

Responsible Use of AI tools to Generate Documents and Presentations: a mini-course

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The AI Era

- Unprecedented technological advancement thanks to NN and computational power.
- AI: increasingly essential tool in multiple fields.
- Data processing, complex calculations, decision-making... **Text Generation!**

Purpose of the Practice

In this practice...

Responsible Use of AI Tools

- Using ChatGPT for academic works and presentations.
- Interaction with AI: prompt engineering.
- Efficient creation of documents and presentations.
- **“Time is golden”**: any time saved on mechanical tasks can be spent on something else (professional or leisure).
- Avoid falling behind technologically (neither students nor the professor).
- Emphasis on responsible, ethical use, and hidden dangers.



Benefits and Limitations of AI

- Critical reflection on AI in education and research: a constantly changing role.
- Ethical and responsible use of AI.
- Development of a solid understanding of emerging technologies and their limitations.

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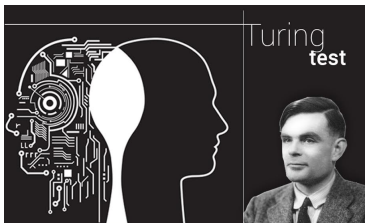
Origins of AI

From Early Concepts to the Modern Era

- The concept of AI was formed in the 20th century, but its roots go back even further.
- Early attempts at creating machines with human-like intelligence.

Fundamental Developments and Early Advances

- Alan Turing and the Turing Test.
- The Dartmouth Conference and the coining of "artificial intelligence."
- Advances in AI programs and programming languages.



Challenges and Renaissance - 1980s and 21st Century



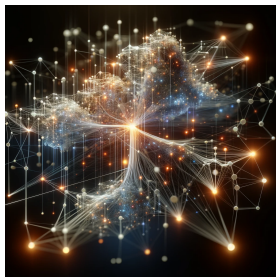
From Expert Systems to Deep Learning

- Popularity and challenges of expert systems.
- The "AI Winter" and subsequent renaissance.
- Advances in deep learning and current applications.

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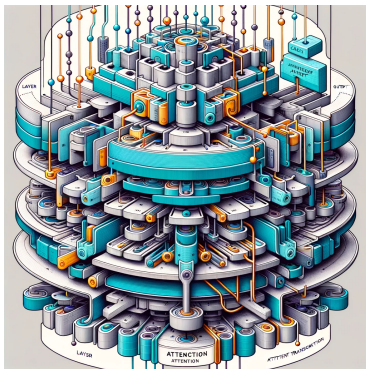
ChatGPT: An Advance in Natural Language Processing



Introduction to ChatGPT

- An advanced model for natural language processing.
- Part of the Generative Pre-trained Transformers (GPT) family.
- Designed to understand and generate human language coherently.

The Architecture and Functioning of ChatGPT



Transformers and Attention Mechanisms

- Neural network architecture based on "transformers."
- Ability to handle data sequences and contextual relationships.
- Use of attention mechanisms to improve language processing.

Challenges and Long-Term Visions

- **Probabilistic Nature:** Variability in generated responses, enhancing creativity but with possible inconsistencies.
- **The Future of AI:** Potential to revolutionize multiple sectors, but with a need to consider ethical and social impacts.
- Importance of training and alignment with ethical values, especially considering:
 - **Artificial General Intelligence (AGI):** AI capable of learning, understanding, and applying intelligence across a wide range of tasks, similar to human intelligence.
 - **Artificial Superintelligence (ASI):** AI that surpasses human intellectual capability in virtually all fields, including creativity and decision-making.



Development of Soft and Hard Skills

- A tool for improving communication, teamwork, and problem-solving.
- Assistance in programming, data analysis, and mathematical modeling.
- Importance of using ChatGPT as a complement, not a substitute.

Access and Versions of ChatGPT

Exploring the Available Options

- **ChatGPT-3.5:** Free version with notable capabilities in natural language tasks.
- **ChatGPT-4:** Significant advancements in accuracy and multimodal capabilities. Available through a subscription to ChatGPT Plus.
- **Bing Chat:** Free alternative with GPT-4 engine, integrating DALL-E 3 for multimodal capabilities.
- **GPT Store and Plugins:** Exclusive access for ChatGPT Plus subscribers to customized bots and specialized applications.
- **ChatGPT API:** Allows the integration of ChatGPT into own applications and services. "Pay-per-use" and provides access to the latest versions and features of GPT, including advanced customization and control over processed data.

Understanding the Limitations of ChatGPT

- **Token Limit:** Limited short-term memory capacity, affecting depth and context in extended conversations.
- **Hallucinations:** Generation of incorrect or irrelevant responses in certain situations. Invention of data, dates, references.
- **Updated Knowledge:** Limitations in updating its knowledge base, cutoff date.
- **Bias and Equity:** Risk of reflecting biases present in the training set.
- **Prompt Dependency:** The quality of responses depends on the quality of the formulated prompts.
- **Shallowness:** On technical topics, ChatGPT's knowledge may be too simple without additional external information.
- **Inappropriate Language:** Risk of using pompous or artificial tone; possible poor translations/variations.
- **Data Security and Privacy:** Risks with sensitive data. Protection of data privacy and regulatory compliance.



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Prompt Engineering: A Crucial Skill



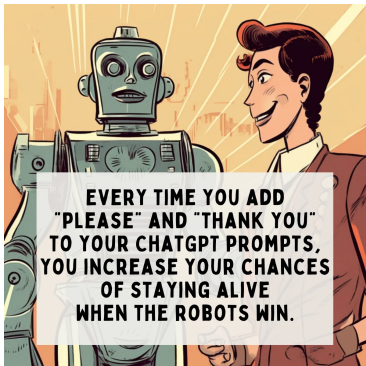
Understanding the Concept of a Prompt

- A prompt is an instruction or question that guides the generation of responses.
- The quality of the prompt directly affects the accuracy and relevance of the response.
- Increasing importance in complex and diverse applications.

Key Elements for a Good Prompt

Objective and Context

- Combine a clear objective with detailed context.
- Include a specific role, additional information, and desired tone.
- Adjust responses with follow-up questions.
- Being polite and appealing to emotions can yield good results (!).



Source: https://www.reddit.com/r/ChatGPT/comments/11u27f3/be_polite

Practical Examples of Prompt Engineering

From Generic to Specific

- **Generic Prompt:**

Write a story.

- **Enhanced Prompt:**

Create a short story about a traveler in an ancient city finding a mysterious object, with elements of suspense.

- **Emotional Prompt, including role:**

Describe the fascinating places of Rome as a friendly tour guide, sharing exciting anecdotes.

Additional Prompt Examples

Detailed and Specific Prompts

- **Prompt for Cooking Recipes:**

As an expert chef, create a vegetarian recipe with tofu and vegetables for a healthy dinner.

- **Prompt for Gardening Advice:**

As an experienced gardener, give advice on caring for orchids in humid climates.

- **Prompt for Book Summary:**

Summarize '1984' by George Orwell, highlighting the main themes and its current relevance.

- **Prompt for Creative Story:**

Write a short story set in a futuristic world where AI and humans coexist, centered on the friendship between a child and a robot.

Professor's Prompts: Specific Examples

Diversity of Applications and Contexts

- **Social Media:**

Writing as an expert in social media, please give some thoughts for a LinkedIn repost. The content of the original post is XXX. I'd like to emphasize YYY.

- **Trivia on a Road Trip:**

Give us 5 questions about the History of Spain in the Middle Ages... Key dates about the history of the Iberian Peninsula in those dates, also provide the answers.

- **Text Summary and Commentary Writing:**

Read the next three reviews and summarize the major points in three paragraphs. Write as an associate editor using formal language. The reviewers should be mentioned by their number and never by their name. One of the reviewers uploaded a pdf file whose content I provide right below the review.

Professor's Prompts: Specific Examples

- **Generating Documents with Minimal Technical Content:**

Act as an expert in pedagogy using formal language. I need, for a report, a section called 'educational innovative project', 2 to 3 pages; something cross-disciplinary, inclusive, with diversity... The innovative project has to be for the course XXX. Duration about 6 months to 1 year.

- **Elaborating Text from Notes:**

You're an expert project evaluator. Summarize the following objectives in a sentence for each one, but linked together: [...]

- **Generating Variations on an Existing Text:**

Hi chatgpt, can you help me in writing a recommendation letter to one of my students? Please act as a seasoned professor and warm human being. Don't exaggerate and don't be pompous. I have a draft, please respect it as much as possible and try slightly improve it without changing the tone. Please also respect the latex codes. Here is the draft: [...]

Professor's Prompts: Specific Examples

- **Quick Calculations:**

How much memory would be required, in MB, to store as floats 17 physical quantities sampled in 10 second increments over one year?

- **Preparation for Round Table Questions:**

Hello chatgpt, I'm going to pass you the answers to some questions I've been asked. Act as a scientific speaker. The questions are in bold, please do not change them. In relation to the answers, if you see something that you can slightly improve, do it, correcting errors you see, but please do not change much. Keep the tone of the text. Thank you: [...]

- **Preparation of emails and translation:**

Hi ChatGPT, please prepare a cheerful email for a visiting professor (XXX) proposing him this agenda (you should translate to English): [..]

Professor's Prompts: Specific Examples

- Calculations and Data Presentation (requires Pro version):

You are a mathematician expert in Latex. Give me the latex code for a table with nine columns and three rows. The element 1,1 should contain "N", the element 1,2 "real eigenvalue" and the element 1,3 "approximated eigenvalue". Now, the first row starting at 1,2 should contain the numbers from 1 to 8. The second row starting at 2,2 should contain the first eight positive solutions of the equation $\cos(2*x)*\cosh(2*x)-1=0$ discarding the solution at zero. The third row starting at 3,2 should contain the numbers $3*\pi/2+n*\pi/2$ for n from 0 to 8.

- Iterating on the Result:

repeat the previous request but using a number of decimals for each number such that the table fits in the width of a page

- The Result:

N	1	2	3	4	5	6	7	8
Real Eigenvalue	2.3650	3.9266	5.4978	7.0686	8.6394	10.2102	11.7810	13.3518
Approximated Eigenvalue	2.3562	3.9270	5.4978	7.0686	8.6394	10.2102	11.7810	13.3518

Future Perspectives of Prompt Engineering

The “prompt engineer”, a lucrative profession with a very limited future...

Towards More Natural Interaction with AI

- Evolution towards self-learning and adaptation through user interaction.
- Less dependence on elaborated prompts, improving intuition and accuracy.
- Future with fluid and natural interaction with AI.

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Using ChatGPT in Programming

Enormous Potential for Code Generation

- Tool for automating tasks and assisting in debugging.
- Useful in education for improving understanding and application of concepts.

Generating Codes with ChatGPT in MATLAB

- Generation of scripts and mathematical functions.
- Creation of advanced visualizations and use of specific functions.
- Providing detailed explanations of generated codes.

Not without dangers...

Data Visualization Example in MATLAB

Objective:

- Visualize functions in MATLAB with attractive visualization options and sufficient size (common mistake).

Prompt:

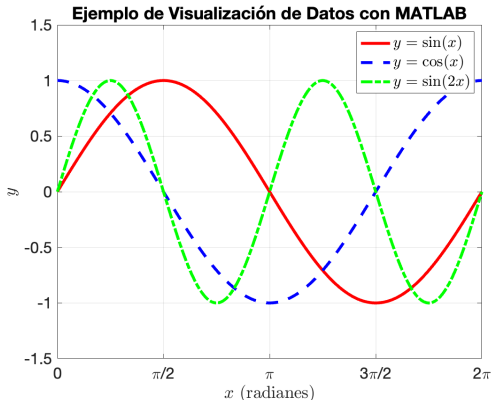
Hello, ChatGPT. I'm working on a MATLAB project and need your help to generate a specific graph. Specifically, I need a MATLAB graph that shows three different functions: $y = \sin(x)$, $y = \cos(x)$, and $y = \sin(2x)$, in the range from 0 to 2π radians. For each function, use different line styles and colors. Please include a legend with the labels of each function written in LaTeX, and label the axes also in LaTeX. The graph's title should be "Data Visualization Example with MATLAB". Ensure the font sizes are large enough to be legible even when the image is reduced to half its original size. I would also like you to add a grid to make the graph easier to read. Finally, please include the code to save the graph as a PNG file.

MATLAB Code for Data Visualization

```
% Function definitions
x = linspace(0, 2*pi, 1000);
y1 = sin(x);
y2 = cos(x);
y3 = sin(2*x);
figure; % Creating the figure
% Plotting the functions
plot(x, y1, 'r-', 'LineWidth', 3);
hold on;
plot(x, y2, 'b--', 'LineWidth', 3);
plot(x, y3, 'g-.', 'LineWidth', 3);
% Adding legend with LaTeX code
legend({'$y = \sin(x)$', '$y = \cos(x)$', '$y = \sin(2x)$'}, 'Interpreter', 'latex', 'FontSize', 16);
% Adding labels with LaTeX code
xlabel('$x$ (radians)', 'Interpreter', 'latex', 'FontSize', 18);
ylabel('$y$', 'Interpreter', 'latex', 'FontSize', 18);
% Graph title
title('Data Visualization Example with MATLAB', 'FontSize', 20);
% Setting axis limits
xlim([0 2*pi]), ylim([-1.5 1.5]);
% Adding grid
grid on;
% Configuring axis ticks
xticks(0:pi/2:2*pi);
xticklabels({'0', '\pi/2', '\pi', '3\pi/2', '2\pi'});
yticks(-1.5:0.5:1.5);
% Additional configuration to improve appearance
set(gca, 'FontSize', 16); % Axis font size
% Saving the figure
saveas(gcf, 'data_visualization_example.png');
```



Generated Visualization in MATLAB



Better presentation than in 90% of the students' academic works corrected by the professor, with clarifying comments in the code!

Example of Using Unknown Functions

Objective:

- Sometimes one may have a need and not know which function to use (important to be very specific and maybe you'll hit the nail on the head!).

Prompt:

Hello, ChatGPT. I need your help to create a visualization in MATLAB. I have a set of 10 points randomly distributed in a 100x100 space. I would like to generate regions in this space so that each region is closer to one of these points than to the others. For this, draw lines that separate these regions. Mark the points with red dots and the lines with blue. Also, include labels for the axes and a descriptive title. Please make sure the graph is clear and easy to understand. Finally, generate a PNG with the result. Thank you for your help.

Resulting MATLAB Code

```
% Generate random points
points = 100 * rand(10, 2);

% Calculate Voronoi diagram
[v, c] = voronoin(points);

% Create figure
figure;
hold on;

% Draw Voronoi diagram lines
[vx, vy] = voronoi(points(:,1), points(:,2));
plot(vx, vy, 'b-', 'LineWidth', 1.5); % Draw lines

% Draw points
plot(points(:,1), points(:,2), 'r.', 'MarkerSize', 20); % Draw points

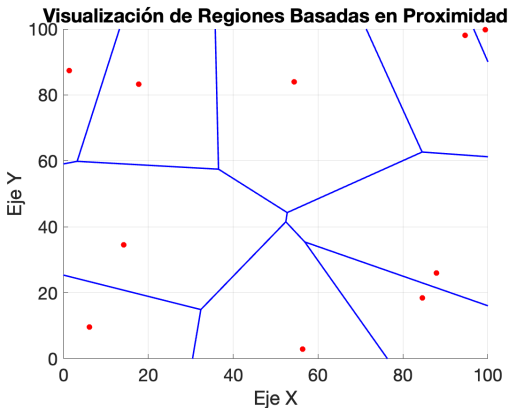
% Customize the graph
title('Visualization of Proximity-Based Regions', 'FontSize', 18);
xlabel('X Axis', 'FontSize', 18);
ylabel('Y Axis', 'FontSize', 18);
set(gca, 'FontSize', 18); % Axis font size
xlim([0 100]);
ylim([0 100]);
grid on;

% Save the figure as PNG
saveas(gcf, 'voronoi_diagram.png');

hold off;
```



Generated Visualization in MATLAB



The student discovers the concept of the Voronoi diagram thanks to this code.

Further Exploration...

What is a Voronoi diagram?

Prompt:

define, for a 4th-year aerospace engineering student, what is a Voronoi diagram, thanks

Answer:

A Voronoi diagram is a mathematical tool used to divide a space into regions based on proximity to a set of specific points. Imagine you have a group of points scattered in a space, like stars in the sky. The Voronoi diagram allows you to create boundaries around each point so that any point within a region is closer to that point than to any other in the set. These regions are called "Voronoi cells".

In the context of aerospace engineering, Voronoi diagrams are used to solve problems related to resource distribution or route planning. For example, if you are planning a space mission and have a network of ground stations, a Voronoi diagram would help you determine which of these stations is closest to a specific location in space, which can be crucial for spacecraft communication or navigation.

Python Automation Example

Objective:

- Automate document generation using Python, learning about its use for document manipulation.

Prompt:

Hi chatgpt. Do you know any way to automate the generation of a Word document? I have a base document, where it is necessary to write the name and ID of several people in various places. I separately have the list of people and IDs. I would like a separate document to be generated for each one with this information replaced. Provide a Python script that performs this task easily and quickly.

Python Code for Document Automation

```
from docx import Document

def fill_template(template_path, personal_data, output_dir):
    for person in personal_data:
        # Load the template
        doc = Document(template_path)
        # Replace placeholders
        for paragraph in doc.paragraphs:
            if '{name}' in paragraph.text:
                paragraph.text = paragraph.text.replace('{name}', person['name'])
            if '{ID}' in paragraph.text:
                paragraph.text = paragraph.text.replace('{ID}', person['ID'])
        # Save the document
        output_path = f"{output_dir}/{person['name']}_document.docx"
        doc.save(output_path)

# Example data and template path
template_path = 'path/to/your/template.docx'
personal_data = [{'name': 'John Doe', 'ID': '12345678A'},
                 {'name': 'Anna Smith', 'ID': '23456789B'}]
output_dir = 'path/to/the/generated/documents'

fill_template(template_path, personal_data, output_dir)
```

Python Automation Result

- This Python script demonstrates an efficient way to automate the generation of customized Word documents.
- Uses the “python-docx” library, which is easy to install (you can even ask ChatGPT how to do it).
- The result is fast, simple, and highly adaptable to various document automation needs.

Risks and Considerations in Code Generation

- Codes that are syntactically correct but may contain logical errors.
- Risk of dependency and limitation in skill development.
- Importance of originality and personal understanding in educational contexts: if we don't learn anything, what are we here for?
- The proposed code may not be optimal or have implicit assumptions we are unaware of (e.g., discretizations for solving differential equations).
- "Sometimes there's no way": ChatGPT keeps producing garbage. Rethink the question, formulate it in different ways starting from scratch again... or admit that you'll have to do the work yourself!

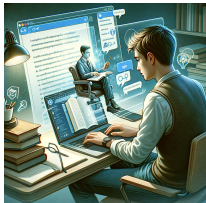
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Writing Papers with ChatGPT

Why Use ChatGPT in Writing Academic Texts?



- The core of this mini-course. ChatGPT offers assistance from the beginning in structuring and developing documents.
- Ability to generate content, ideas, and provide explanations. **Fighting the writer's block.**
- A complementary tool for efficiency.
- The start: generating an index.

Example Prompt

"As an expert in space engineering, generate a detailed index for a paper on space debris, including theoretical sections and practical applications, in LaTeX and providing the generated code."

Selection and Customization of Templates

- The second step: generating a document template.
- ChatGPT's help in choosing and adapting LaTeX templates.
- Tips for customizing and enriching the document.

Example Prompt

"Recommend a visually appealing LaTeX template for an engineering project report, and explain how to customize it."

Iteration and Content Enrichment

Document Development and Improvement

- Next steps: Using ChatGPT to draft and develop arguments section by section.
- The importance of reviewing and customizing ChatGPT's contributions.
- Iterating when not satisfied with the results. Even changing the approach.

Example Prompt

"Act as an aerospace engineering expert. Provide an initial draft for a section on the environmental impacts of space propulsion in an aerospace engineering paper."

Example Prompt

"Improve section X, specifically focusing on the impact generated by a launch, providing more details."

Deepening and Diversifying Content

- Active search for external sources to avoid shallowness in the topics covered.
- Using ChatGPT to summarize and adapt these external contents to the document, improving the depth and richness of the work.
- Essential: All material from external sources used must be duly cited to maintain academic integrity and respect copyright.

Example Prompt

"Based on the following excerpt from a study on chemical propulsion, summarize the key points that could enrich my work on aerospace engineering. Be sure to include a proper citation to the study in the required format."

Verification and References

Ensuring Accuracy and Reliability

- Independent verification of the information provided by ChatGPT: a crucial step.
- Use of primary sources and review of relevant literature: Google, Google Scholar, others.
- Emphasis in particular on those things we do not control: better not to trust too much! It's better to omit and admit than to lie.
- Leveraging LaTeX capabilities to generate appropriate formats (bibtex).

Example Prompt

"Suggest some recent references on artificial intelligence in aerospace engineering. Generate the corresponding bibtex file for inclusion in LaTeX."

Note: Verify all generated references!

Integrating Formulas and Graphics

Enhancing Presentation

- Since LaTeX can be considered code, ChatGPT is capable of assisting in producing quality texts in this format by integrating complex elements.
- ChatGPT's assistance in including visual elements in LaTeX.
- Generating code for figures, tables, and equations.
- Resolving LaTeX errors.

Example Prompt

"Generate LaTeX code for a table showing performance data of different types of space thrusters."

Example Prompt

"Show an example of LaTeX code for a customized, visually appealing cover for an aerospace engineering report."

Collaboration and Review in Overleaf

Overleaf is a collaborative online editing platform for LaTeX that can be used for free (up to a certain document size).

Advantages:

- Real-Time Collaboration: Overleaf allows multiple users to work on the same document simultaneously, facilitating collaboration on group projects and document review.
- Ease of Use: Overleaf features an intuitive interface and editing options that make LaTeX more accessible.

Optimizing Teamwork

- ChatGPT as a facilitator in project collaboration on Overleaf.
- Strategies for joint document review and editing.

Example Prompt

"Suggest some strategies for effective collaboration in writing a group report in Overleaf."

Tips for Effective Academic Writing

Improving Writing Skills

- ChatGPT as a resource to strengthen academic writing.
- Strategies for solid arguments and content review.
- Summaries, conclusions, text unification, rewriting.

Example Prompt

"Provide tips for improving coherence and fluency in scientific article writing."

Example Prompt

"Apply the previously provided tips to this text block and explain the changes you've made."

Example Prompt

"Merge the second and third paragraphs so that the text flows better, and also generate a summary of the text."

Balancing Assistance and Personal Knowledge



Complement, Not Substitute!

- The importance of ethical and responsible use of ChatGPT.
- ChatGPT as a complement to personal effort and learning.
- It is impossible to detect with certainty that a text has been produced by an LLM, but it is possible to detect a poorly done text or with false errors/references, plagued with pomposity and exaggerations!



Managing ChatGPT's Limitations

Practical Tips in the Face of Challenges and Limitations:

- **Token Limit:** Divide extensive topics into manageable segments to maintain coherence.
- **Hallucinations:** Always verify the information provided with external sources.
- **Updated Knowledge and Internet Access:** Supplement with searches in recent sources to obtain updated data.
- **Biases and Fairness:** Be critical and aware of potential biases in the responses.
- **Prompt Quality Dependence:** Formulate clear and specific prompts to obtain more relevant and coherent responses.
- **Shallowness:** Supplement the creative process with external sources to enrich content and ensure depth.
- **Inappropriate Language:** Carefully review the generated text and adjust the tone by formulating appropriate prompts.
- **Security and Privacy:** Avoid sharing sensitive information and stay informed about privacy and security policies.

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Introduction to Preparing Presentations with Beamer

Transforming Documents into Visual Presentations

- Beamer: A LaTeX class specialized for creating slides.
- ChatGPT can assist in converting document content into attractive presentations.
- ChatGPT can serve as a tool for suggesting titles and key content.
- ChatGPT can assist with complex formatting aspects (see the cover of this document).

This document is an example generated from the practice report. The reverse process is also possible (generating text from a presentation) but will typically require more effort (adding more detail).

Optimizing Slide Appearance

- First step: ChatGPT suggestions on template, color schemes, and design.
- Tips for effective text and visual element arrangement.

Example Prompt

"Based on the document I provide, suggest a format for a Beamer presentation in LaTeX, including an attractive title, color scheme, and cover. Pass me the code for that presentation."

Effectively Creating Slides with ChatGPT

- Using ChatGPT to transform text from sections into slides, step by step.
- Focus on key ideas and clear, concise presentation. Iterate until satisfied/retouched.

Highlighting the Essentials on Each Slide

- Identify and highlight key points from each section.
- Avoid overloading slides with excessive text.

Example Prompt

"Begin generating the document with the introduction section. I pass you the LaTeX of that section. There are two figures, it would be great if somehow one of them could be integrated into the cover. Please return the revised LaTeX code of the cover as well as the proposal for the introduction section for the presentation. Be concise but do not omit relevant information."

Enriching Slides with Graphic Elements

- Use of images and graphics to reinforce concepts.
- Identifying opportunities to include graphics and tables.
- Enhancing audience comprehension and retention.

Example Prompt

"Generate LaTeX code to include a graph illustrating elliptical orbits in a Beamer slide."

Review and Final Adjustments

Ensuring Quality and Effectiveness

- **Consistency and Coherence:**
Review of style, format, and narrative.
- **Clarity and Simplicity:** Simplification of slides to highlight key messages.
- **Visual and Aesthetic Impact:**
Improvements in arrangement, image quality, and professional appearance.



Example Request to ChatGPT

"Review the coherence and visual impact of my computational fluid dynamics presentation slides. Suggest improvements if you see any possible."

Tips for an Effective Presentation

Beyond the Slides

- Guidance on communication and public speaking skills.
- Techniques to engage and maintain audience attention.
- Strategies for managing Q&A sessions effectively.

Example Prompt

"Provide tips for successfully managing a Q&A session after a technical presentation."

Example Prompt

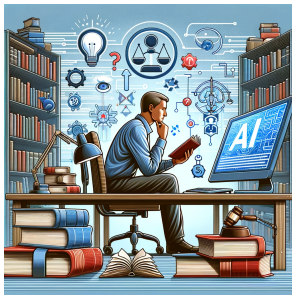
"Act as a professor very critical with his students. Based on the presentation I provide, generate five questions and propose answers to them."

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Using ChatGPT in Education and Professional Practice

- The growing importance of AI skills in various contexts.
- Balancing technological adoption with the preservation of fundamental skills: we cannot lose hard skills.
- Developing a critical and ethical attitude towards the use of AI tools: hidden risks and biases.
- Preparing for a future with greater integration of AI.

Other Unaddressed Aspects



- **Terminator 2030: Is Skynet coming?**
- **Grey Mirror: Harmful Uses of AI.**
- **Does ChatGPT Dream of Electric Sheep? Embodiment, Bioengineering.**
- **The Discreet Charm of the Mediocrity: Leveling the Labor Market from Below.**

Disclaimer

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