

## Research on the Development Trend of Identity Authentication Technology on Internet: A View of Patent Analysis

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**Abstract.** The research explores the development trend of identity authentication technology on internets based on DII patent database. by patent analysis and text mining, we discuss technological hotspot, competition relationship and evolution trend of identity authentication technology on internet at the level of patent priority countries and patent assignees.

### Introduction

Identity authentication is a method for checking the user's validity and it is widely used in personal electronic products and on-line service systems. At present, with the rapid development of E-Commerce and E-Government service, identity authentication technology on Internet also gets becoming more attention [1,2,3,4]. For example, national government service platform of China has provided a unified identity authentication service for its system and mobile terminal [5]. Therefore, this article will discuss how to identity technological competition trend of authentication technology on internet in the world by patent analysis and text mining for supporting decision making.

### Research Framework

The research framework is followed figure1:

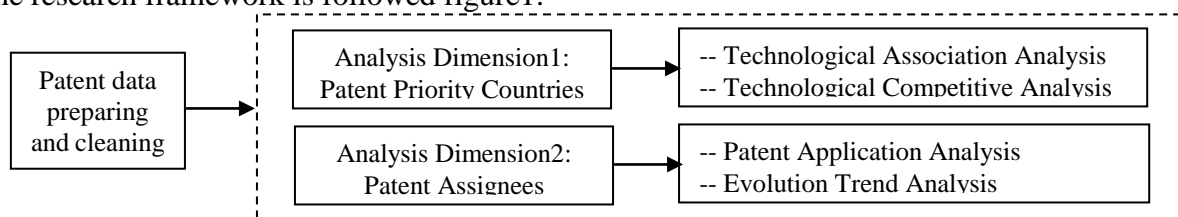


Figure 1. Research Framework.

### Data Preparing

Patent literature can reflect technology innovation activities directly and information analysts utilize patent datum to research the development trend of a particular technology field. In this article, DERWENT WORLD PATENT INDEX (DII) will be used that can provide the high-quality world patent database. Considering the technology field of identity authentication on internet, we confirm the retrieval keywords “user identity and internet”, “bot Distinguish” and “software robot Distinguish” to search the relevant patent data. There get 626 patent family records from 1963 to 2018 in DII database about identity authentication technology on internet. A patent family may include one or more patents that have the same patent priority. In this article, all analysis results will be calculated based on patent family or patent priority records.

## The Software of ITGInsight for Patent Analysis and Text Mining

For mining the patent datum and mapping the technology trends by patentometrics analysis, we would introduce the software of ITGInsight for analyzing and visualizing the patent analysis results. ITGInsight is a general science text visualization mining system, also known as a system for constructing and visualizing scientific research relationships [6,7].

## Competitive Analysis among Patent Priority Countries at the Technology Field of Identity Authentication on Internet

Patent priority is an important indicator for disclosing which country the original patented innovation comes from. In the article the information of patent priority countries are introduced to analyze the development trend, key technology and association of identity authentication technology on internet at the level of country.

### Distribution of Patent Families in Main Patent Priority Countries

Extracting and Calculating patent priority information from 626 patent family records, distribution of main patent priority countries is showed in table 1. The top five countries are China, the United States, South Korea, India and Japan, patent priority records are respectively 277, 229, 47, 12 and 10. Among these countries, the main original technology of identity authentication on internet come from China and the United States.

Table 1. Number of Patent Families of Top 5 Patent Priority Countries.

Top 5	Patent Priority Country	Number of Patent Family Records	Proportion(%)
1	China	277	44%
2	the United States	229	36%
3	Korea	47	7%
4	India	12	1%
5	Japan	10	1%

## Technological Association Analysis among Patent Priority Countries of Identity Authentication Technology on Internet

The text mining technology is introduced to analyze technological association among patent priority countries of identity authentication technology on internet and disclose technological competition among main countries. We use the ITGInsight software to visualize the analysis results followed as figure 2. In the figure 2, the size of nodes is proportional to the number of patent literatures, and the connection between two nodes is proportional to technological association strength between two countries.

Analyzing technological association strength, it is most intensive between China and the United States at technological field of the identity authentication on internet. The main technological association fields include flow diagram, identity authentication, and internet protocol. In addition, the association between the United States and Turkey also deserves to be mentioned, and main association field includes mobile device, laptop compute, and personal computer.

## Technological Competitive Analysis among Patent Priority Countries of Identity Authentication Technology on Internet

Patent map can reflect the technical competitive relationship directly. In the article, we use the ITGInsight software to visualize patent map of identity authentication technology on internet at the level of patent priority country. The result is followed as figure 3. In this patent map, each node indicates a patent family, and all the countries are labeled by different colors. The distance between two nodes indicates whether two technology is similar.

The contour map in the figure 3 describes main technological topics of identity authentication technology on internet. It can be indicated that each country has its focus field of identity authentication technology on internet. The Comparison of key technology among main patent priority countries of identity authentication technology on internet is as table 2.

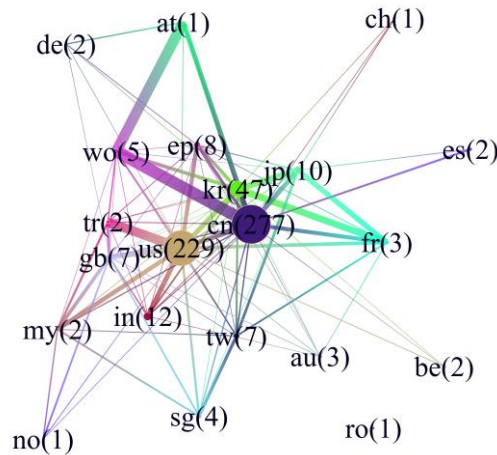


Figure 2. Association Relationship among Patent Priority Countries of Identity Authentication Technology on Internet.

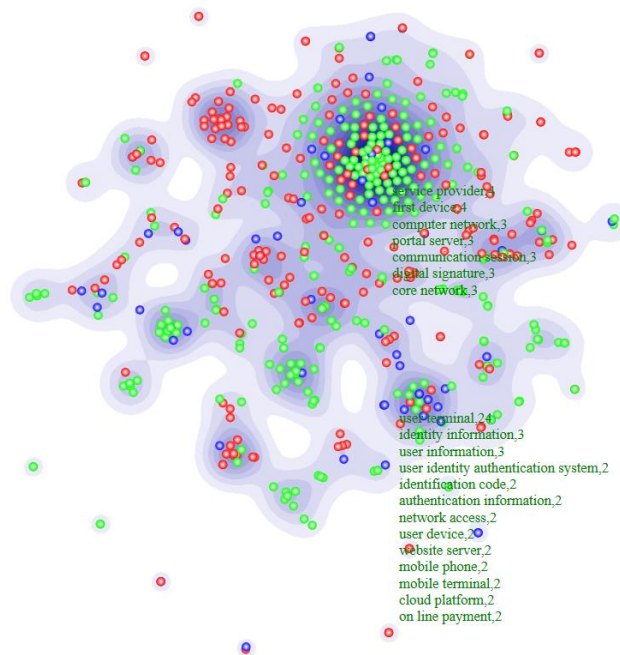


Figure 3. Technological Competitive Analysis of Identity Authentication Technology on Internet (Red Nodes: South Korea; Green Nodes: The United States; Blue Nodes: China).

Table 2. Comparison of Key Technologies among Main Patent Priority Countries.

Top 5	Patent Priority Country	Key technologies
1	China	flow diagram, identity authentication, internet protocol
2	the United States	mobile device, laptop computer, personal computer
3	Korea	user terminal, smart phone, identity information
4	India	user device, application server, authentication system
5	Japan	user terminal, mobile phone, storage unit

## Technological Competitive Analysis of Patent Assignees of Identity Authentication Technology on Internet

In the article, we would compare with the competitiveness of patent assignee to have an insight to the development trend of identity authentication technology on internet.

### Patent Application Analysis on Patent Assignee of Identity Authentication Technology on Internet

According to the patent assignee information in DII database, the amount of patent application are calculated and the results are as shown in table 3. Top five patent assignees are ZTE CORP (ZTEC-C)[China],INT BUSINESS MACHINES CORP (IBMC-C)[ the United States],AT & T INTELLECTUAL PROPERTY I LP (AMTT-C)[ the United States],ALIBABA GROUP HOLDING LTD (ABAB-C)[China],SAMSUNG ELECTRONICS CO LTD (SMSU-C)[Korea],and the records of patent family records are 12, 10, 9, 8, and 7 respectively.

Table 3. Number of Patent Families of Top 10 Patent Assignee.

Top 10	Patent Assignee	Number of Patent Family Records	Country of Assignee
1	ZTE CORP (ZTEC-C)	12	China
2	INT BUSINESS MACHINES CORP (IBMC-C)	10	the United States
3	AT & T INTELLECTUAL PROPERTY I LP (AMTT-C)	9	the United States
4	ALIBABA GROUP HOLDING LTD (ABAB-C)	8	China
5	SAMSUNG ELECTRONICS CO LTD (SMSU-C)	7	Korea
6	HUAWEI TECHNOLOGIES CO LTD (HUAW-C)	7	China
7	BANK OF AMERICA CORP (BAMC-C)	6	the United States
8	VERIZON PATENT & LICENSING INC (VEZN-C)	6	the United States
9	BLACKBERRY LTD (RIMR-C)	5	the United States
10	INTERDIGITAL PATENT HOLDINGS INC (IDIG-C)	5	the United States

### Evolution Trend Analysis on Patent Assignee of Identity Authentication Technology on Internet

While identifying the main patent applicants by patent family records, evolution trend of patent applicants would be analyzed by the key patent assignee in different year-distance. The result of evolution trend analysis is as shown as figure 4.

According to the figure 4, three patent assignees, ZTE CORP, INT BUSINESS MACHINES CORP, and AT & T INTELLECTUAL PROPERTY I LP, have been maintaining leading position in recent years. Early leading patent assignees include SAMSUNG ELECTRONICS CO LTD, VERIZON PATENT & LICENSING INC, and SPRINT COMMUNICATIONS CO LP. The main patent assignees in the middle of year-distance include ZTE CORP, AT & T INTELLECTUAL PROPERTY I LP, and INT BUSINESS MACHINES CORP. Latest active patent assignees include ALIBABA GROUP HOLDING LTD, ZTE CORP, and INT BUSINESS MACHINES CORP.

### Summary

Identity authentication technology on internet ensures the information security for various e-commerce and e-government service systems. As of November 2018, the total number of patent families of identity authentication technology on internet are 626 from DII database. By Association and Competitive Analysis, the hot patented technologies focus on mobile device, user terminal,

authentication server, mobile terminal, and client device. The leading five countries in this field include China, the United States, Korea, India, and Japan and patent assignees who come from China and the United States have taken a certain advantage in the field of identity authentication on internet in the world. For Chinese leading companies in this field need to strengthen the R & D investment and patent portfolio in the future.

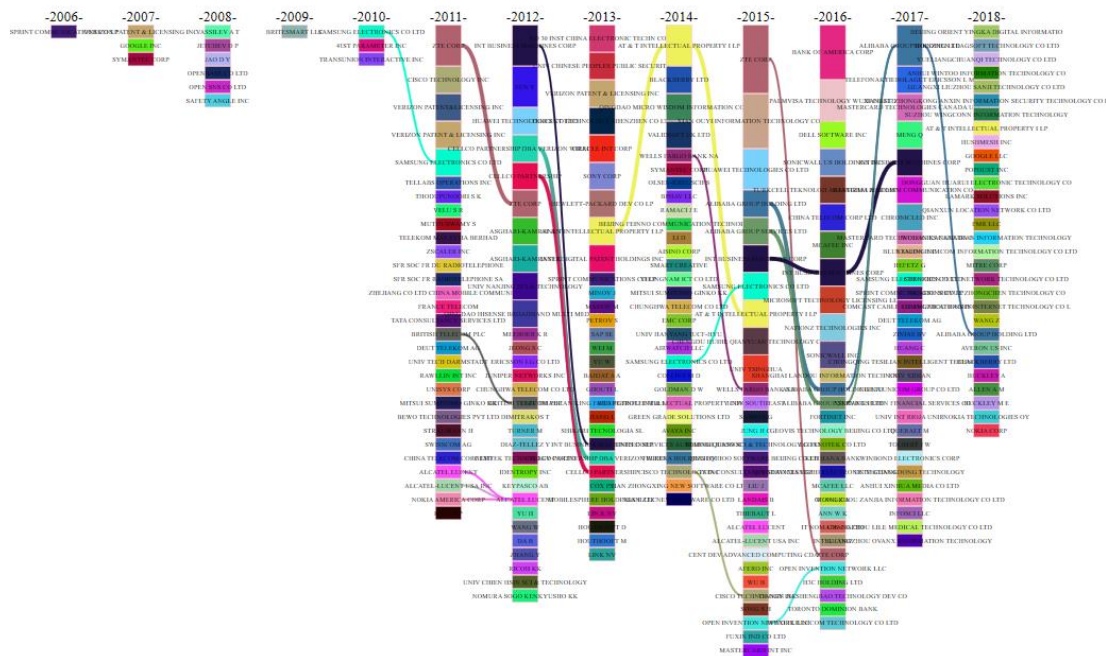


Figure 4. Evolution Trend on Patent Assignee of Identity Authentication Technology on Internet.

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