Parsing Complex Documents for Free

A Deep Dive into Docling and its RAG Capabilities

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Yogesh Haribhau Kulkarni (PhD)

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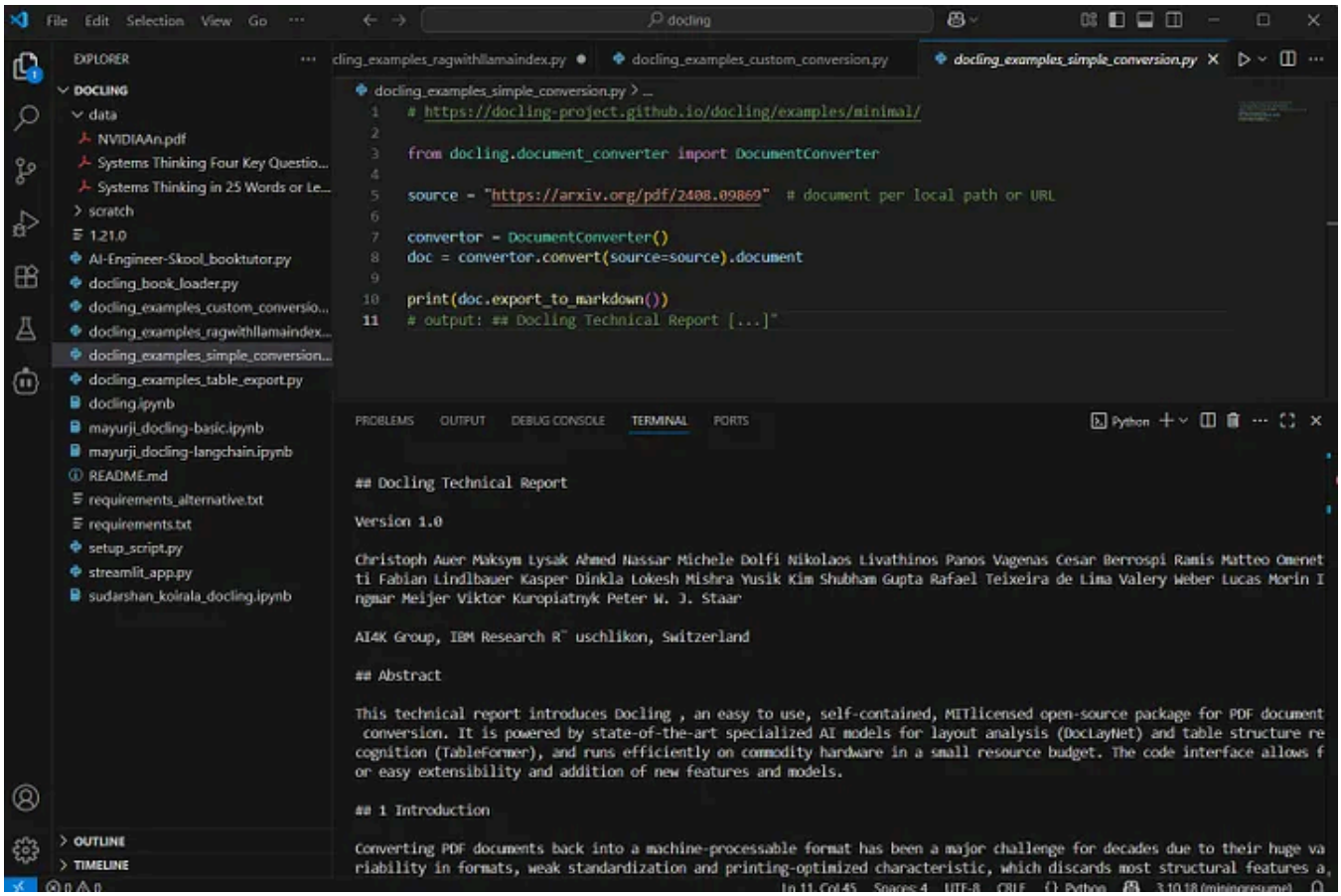
The ability to efficiently and accurately process complex documents is paramount in the age of large language models (LLMs) and AI-driven workflows. For non-trivial, enterprise-level LLM applications, Retrieval-Augmented Generation (RAG) on complex documents is a common scenario. The quality of the conversion from documents with complex layouts, tables, pictures, etc., to a processable text format is key to achieving good output. Docling is a powerful tool designed to simplify document processing across a multitude of formats, enabling seamless integration with the generative AI ecosystem. This blog post explores the architecture, key features, and practical applications of Docling, including a detailed look at how it can be used to build a sophisticated RAG system.

Core Features and Architecture

Docling boasts a rich feature set that makes it a standout choice for document AI tasks.

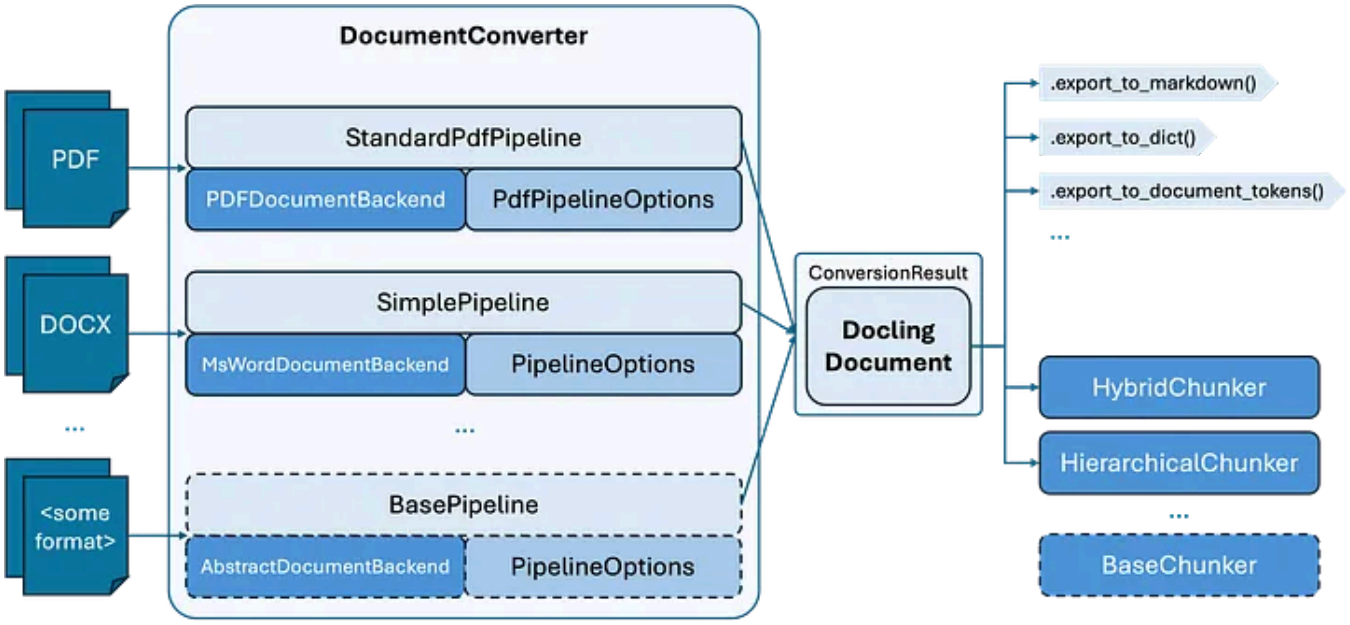
Key Features at a Glance

- **Multi-format Parsing**: Docling can parse a wide array of file types, including PDF, DOCX, PPTX, XLSX, HTML, and even audio and image files.
- **Advanced PDF Understanding**: It intelligently interprets PDF layouts, reading order, tables, and formulas, a critical feature for complex documents.
- **Unified Representation**: All processed documents are converted into a standardized `DoclingDocument` format, which simplifies downstream tasks.
- **Flexible Export Options**: Documents can be exported to Markdown, HTML, DocTags, and JSON, offering versatility for different use cases.
- **Local Execution**: For sensitive data or air-gapped environments, Docling can be run locally, ensuring data privacy.
- **Plug-and-Play Integrations**: It integrates smoothly with popular AI frameworks like LangChain, LlamaIndex, Crew AI, and Haystack.
- **Advanced OCR and ASR**: Docling includes extensive OCR support for scanned documents and Automatic Speech Recognition for audio files13.



(Author's own screenshot of Docling trials)

Architectural Overview



(Source: Docling documentation)

Docling's architecture is designed for modularity and efficiency. A document converter selects the appropriate backend for a given file format, and a pipeline orchestrates the conversion process. The result is a `DoclingDocument`, which can then be exported or segmented using serializers and chunkers, respectively.

At the heart of Docling is the `DoclingDocument`, a Pydantic datatype that provides a unified representation for all documents. This structure expresses text, tables, pictures, and hierarchical sections, distinguishing between the main body and "furniture" like headers and footers15. It maintains provenance information for traceability and includes layout details with bounding boxes, enabling structured analysis and processing.

The content is organized into categories:

- **Content Items**: These include text, tables, pictures, and key-value pairs.
- **Content Structure**: This comprises the main body, furniture, and groups for organizing content.

Reading order is preserved through a hierarchical tree structure, with items nested under parent elements and ordered sequentially.

Chunking and Serialization: Preparing Data for AI

For AI applications like RAG, documents need to be broken down into smaller, meaningful segments or “chunks.” Docling’s **Chunking Framework** abstracts this process, allowing for flexible segmentation strategies. It offers two primary implementations:

1. **Hierarchical Chunker**: This method uses the document’s inherent structure for element-based chunking.
2. **Hybrid Chunker**: This approach refines hierarchical chunks by splitting oversized ones based on token limits and merging undersized ones, making it highly effective for preparing data for LLMs.

Here’s a Python snippet demonstrating the `HybridChunker`:

```
from docling.document_converter import DocumentConverter
from docling.chunking import HybridChunker

doc = DocumentConverter().convert(source=DOC_SOURCE).document
chunker = HybridChunker()
chunk_iter = chunker.chunk(dl_doc=doc)
for i, chunk in enumerate(chunk_iter):
    print(f"=== {i} ===")
    print(f"chunk.text:\n{f'{chunk.text[:300]}'!r}")
    enriched_text = chunker.contextualize(chunk=chunk)
```

```
        print(f"chunker.contextualize(chunk):\n{f'{enriched_text[:300]}'!r}")
        print()
```

Similarly, the **Serialization Framework** converts `DoclingDocument` objects into textual formats like Markdown or HTML. It features a provider model that allows for custom serialization strategies, such as specifying a different table serializer.

Use Case: Building a RAG System with Docling and LlamaIndex

One of the most powerful applications of Docling is in building RAG systems. This example demonstrates how to create a RAG pipeline using Docling, LlamaIndex, ChromaDB, and HuggingFace models.

The pipeline performs the following steps:

- **Document Processing:** Docling intelligently parses a complex PDF, preserving its structure and metadata.
- **Node Parsing:** The `MarkdownNodeParser` from LlamaIndex converts the document into semantic chunks or nodes.
- **Vector Storage:** The text chunks are converted into vector embeddings using a HuggingFace model (`BAAI/bge-small-en-v1.5`) and stored in a ChromaDB vector store.
- **Indexing:** A `VectorStoreIndex` is created from the documents, making them searchable.
- **Querying:** A query engine, powered by a local language model (`microsoft/DialoGPT-small`), performs a similarity search to find relevant document chunks and generate a coherent response.

Here is the core code for building the searchable knowledge base:

```
# Setup the reader and parser
reader = DoclingReader()
node_parser = MarkdownNodeParser()
# Create the vector index
index = VectorStoreIndex.from_documents(
    documents=reader.load_data(SOURCE),
    transformations=[node_parser],
    storage_context=StorageContext.from_defaults(
```

```
            vector_store=vector_store
        ),
        embed_model=EMBED_MODEL,
    )

    result = index.as_query_engine(llm=GEN_MODEL).query(QUERY)
    print(f"Q: {QUERY}")
    print(f"A: {result.response.strip()}")
    print(f"\nSources:")
    print([(n.text, n.metadata) for n in result.source_nodes])
```

This architecture enables the system to answer specific questions by retrieving relevant passages from the source document and generating accurate, context-aware responses.

Extensibility and Confidence

Docling is also designed to be extensible through a **plugin system**, allowing developers to add new capabilities, such as different OCR engines. This is managed via the `pluggy` system with setuptools entry points. Furthermore, Docling provides **confidence scores** to assess the quality of document conversion. These scores, ranging from 0.0 to 1.0, help identify documents that may require manual review and allow for the adjustment of conversion pipelines. The scores are broken down into components like layout, OCR, and table extraction quality, providing a granular view of the conversion process.

Conclusion

Docling stands out as a robust and flexible solution for modern document processing challenges. Its ability to handle complex formats, preserve document structure, and seamlessly integrate with the generative AI ecosystem makes it an invaluable tool for developers building RAG systems, content management solutions, and other document-intensive applications36. By providing a unified representation, advanced chunking and serialization, and transparent quality assessment, Docling empowers organizations to unlock the full potential of their unstructured data.

References

Docling

Docling simplifies document processing, parsing diverse formats - including advanced PDF understanding - and providing...

docling-project.github.io

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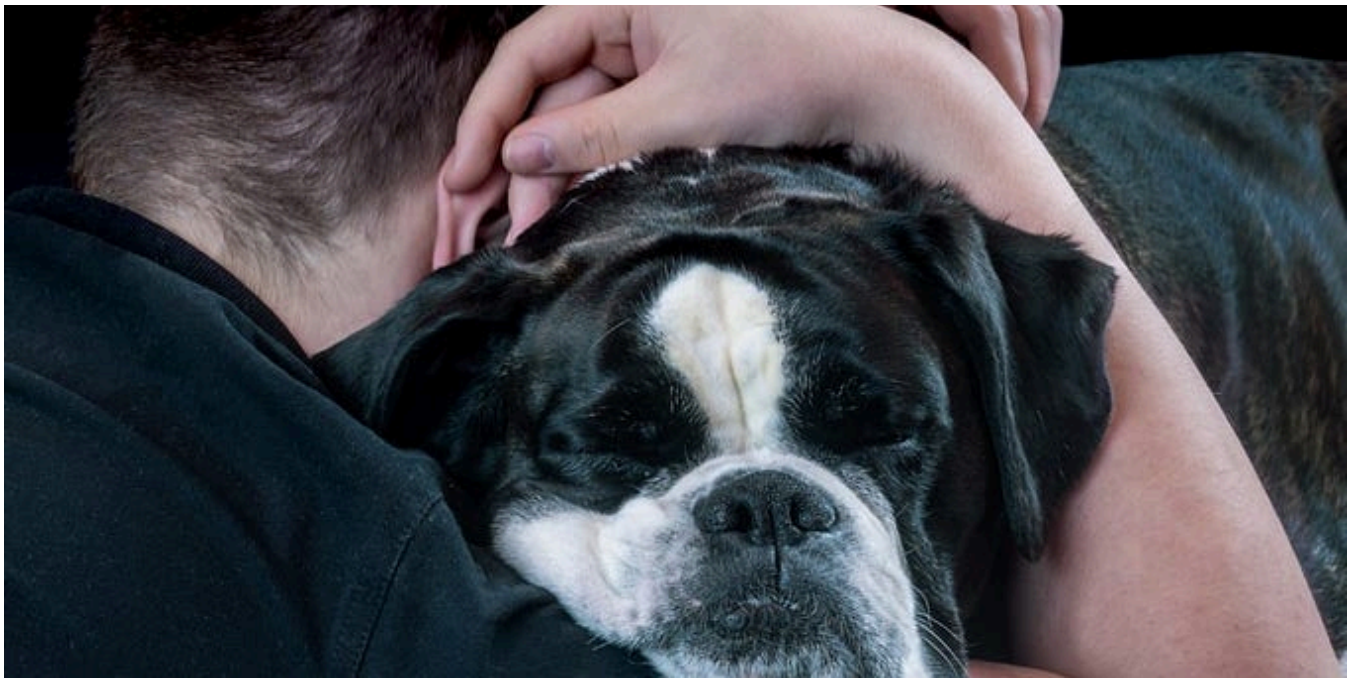

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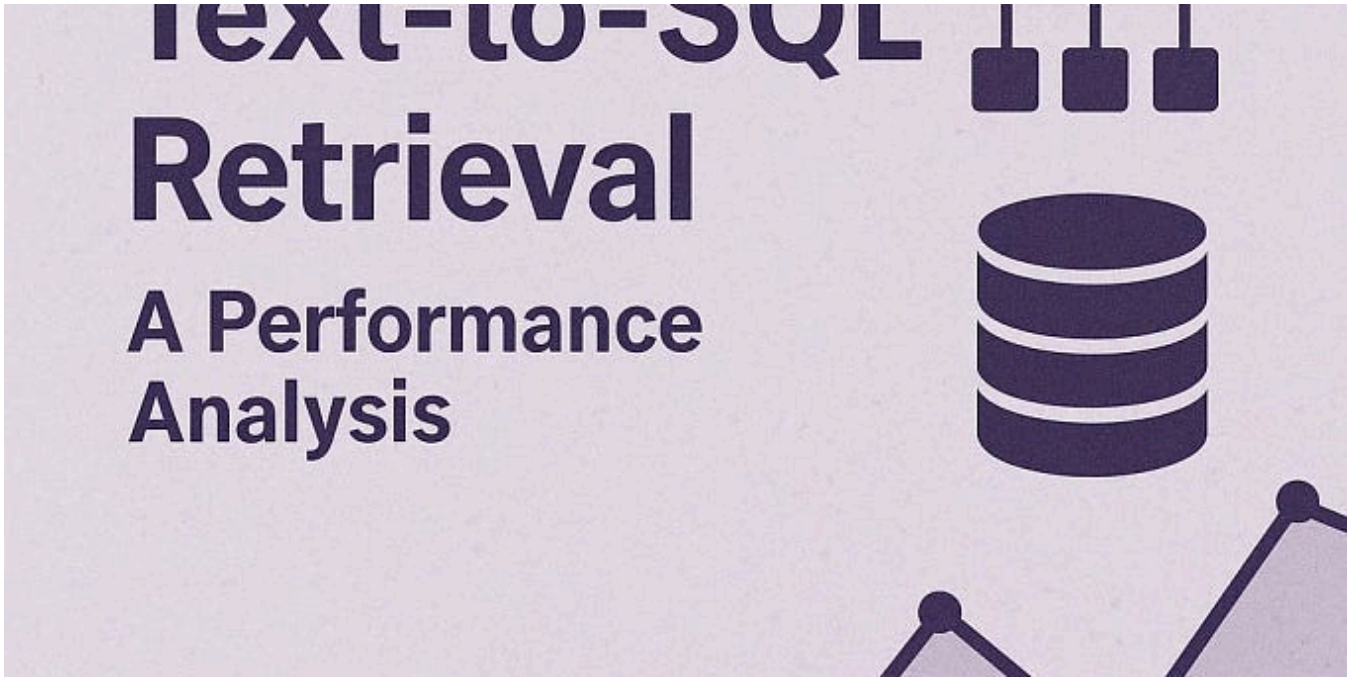

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