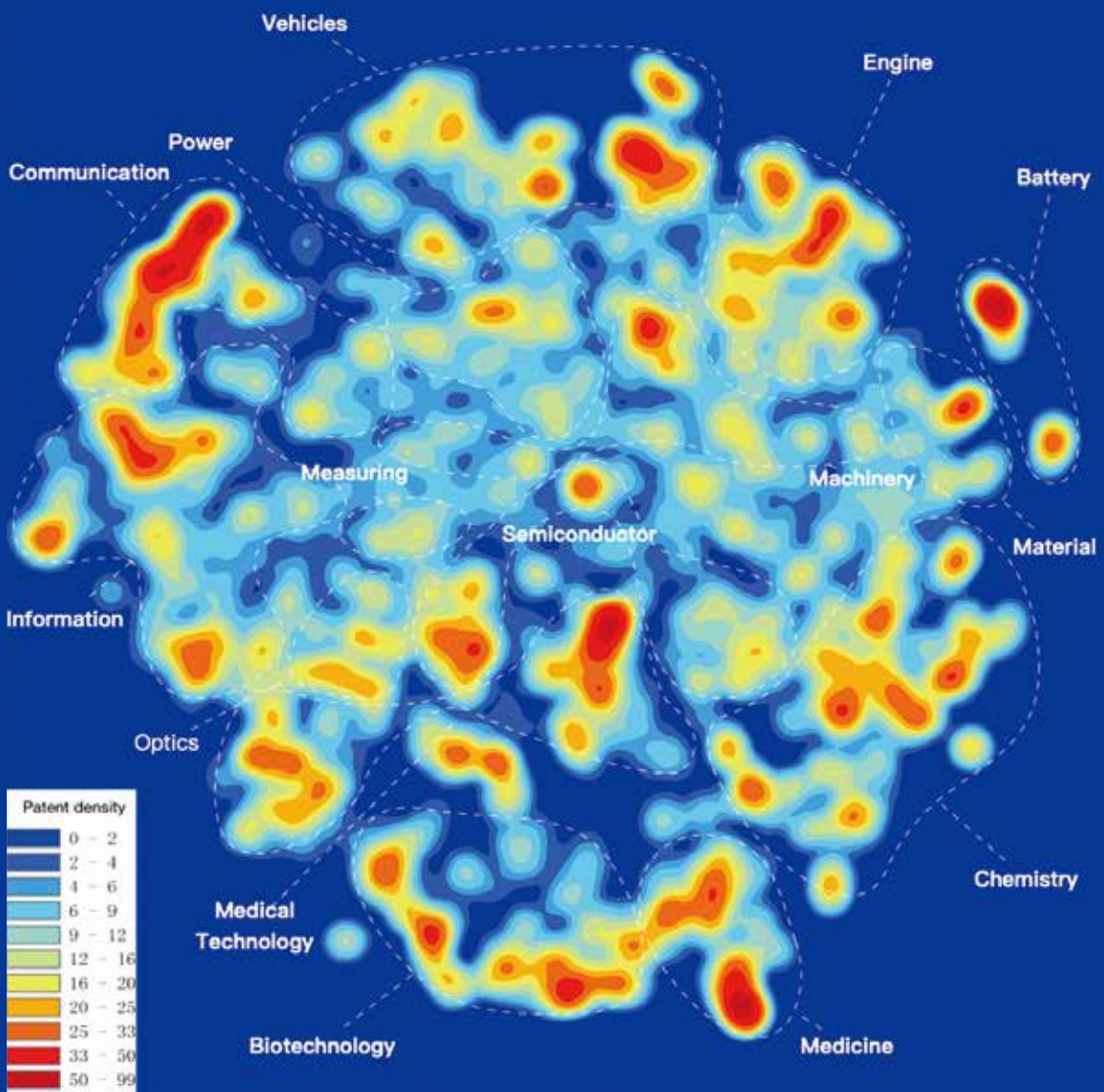
China's Technological Research Capabilities See a Steady Growth



Mapping technology structure (Image by CASISD)

China's technological research capabilities have seen a steady growth from 2014 to 2019, according to *2021 Technology Focus* and *Mapping Technology Structure 2021*, two reports released on June 4 by the Institutes of Science and Development, Chinese Academy of Sciences (CASISD).

The purpose of the reports, as introduced by Prof. PAN Jiaofeng, President of CASISD, is to describe the current global technological landscape as it is, hence enabling experts and policymakers to intuitively observe the developments of frontier technologies, and to allow science and technology better serve the economy.

To meet this end, CASISD researchers built a database for global technological focuses, mapped out and interpreted technological structures, and comprehensively analyzed the revealed technological areas that have drawn worldwide attention. The research, introduced PAN, had been based on a special type of patent families, the triadic patents filed at the European Patent Office (EPO), the United States Patent and Trademark Office (USPTO) and the Japan Patent Office (JPO), for the same invention and by the same applicant or inventor. These families of patents are believed to be more valuable in technological as well as economic terms.

China's technology buildup is characterized by its contribution of 12,284 "triadic patents" within the period from 2014 to 2019, accounting for 4.5 percent of the global total, according to the reports. China ranked fourth in the world in terms of total number of triadic patents during the period, as revealed in the *Mapping Technology Structure 2021*, with communication and information technology being the nation's most technologically advantageous field.

Furthermore, China is the only country among the world's top six holders of triadic patents that is still experiencing relatively fast growth in this field, said Prof. WANG Xiaomei, a researcher from CASISD and a key author of the reports. However, she added, creating more high-quality patents is one of the major challenges for China.

Compared with other technological powerhouses such as Japan, the U.S. and Germany, China is noticeably behind both in diversity and total number of triadic patents. For instance, Japan held 91,618 such patents from 2014 to 2019, followed by the U.S. with 71,658 and Germany with 20,793.

"Medical technologies, biomaterials, machine tools and engine design are technological fields featuring high-quality patents," said WANG, "in which China needs considerable improvement to catch up with other major economies."

The release of the reports also highlights the role played by a novel method for technology structure discovery developed by WANG's team. The new method, according to the researchers, is able to reveal the landscape of technology innovations in a more unbiased and thorough way, compared to traditional methods.

For example, patent layout analysis, a common method using the patent classification system (IPC/CPC) for statistical analysis, fails to fit the needs in analyzing fields of industrial technology. Another method, the classical citation co-occurrence analysis, has shortcomings too. The new method might help experts overcome such drawbacks.

In their studies, the researchers used deep learning models to learn the line characteristics of patent texts, and trained a dedicated patent text feature extraction model. Using this model as a basis, they drew a panoramic patent structure map and form a patent technology hotspot database.

The report *2021 Technology Focus* selects the top 100 from the 7,375 technology focuses in the World Technology Focus database, based on data given by the World Intellectual Property Organization (WIPO). The selected focuses cover 32 technology areas falling in four technology divisions, namely electrical engineering, instrumentation, chemistry, and mechanical engineering. The report also provides a detailed interpretation for 32 key technology focuses chosen from the top 100.

So far, CASISD has produced a series of scientific and technological think tank outputs, such as the *Research Fronts* and the *Mapping Science Structure* based on the analysis of high-impact papers, as well as the newly released *2021 Technology Focus* and *Mapping Technology Structure*, based on the analysis of high-value patents.