting outliers. To activate we select the data table, then click **Home > Analyze Data**. Excel will automatically present insights and visual suggestions based on the dataset's structure and content.

Automatic Forecasting (Forecast Sheet)

For time series data like monthly sales, Excel's **Forecast Sheet** generates predictions and trend graphs.

How it works: we select two columns (a time-based one and a value-based one), then go to **Data > Forecast Sheet**. Excel will generate a visual projection of future values based on historical patterns.

Power Query + Cloud AI Integration

Advanced users can connect Excel to cloud-based AI services, such as Azure Machine Learning. For example, we can train a predictive model in Azure and import its results directly into Excel using Power Query.

AI for Charting and Visual Patterns

While charts themselves aren't driven by AI, Excel uses AI to suggest the most appropriate visualizations:

The Analyze Data tool helps choose the best chart for the data. Quick Analysis (appears when we select a data range) offers a set of chart suggestions and pattern highlights. AI helps detect anomalies or recurring trends directly in visual outputs.

AI Functions via Add-ins (ChatGPT and others)

We can enhance Excel with AI-powered add-ins available from the Office Store, such as **ChatGPT for Excel**, **DataSquirrel**, or **Numerous AI**. These tools allow Formula generation from natural language, text data analysis and classification and smart content summarization or correction.

Practical Use Cases

Scenario	AI Solution in Excel
We have a product list and want to know top sellers	Use Analyze Data to identify trends
We need to forecast next month's sales	Create a Forecast Sheet
We want to quickly build visualizations	Use Quick Analysis or Analyze Data
We need details about companies or countries	Use Linked Data Types
We're working with a large table and want insights	Let Analyze Data suggest key findings
Excel's integration of AI continues to grow, offering both everyday users and professionals intelligent tools to explore, understand, and act on data—without the need for complex formulas or code.	

Conclusion

The integration of Artificial Intelligence into Microsoft Excel marks a significant evolution in how users interact with data. From built-in tools like Linked Data

Types, Analyze Data, and Forecast Sheet, to more advanced capabilities powered by add-ins such as ChatGPT or Numerous AI, Excel now offers powerful features that go far beyond traditional spreadsheet functions. These AI enhancements enable users to generate formulas from plain language, analyze trends and sentiment, visualize data intelligently, and even connect to cloud-based machine learning models—all without needing programming knowledge. As AI continues to develop, its role in tools like Excel will only become more central, helping users make faster, smarter, and more data-driven decisions across all fields.

References

- Thiruvankadam, R. (2023). Using AI to Transform VBA in Excel. <https://ijrpr.com/uploads/V5ISSUE3/IJRPR23778.pdf>
- Numerous.ai. (2024). 20 Best AI Tools for Excel Formulas. <https://numerous.ai/blog/ai-for-excel-formulas>
- Davis, J., et al. (2024). SpreadsheetLLM. <https://venturebeat.com/ai/microsofts-new-ai-system-spreadsheetllm/>
- Payan, J., et al. (2023). InstructExcel. <https://arxiv.org/abs/2310.14495>
- Barowy, D. W., et al. (2019). ExceLint. <https://arxiv.org/abs/1901.11100>
- Microsoft. (2023). AI in Excel. <https://www.microsoft.com/en-us/microsoft-365/excel/ai-for-excel>

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