PatentPolish

You can access a self-deployed version of our tool at the following link: http://shnei.de:8501/

1. Abstract

- Creativity and Innovation

  Our project leverages generative AI to address a unique problem faced by patent attorneys: avoiding formal mistakes that weaken patents. While most AI tools for patent attorneys focus on generating text, which is unreliable for high-precision tasks, our approach innovates by using AI as a supplementary proofreader. It helps attorneys identify preventable errors missing reference signs. This shift from content generation to mistake prevention is novel and addresses a critical gap in the legal AI market, enhancing patent quality without demanding perfect AI accuracy.

- Design and Usability

  We designed the tool with a user-friendly interface, prioritizing accessibility and ease of use for patent attorneys who may not be technically inclined. The system allows easy uploading of documents and visual feedback to check AI results. Each reference sign is flagged, and users can verify AI findings with minimal manual effort. Usability is further enhanced by providing clear visual cues, like color-coded meanings of reference signs in the text. The system design ensures that attorneys can quickly identify and correct mistakes, improving workflow efficiency while maintaining a clean, intuitive interface.

- Effectiveness and Efficiency

  Our tool significantly improves the efficiency of patent attorneys by reducing the time spent on proofreading and checking for formal errors. The AI analyzes both the text and figures of patent applications to find missing or mismatched reference signs, increasing the accuracy and thoroughness of the review process. By automatically flagging errors such as missing references or inconsistencies, it minimizes back-and-forth interactions with patent examiners and reduces revision costs.

- Completeness and Transferability

  The minimal viable product (MVP) we developed focuses on reference sign analysis, a critical but overlooked issue in patent applications. While simple, this functionality provides a foundation that can be extended to address broader formality issues. The tool's backend is built to be modular and scalable, allowing for the easy integration of additional features and models in the future. This extensible design ensures the solution can grow to cover other types of patent mistakes, making it transferable to a wide range of legal and technical contexts. Furthermore, its structured output format makes the results transferable to other legal tools or systems, ensuring its adaptability across different platforms and legal environments.

2. Problem

1.1. Introduction

We aimed to tackle a significant challenge faced by patent attorneys using generative AI. While the capabilities of generative AI have advanced rapidly, its current limitations—such as inaccuracies and hallucinations—make it unreliable for tasks that require high precision. After speaking with patent attorneys, we realized that instead of relying on AI for drafting entire patent documents, it could be used more effectively to help avoid common, easily preventable mistakes. These mistakes often lead to costly revisions and reduced patent scope, yet they can be identified with AI without requiring perfect accuracy.

The challenge we focused on solving is the elimination of specific mistakes that patent attorneys encounter frequently. Examples of these mistakes include:

1. **Negated patent features in the claim:** If a claim negates a feature, it opens up the possibility for opponents to use the feature to avoid infringing the patent.
2. **Inconsistent terminology throughout the document:** Synonyms should be avoided unless explicitly introduced, as this can cause parts of the description to not correspond with the terms used in the claims, reducing the overall disclosure of the patent and potentially weakening it in court.
3. **Avoiding lengthy enumerations of options:** Extensive lists of alternatives can make the core inventive concepts harder to identify and may suggest a lack of focus in the description. Additionally, they clutter the application and hinder clarity.
4. **Ensuring all terms introduced in the claims are defined in the description:** This ensures clarity and completeness, avoiding ambiguity in the patent.

Tackling these issues using generative AI is innovative, as most current AI tools for patent attorneys focus on generating text, which, as attorneys shared with us, is not yet accurate enough to be useful. In contrast, our approach uses AI to act as a supplementary proofreader, flagging potential mistakes and allowing attorneys to review them before submission. This approach does not require perfect accuracy and provides an additional layer of review to help attorneys avoid costly mistakes that could weaken their patents.

1.2. Potential Users

The primary users of this tool are patent attorneys who want to check their patent documents for formal errors before officially filing an application, helping them avoid costly revisions and ensuring compliance with patent guidelines. The tool is especially valuable for attorneys looking to streamline the patent submission process and reduce the risk of office actions. A potential future idea would be to integrate this tool into the European Patent Office's (EPO) online filing system, making it accessible to all patent attorneys when filing new patents through platforms like EPO's online filingservice.

1.3. Importance of the Identified Quality Criteria

By adhering to the above-mentioned quality criteria, patent attorneys can ensure that:

- **Scope of claims is maintained:** Inconsistent terminology can lead to unintentional limitations on the patent's scope.
- **Clarity is improved:** Ensuring clarity reduces the risk of legal uncertainties in court.
- **Costs are reduced:** Avoiding back-and-forth communications with the patent examiner, which can be time-consuming and expensive.
- **Compliance with guidelines:** The guidelines for patent examination emphasize these quality criteria as essential elements in assessing a patent.

At the same time, adhering to these criteria is a tedious and time-consuming task:

- **Patent assistants often perform proofreading tasks** to catch formal mistakes, but the technology landscape for drafting patents remains fragmented.
- **Mistakes still occur regularly**, even with dedicated patent assistants, creating inefficiencies and potential issues for the patent attorney.

1.4. Reference Signs: A Minimal Viable Use Case

In discussions with patent attorneys, another critical aspect identified was the correct usage and placement of reference signs. This formed the basis for our minimal viable use case (MVP). According to the EPC Guidelines and PCT Rules, reference signs used in drawings must be correctly mentioned in the claims. We realized that multimodal large language models (LLMs) could assist in this by analyzing the claims and figures, suggesting where additional reference signs might be necessary, and identifying mismatches between the description and figures. This feature is highly relevant to patent attorneys seeking to ensure that all necessary information is included in their descriptions.

We can distinguish between three different kinds of abnormalities. They are ranked by feasibility:

Type1: A reference sign from the description (or claim) is not depicted in the images. This should by all means not happen and is a formal error.

Type2: A reference sign from the images is not mentioned in the description. This is relevant for the patent attorneys filing the patent because it is a sign that the disclosure of the patent can be increased by mentioning the reference sign.

Sources, proving that reference signs are important in the examination process

"If the application contains drawings, and the comprehension of the claims is improved by establishing the connection between the features mentioned in the claims and the corresponding reference signs in the drawings, then appropriate reference signs need to be placed in parentheses after the features mentioned in the claims." - https://www.epo.org/en/legal/guidelines-epc/2024/f_iv_4_18.html

"The description and drawings need to be consistent with one another, especially in the matter of reference numbers and other signs, and each number or sign must be explained. However, where as a result of amendments to the description whole passages are deleted, it may be tedious to delete all superfluous references from the drawings and in such a case the examining division does not pursue an objection as to consistency too rigorously. The reverse situation should never occur, i.e. all reference numbers or signs used in the description or claims must also appear on the drawings." - https://www.epo.org/en/legal/guidelines-epc/2024/f_ii_4_8.html

"Where the international application contains drawings, the technical features mentioned in the claims shall preferably be followed by the reference signs relating to such features. When used, the reference signs shall preferably be placed between parentheses." - https://www.wipo.int/pct/en/texts/rules/r6.html#_6_2

1.5. Relevance of the Minimal Viable Product

Focusing only on reference signs (at least for the first minimum viable product (MVP)) might seem not very impactful. However, according to several interviews we conducted with patent attorneys, this type of formality checker does not currently exist and could be a highly valuable tool for patent attorneys for two major reasons:

1. In the description, it can happen that, due to human error, a reference sign mentioned in the images is not mentioned in the text. For the patent attorney, this can be a sign that relevant information intended for the description was forgotten. By making patent attorneys aware of this, it is more likely that they will avoid unnecessarily limiting the disclosure in the description.
2. In the claims, patent attorneys have an interest in using as few reference signs as possible to make their patents as broadly applicable as possible. Meanwhile, patent examiners wish for reference signs to clarify the claims. Consequently, patent attorneys often leave out as many reference signs as possible, risking the patent being returned by the examiner requesting more reference signs. An AI with good fine-tuning could help patent attorneys make better decisions on when reference signs are actually needed and when they can be left out. This would indirectly help the patent examiner and lead to less back-and-forth with the EPO.

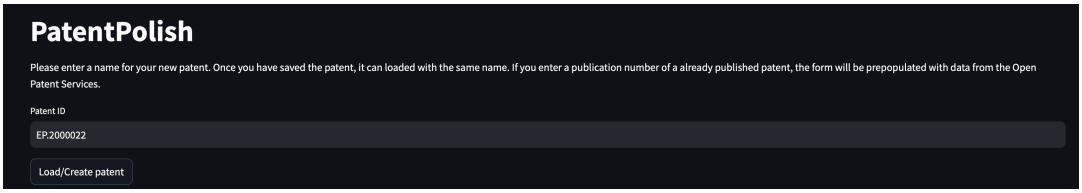
As mentioned in the last section, over time this simple reference sign checker could be extended to check for more complex formalities or common mistakes in patents, helping patent attorneys make fewer mistakes that unnecessarily limit their patent scope.

2. Our Solution

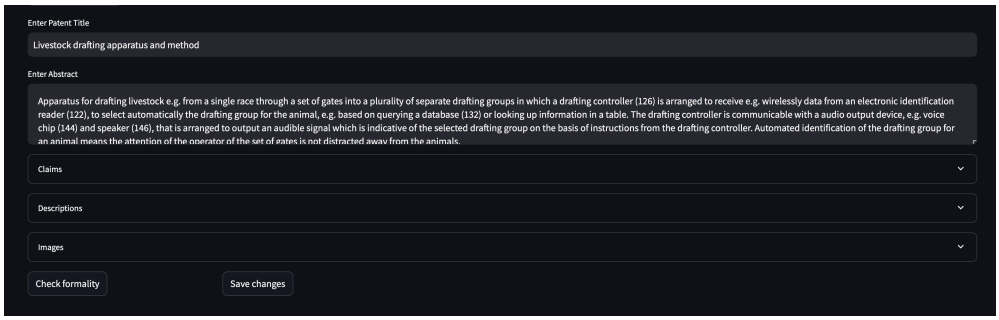
2.1. Description

To address the issue of reference signs in patent applications, we developed a tool where patent attorneys can upload their patent documents and have AI analyze them:

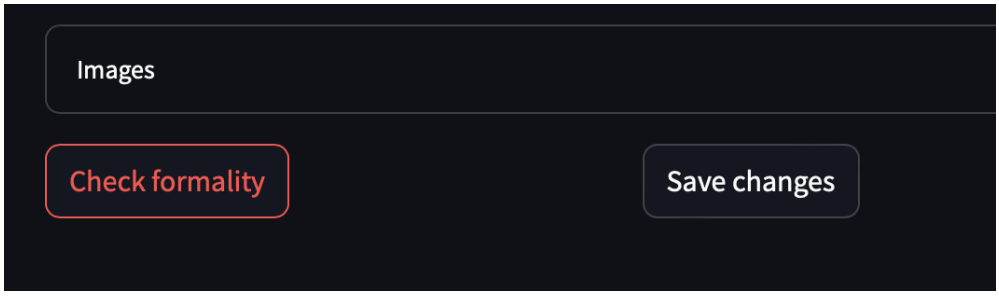
- Patent attorneys can locally upload their patent or check existing submitted patents:



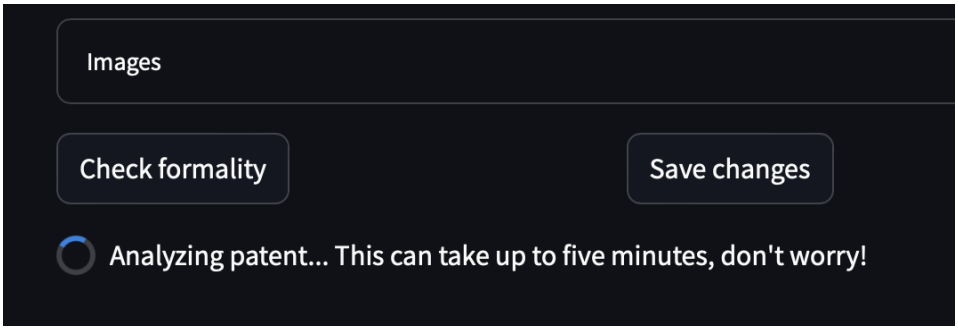
- They can then edit the prepopulated patent (or create a new one from scratch):



- After that, patent attorneys can check the patent for formality errors:



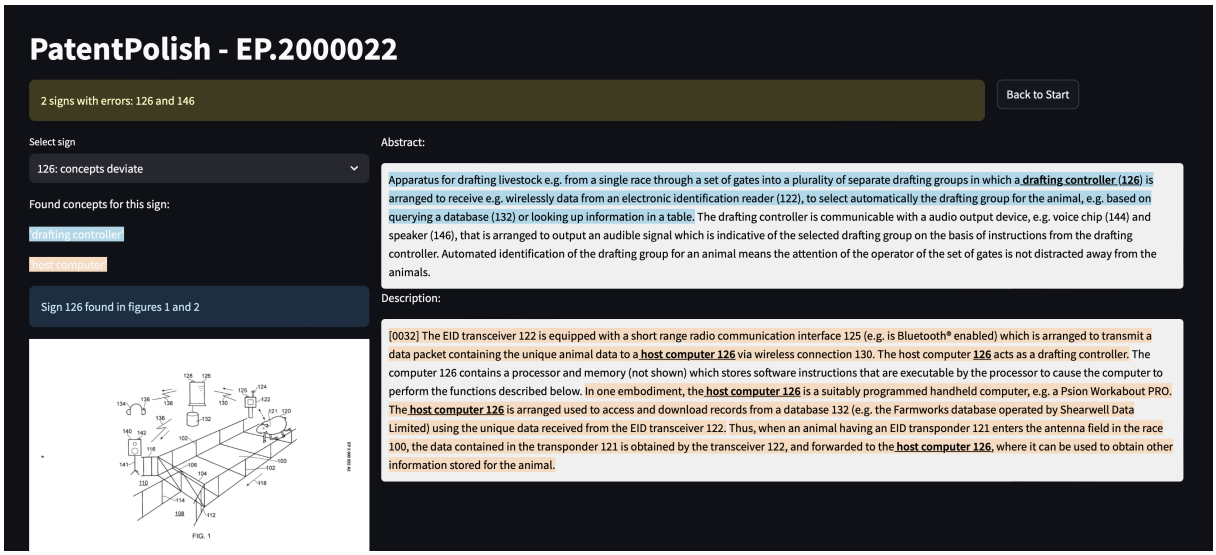
- AI will analyse the patent by reading out reference signs in figure and reading out reference signs in text (plus their conceptual meaning in the text)



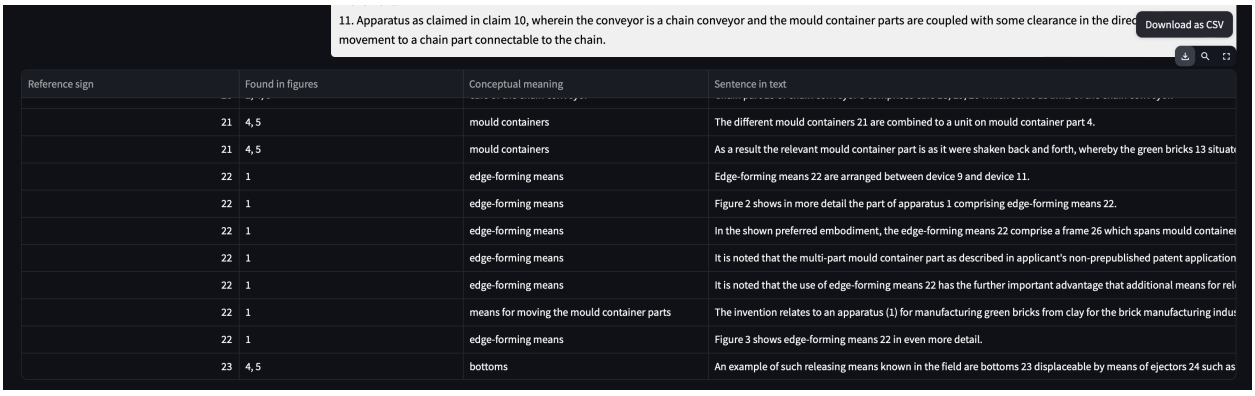
The AI findings are used to identify three abnormalities:

- reference sign only in images
- reference sign only in text
- mentions of reference sign in text have different meanings

- The results of the AI are displayed such that it is transparent and easily checkable what the AI found and where:



- The patent attorneys can also download a csv of all the found reference sign occurencies and then continue working with that or edit it in the case of mistakes:



Reference sign	Found in figures	Conceptual meaning	Sentence in text
21	4, 5	mould containers	The different mould containers 21 are combined to a unit on mould container part 4.
21	4, 5	mould containers	As a result the relevant mould container part is as it were shaken back and forth, whereby the green bricks 13 situat
22	1	edge-forming means	Edge-forming means 22 are arranged between device 9 and device 11.
22	1	edge-forming means	Figure 2 shows in more detail the part of apparatus 1 comprising edge-forming means 22.
22	1	edge-forming means	In the shown preferred embodiment, the edge-forming means 22 comprise a frame 26 which spans mould containe
22	1	edge-forming means	It is noted that the multi-part mould container part as described in applicant's non-prepublished patent application
22	1	edge-forming means	It is noted that the use of edge-forming means 22 has the further important advantage that additional means for rel
22	1	means for moving the mould container parts	The invention relates to an apparatus (1) for manufacturing green bricks from clay for the brick manufacturing indus
22	1	edge-forming means	Figure 3 shows edge-forming means 22 in even more detail.
23	4, 5	bottoms	An example of such releasing means known in the field are bottoms 23 displaceable by means of ejectors 24 such as

2.2. Considerations in Building the Solution

2.2.1. Frontend:

Design and Usability vs. Effectiveness and Efficiency

When developing the frontend, we prioritized usability and design to ensure that the tool could be used by individuals who may not be technically proficient. For example, we made sure that the interface does not require a command-line interaction, making it accessible to a broader audience. Additionally, uploading a patent must be simple and intuitive for the user.

Since AI is not yet perfect, we placed significant emphasis on making the AI results explainable and easy to verify by a human. The AI serves as a helper, but the final review should always involve human oversight. To ensure this, the tool displays all the reference signs that the AI finds, allowing users to confirm whether the AI missed any. The AI also reports where it found each reference sign in the figures, so the user can cross-check whether the reference sign is actually present in the figure. For reference signs that the AI did not find in the figures, the user is alerted, allowing them to manually verify this information.

Another critical feature of our tool is how it handles reference signs in the text. The AI returns all occurrences of each reference sign, but since manually searching through the text for specific sentences is tedious, we implemented a feature that displays different conceptual meanings of the reference signs in distinct colors. This allows users to instantly check the context and verify if the identified meanings are correct.

Proof of Concept vs. Usability

While designing the frontend, we were mindful of striking the right balance between creating a proof-of-concept prototype and ensuring usability. Our goal was to develop a simple yet functional prototype that users could test to determine if it is useful and relevant to their needs. At the same time, we wanted to avoid overcomplicating the UI before knowing whether the tool would be widely adopted or if the AI would perform well in practice. Building a complex UI for a tool that might not meet user needs would be inefficient. Therefore, the frontend had to be simple enough to code but robust enough for people to enjoy using it.

By keeping these considerations in mind, we believe we have achieved a good balance between design, usability, effectiveness, and efficiency. The current functionality and frontend design allow users to easily test the tool, and if it proves useful, we can expand its features further.

2.2.2. Backend:

We experimented with various approaches to solve the problem of identifying and analyzing reference signs in patent applications. While there are still several potential methods we could explore, the current approach we use has proven to be quite reliable.

Our approach consists of several key steps:

1. **Image Analysis**: We send the images to OpenAI, which returns an exhaustive list of all the reference signs found in the images, specifying in which figure each sign appears.
2. **Text Analysis**: We also send the text to OpenAI, which provides a detailed list of where it found reference signs, along with the complete sentence in which the reference sign was located and a conceptual meaning for each sign in the context of the text.
3. **Merging and Checking**: After obtaining these two lists, we merge them. We then check for formality issues by determining whether a reference sign is missing from either the text or the images. Additionally, we assess whether the conceptual meanings of the reference signs across different contexts are consistent. This step is also performed by ChatGPT, which has shown excellent performance in handling this task.

While this approach has proven to work well, we initially tried other methods. For example, we experimented with specialized object detection models like Molmo to extract reference signs, followed by using optical character recognition (OCR) tools to analyze the identified signs. However, we found that using foundation models, such as OpenAI's, resulted in significantly better performance. These foundation models seem to excel because they understand the broader context, and they can compensate for challenges such as image rotation, cropping, or other pre-processing issues through their world knowledge.

2.3. Code design

Throughout the development process, we focused on several key principles to ensure the scalability and reliability of our tool. We designed the code to be highly **extensible**, structuring it around modular components so that new features can be added incrementally without requiring major refactoring. By using **abstractions**, we ensured that the system is **transferable**, allowing for the integration of different models in the future as needed.

To guarantee **robustness**, we incorporated Pydantic for data type-checking and validation at every stage, significantly reducing the likelihood of unexpected states or errors in the system. This design also makes the tool **effective** from a maintenance perspective, as the foundation models we rely on continue to improve, ensuring seamless incremental updates over time.

Additionally, the structured output generated by the tool is **transferable** and can be easily parsed into machine-readable formats, such as JSON schemas, for further use. Finally, we kept **inference costs** low, making the solution not only practical but also cost-effective for frequent use.

3. Outlook

For the future, there are several improvements and expansions that could enhance the tool:

Regarding the reference sign functionality, there are still some edge cases and errors that need addressing, such as ensuring that every patent is fully readable. Currently, some patents still encounter formatting issues. In terms of explainability, using pointer models like Molmo to highlight image reference signs and displaying them would provide clearer visual feedback for the user.

Data security remains an important consideration. Presently, everything is processed via OpenAI, and while the enterprise version promises data confidentiality and that it is not used for training, some patent attorneys may still have concerns. A more trusted alternative could involve using European models like Mistral, which may instill greater confidence. The ideal solution, however, would be to deploy self-hosted, open-source models. While these are not yet as effective as proprietary ones, given the rapid pace of model improvement, it is likely that open-source options will become viable in the near future. The good news is that our code is designed to allow easy model swapping, meaning users can select another model, and the rest of the code will continue functioning seamlessly.

In terms of user interface enhancements, we envision features that could significantly improve usability. For example, when clicking on a reference sign, the tool could automatically scroll to the corresponding position in the text. Pressing a key like "Tab" could scroll to the next occurrence, while simultaneously displaying the relevant figures and highlighting the appropriate sign. Additionally, we could implement an interactive AI chat feature, where users could prompt the AI to re-run an analysis with additional instructions (e.g., "consider that X is also a reference sign"). This would make the system more adaptive and interactive, reducing the need for manual oversight.

Beyond the reference sign checker, we could expand the tool's scope to include the more complex formality issues discussed in the introduction. By covering a broader range of common patenting mistakes, the tool could provide even greater value to patent attorneys, helping them to minimize errors and maximize the scope and clarity of their patents.