Retrieval-Augmented Generation (RAG) Explained

A language model, the kind of AI behind chat assistants, writes answers from patterns it learned during training. It does not automatically know a company's own documents, and its knowledge stops at the time of training. Retrieval-augmented generation, or RAG, fixes this by letting the AI look up relevant documents before it answers. The idea was described in 2020 by Patrick Lewis and colleagues, working at Facebook AI Research and other institutions. We can follow four parts: the problem it solves, how it works, its benefits, and its limits.

1. The Problem RAG Solves

A language model learns from a large collection of text during training, and afterwards its knowledge is fixed. So it may be out of date, and it cannot know private material such as a company's policies. When it lacks the facts, it can still produce a confident but wrong answer, which people often call a hallucination. RAG addresses this by giving the model the right information at the moment of the question.

Example: A closed-book exam depends on memory alone, and memory can fail. Applying The Problem RAG Solves, an open-book exam lets the student look up the facts before answering.

At work: Samer asks a chat assistant how many days of leave his company gives. Applying The Problem RAG Solves, he notices that the answer sounds sure but is generic, because the model has never seen the company's policy. He decides that the assistant needs access to the policy document.

2. How RAG Works

First, the documents are split into small pieces, and each piece is turned into a list of numbers, called an embedding, that captures its meaning. These are stored in an index, often called a vector database. When a question arrives, the system finds the pieces whose meaning is closest to it. It then adds those pieces to the prompt, and the model writes its answer using them. Good systems also show which sources were used.

Example: A librarian receives a question about local history. Applying How RAG Works, the librarian first finds the most relevant pages and then writes the answer from them, naming the books.

At work: Samer's team adds the leave policy to a RAG assistant. Applying How RAG Works, the system splits it into pieces and stores them in an index. When Samer asks about leave, the assistant finds the right paragraph and answers from it.

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3. Benefits

RAG lets an AI answer from our own, current documents instead of only its training. When a document changes, we usually update the index, so there is no need to train the model again. Answers can point to their sources, which makes checking easier. It can also help keep private material under control, because we decide which documents the system may search.

Example: A shop assistant checks the latest price list before answering a customer. Applying Benefits, the answer is current, and the assistant can show the list.

At work: Samer's HR team updates the leave policy. Applying Benefits, they refresh the index without training a new model. The assistant now answers with the new rule and shows the paragraph it used.

4. Limits and Good Practice

RAG is helpful, but it is not magic. If the search step finds the wrong pieces, or the documents are outdated or unclear, the answer will suffer. The model can still misread or add details, so important answers should be checked against the sources. Access rights also matter, because people should only receive information they are allowed to see. It is wise to test the system with real questions before relying on it.

Example: A traveller uses an old map. Applying Limits and Good Practice, a careful traveller checks it against the street signs.

At work: Before launch, Samer tests the assistant with twenty real questions. Applying Limits and Good Practice, he checks each answer against the cited paragraph. He finds one outdated document and removes it.

Conclusion

In summary, retrieval-augmented generation lets an AI look up relevant documents before it answers. It was described by Patrick Lewis and colleagues in 2020, and it is now a common way to build assistants that use their own knowledge. It helps with current and private information, and it can show its sources. It still depends on good documents, good search and human checking.

Sources

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