

and closely related areas would reside on the same continent. Teachers might say: 'Let's look at the new research frontier in sector F5'. Students could say: 'My mom works over there'."

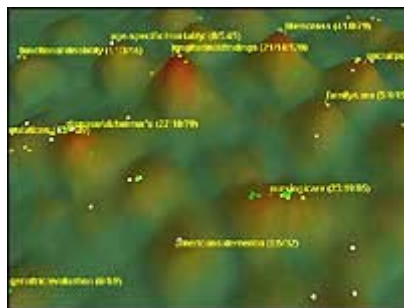
Data landscapes

Researchers maintain that the very nature of knowledge is different in the digital age because information held on computers can be cross-referenced and linked.

That opens new possibilities and presents new problems of extracting meaningful and relevant information from largely unorganised data collections.

"Today, almost all of us access knowledge in ways vastly different from those used for hundreds of years," says Richard Shiffrin, also of Indiana University.

"The traditional method involved books, reference works and physical materials on library shelves, most of which had been verified for accuracy by one or another authority. Now, we sit at computers and cast our net into a sea of information, much of which is inaccurate or misleading."



Data on ageing research form a mountain range of information

Several of the papers in the PNAS describe ways to analyse article collections and map out new data landscapes that humans can view.

Some methods "read" scientific articles and use a deep understanding of the content as the basis for a map. Other methods use relationship networks between the articles, such as citation of other papers, as the basis for a map.

Scientific landscapes might have hundreds of possible dimensions, presenting a challenge in creating two- or three-dimensional maps.

Huge effort

The borders between maps may also contain useful insights, allowing scientists to view subjects in a multidisciplinary way.

For example, some researchers used the method to map the boundaries of an emerging biology-inspired research community within physics.

In another paper, they

showed that clusters in social networks can also be used to map scientific communities. A scientist may or may not be six degrees from Kevin Bacon, but Newman showed that scientists were about six co-authors away from any other scientist.

“ **Creating a map for all of science will require large-scale cyberinfrastructure** ”

Katy Börner, Indiana University


However, these borders, like the world's political boundaries, change over time.

One group of researchers devised a method that mapped, across a landscape of 1.8 million computer science articles, the scientific communities that evolved over the course of a decade.

"Creating a map for all of science will require large-scale cyberinfrastructure," Börner says.

"The endeavour will involve terabytes of data-publications, patents, grants and other databases-scalable software and large amounts of number-crunching power.

"Such computational effort is common in physics or biology but not in the social sciences. However, maps of science will benefit every field."

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