

News in focus

researchers. “I was not aware that Chinese academia was doing that kind of big project,” says computer scientist Masashi Sugiyama, director of the RIKEN Center for Advanced Intelligence Project in Tokyo. “That was a big shock to me.”

Building a Chinese bot

ChatGPT is not available in China. But that’s not the only reason to build local alternatives. Chinese-oriented LLMs produce outputs that better reflect the needs and preferences of people in China, says Tang – including, say, nation-specific financial or education information.

He gives the example of training a language model on a Chinese social-media app rather than a Western one. “WeChat basically knows more about the people from China than Snapchat,” he says. Models that are tailored to different languages avoid “oversimplifying or neglecting the specific characteristics of certain languages and cultures”, says Adina Yakefu, a community lead at open-source language-model platform Hugging Face, who is based in Paris.

To generate human-like responses to inputs, LLMs learn statistical correlations between words by processing billions of sentences, usually scraped from the Internet. Chatbots are further optimized for conversation using feedback from human trainers. ChatGLM’s developers trained it specifically on Chinese examples, and used Chinese-speakers to provide feedback (Z. Hou *et al.* Preprint at arXiv <https://doi.org/mxhm;2024>).

The Chinese data came from the Internet and some were bought from companies, says Tang. But there’s a lack of publicly available data sets in Chinese to train models, says Tiezhen Wang, an engineer at Hugging Face in Haikou, China.

There are other challenges in building non-English LLMs. To ease analysis, most language models break down text input into chunks known as tokens. But Chinese does not use spaces to separate words, which complicates tokenization, says Wang. However, Tang says that the tokenization methods used for ChatGLM are “almost the same” as those for English-language AI models.

At ICLR2024, Zhipu AI shared data claiming that the highest-performance version of ChatGLM’s underlying model, GLM-4, comes within 90% of the scores achieved by OpenAI’s formidable GPT-4 model on several benchmarks. Those include tests of general knowledge, common sense and mathematics. ChatGLM also beats GPT-4 on a benchmark of optimization of LLMs to Chinese. Tang’s team will publish a tech report on GLM-4 as a preprint “very soon”, he says.

“I am quite impressed that they have achieved on-par performance with GPT-4,” says Yizhou Sun, a computer scientist at the

University of California, Los Angeles.

A version of ChatGLM is available for public use through its website, with Chinese and English interfaces. Some GLM products – including the earlier GLM-130B base model (A. Zeng *et al.* Preprint at arXiv <https://doi.org/mxhp;2024>) and the ChatGLM-6b chatbot – are open source. This means anyone can download them and train them to suit specific applications, and scientists can inspect the underlying code to understand how it works.

ChatGLM-6b has been downloaded 13 million times, says Tang. The model uses six billion ‘parameters’ – the components that capture the statistical correlations between

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words – and is the smallest of the ChatGLM chatbots. But the inner workings of the GLM-4 model and the larger versions of ChatGLM, which have up to 130 billion parameters, are closed, like those of ChatGPT and GPT-4.

Dozens of other LLMs are being developed in China. More than 100 AI language models were released in there in 2023, says Yakefu. “We call it ‘battle of the 100 Models,’” she says. Tech giants Baidu and Alibaba have their own AI chatbots, for example.

LLMs in China are subject to regulations specifically designed for generative AI systems that came into effect in the country last August. They state that the models must “adhere to the core socialist values, and shall not incite subversion of state power” and must “take effective measures to improve the

transparency of generative artificial intelligence services and improve the accuracy and reliability of generated content”, among other things.

Yu compares the Chinese regulations to efforts to make AI systems safe in other countries. “In China, there are certain values the whole country holds,” he says. “In any society, there are some topics that people won’t talk [about] – every society has this kind of forbidden part.”

General intelligence

Tang is focused on making ChatGLM and GLM-4 even more capable. He likened the current system to a “brain in water” because it is not able to interact with the world physically. Giving AI systems human-level capabilities when it comes to a wide range of tasks – a milestone known as artificial general intelligence, or AGI – will require them to be embodied in the world, he said. Could ChatGLM be the first AI system to achieve AGI? “I have no idea,” says Tang. “I hope we are the first, but we are competing with all the other people.”

How close computer scientists are to developing AGI – and whether LLMs will be the technology to deliver it – is a topic of fierce debate. So is whether AGI is even desirable, given that super-intelligent AI models could pose a threat to humanity. “AGI is not a word you throw around,” says Yu.

AGI aside, Yu says that AI systems could help to address grand challenges such as global warming. He says China is investing heavily in AI infrastructure and know-how. “We think we have a really good chance to optimize our whole industry with AI – and to do it well,” he says. “It is not only of benefit to the Chinese. If you can reduce the use of energy and emission of CO₂, it’s good for everyone.”

FOUND: LONG-LOST BRANCH OF THE NILE THAT RAN BY THE PYRAMIDS

Geological survey reveals the remains of a waterway that ancient Egyptian builders could have used.

By Freda Kreier

Stretching beneath the ground near the Giza pyramid complex in Egypt lie the remains of an ancient branch of the Nile River that might once have helped ancient Egyptians to build their monuments.

The highest concentration of pyramids

in Egypt can be found in a stretch of desert between Giza and the village of Lisht. These sites are now several dozens of kilometres away from the Nile River. But Egyptologists have long suspected that the Nile might once have been closer to that stretch than it is today.

Satellite images and geological data now confirm that a tributary of the Nile – which

researchers have named the Ahramat Branch – used to run near many of the major sites in the region several thousand years ago. The discovery, reported on 16 May (*E. Ghoneim et al. Commun. Earth Environ.* 5, 233; 2024), could help to explain why ancient Egyptians chose this area to build the pyramids (see ‘Ancient river’).

“The pyramids seem like pretty monumental work,” says Judith Bunbury, a geoarchaeologist at the University of Cambridge, UK. “But it’s less arduous if you can bring big stones up by boat rather than carrying them over land.”

Wandering waterways

For thousands of years, the Nile and its floodplain have provided food, agriculture and water to Egypt’s inhabitants. The majority of the country’s population still lives in the Nile basin.

But the river is prone to migrating, and in the past, populations have had to relocate to keep up. Over the past few hundred years, the Nile has moved several kilometres to the east, possibly owing to shifting plate tectonics.

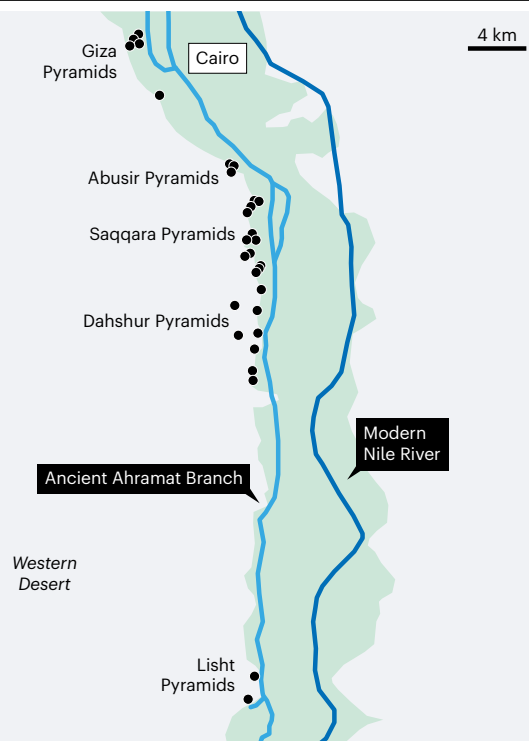
There is evidence that some of Egypt’s important archaeological sites do not have the same relationship to the river as they would have had at the time that they were built. There are remains of harbours and other such clues at sites between Giza and Lisht. But scientists have found it difficult to chart the scope or locations of these lost waterways.

While looking for traces of ancient water, a team led by Eman Ghoneim, a geomorphologist at the University of North Carolina at Wilmington, spotted what looked like a dried-up river channel several kilometres



ANCIENT RIVER

Many of Egypt’s pyramids might have been built along a branch of the Nile River that enabled the transport of building materials. The ancient waterway has since dried up and been buried by sand, but traces of the riverbed remain.



west of the Nile. The channel ran for around 60 kilometres through agricultural areas and had a similar depth and width to the modern Nile.

To investigate whether the channel could be part of an ancient river bed, the researchers collected core samples of sediment from the channel. Beneath the wet mud of the fields, they found an layer of gravel and sand consistent with that of a river bed. Combining these sample data with satellite imagery allowed the

team to map the branch’s location. They found that it would have flowed past more than 30 Old- and Middle-Kingdom pyramids dating from between 2686 to 1649 BC – thus the decision to call it the Ahramat Branch, using the Arabic word for pyramid.

The Ahramat “connected all these different pyramid fields”, says Suzanne Onstine, an Egyptologist at the University of Memphis in Tennessee. “Their valley temples and causeways all oriented exactly to where the water would have been.”

Riverside sites

Researchers have long debated the significance of the pyramids’ locations. The waterway running right past them could have been an important factor, because it would have provided a convenient method for builders to transport materials to the sites.

This theory aligns with documents from the era, which state that building materials were brought in by boat, says Bunbury.

Eventually, the movement of the Nile and sand blowing in from the Sahara Desert would have caused the Ahramat Branch to dry up and become unnavigable. Today, only a few stray lakes and channels remain where the major branch once ran.

But knowing the ancient river’s location provides a blueprint that archaeologists can use to try to uncover more ancient Egyptian settlements, says Onstine. And the finding that Egyptians were probably using boats rather than land transportation to move materials to build the pyramids hints that they were “a lot more pragmatic than perhaps we realized before”, says Bunbury.



The Red Pyramid at the Dahshur necropolis was built more than 4,500 years ago.