



# Correlation analysis of publication volume in abnormal behavior detection: A knowledge network perspective

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**Abstract** .his study employed CiteSpace software to analyze research outcomes related to abnormal behavior detection based on video surveillance. The primary focus was on the China National Knowledge Infrastructure (CNKI) and “Web of Science” (WoS) databases. The objective was to identify research trends and provide valuable references for advancing the exploration of this research direction. The following conclusions were drawn: (1) The published literature on abnormal behavior detection models and algorithms exhibits a consistent growth trend over time; (2) The results of authors, institutions, and countries (from the WoS and CNKI databases) that have conducted research in this field were statistically analyzed. (3) In the last two years, domestic journals key words focused on behavior recognition and classroom monitoring, while foreign journals prioritized feature extraction.

**Keywords:** Deep learning; Abnormal behavior detection; Video surveillance; Artificial intelligence; CiteSpace.

## 1 Introduction

Video surveillance systems are widely employed to monitor activities in both public and private settings, ensuring security in diverse environments such as public spaces, transportation hubs, and critical infrastructure [1]. Anomalous activity detection, involving identifying unusual or suspicious behaviors that deviate from normal patterns observed in a given environment, encompasses activities like trespassing, theft, and violence [2].

These surveillance systems leverage computer vision algorithms and machine learning techniques for anomaly detection [3,4], analyzing video streams by extracting features such as object trajectories, spatial relationships, and motion patterns. Deep learning, particularly convolutional neural networks and recurrent neural networks, has proven effective in detecting abnormal behaviors [5]. Recent research has highlighted the success of deep learning across various applications, including crowd behavior analysis, violence detection, and abnormal event recognition [3,6–9].

This study utilizes CiteSpace software to analyze abnormal behavior detection research based on artificial intelligence in the China National Knowledge

Infrastructure (CNKI) [10] and the “Web of Science” (WoS) [11] databases. The objective was to organize the research outcomes, identify hotspots and topics, and track the latest trends, providing a valuable reference for advancing the detection of abnormal behaviors.

## **2 Materials and Methods**

### **2.1 Sample Preparation**

The study employed CiteSpace 6.2.R3, a widely utilized software developed by Dr. Chaomei Chen, for data mining and visual analyses. CiteSpace is renowned for its capability to visually represent research hotspots, topics, and patterns through advanced data mining techniques, scientific metrology, and graph visualization [12].

The time span covered by our query extended from January 2013 to June 2023. Under the conditions of “(KY=Abnormal Behavior Detection or KY=Anomalous Behavior Detection) and (KY % ‘Video’+‘Surveillance’+‘Monitoring’),“ a total of 245 related research results were found in the CNKI database, including only journal and thesis citations. By combining this query with “(Abnormal Behavior Detection OR Anomalous Behavior Detection) (Topic) and (Video OR Surveillance OR Monitoring) (Topic)” to search the WoS core library, a total of 896 related research results were identified, including only journal and thesis citations.

### **2.2 Experimental Setup**

CiteSpace is a software tool that assists researchers in visualizing scientific knowledge maps and analyzing citation networks. It transforms extensive datasets into visual graphs, empowering researchers to recognize research trends and make well-informed decisions. Our analysis and discussions were conducted using CiteSpace 6.2.3 on a 64-bit Windows 7 system with 4 GB of RAM.

## **3 Results and Discussion**

### **3.1 Number of Publications**

An institution’s research capability can be partially gauged by its number of publications. Data mining was conducted on 896 relevant papers from the WoS database, focusing on the most recent decade. Figure 1 illustrates the article volume, with data for 2023 covering only six months. Overall, there was a consistent increase in the number of articles published annually.

In the CNKI database, data mining was performed on 245 relevant papers published over the past decade. Figure 2 shows the article volume, depicting fluctuations between 10 and 30 publications per year. Considering that the data for 2023 accounts for only the January–June period, it is anticipated that the total number of publications for all of 2023 will reach a new high.

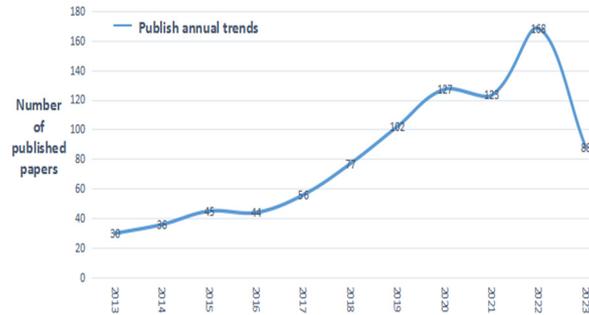


Fig. 1. Distribution of publications by year

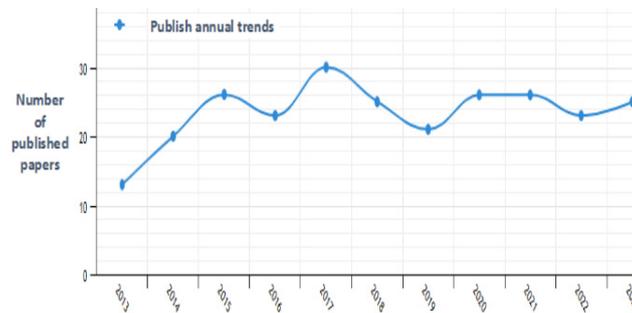


Fig. 2. Distribution of publications by year (CNKI data)

### 3.2 Author Analysis

Using CiteSpace software to analyze the authors, we can obtain an author's cooperation map from WoS, as shown in Fig. 3. The top four authors are listed based on the number of publications. There are 313 nodes in the graph, with the number of relationship nodes being 162. The study period was from 2021 to 2023. Evidently, while some scholars cooperated closely, the overall cooperation is less, with the research among most scholars being scattered. The author with the most publications was Bander Alzahrani, with five publications. The second-most published author was Reem Alotaibi, with four publications.

In Chinese literature, we examined the top author based on the number of published articles. The graph comprised 264 nodes with 134 relationship nodes. Among the authors, only 12 individuals published two papers, with limited collaboration among authors. However, with the advancement of artificial intelligence in abnormal behavior detection research, scholars have begun to collaborate more closely. Through data mining, we identified two closely collaborating scientific research teams. The largest cluster comprised 23 members with a silhouette value of 0.983. In 2023, Wu Fan published a paper titled "Semi-supervised group abnormal behavior detection model in subway application scenarios," while Shan Guoda's paper focused on "Research on automatic detection of abnormal behavior in videos." This information is showcased in Fig. 4.

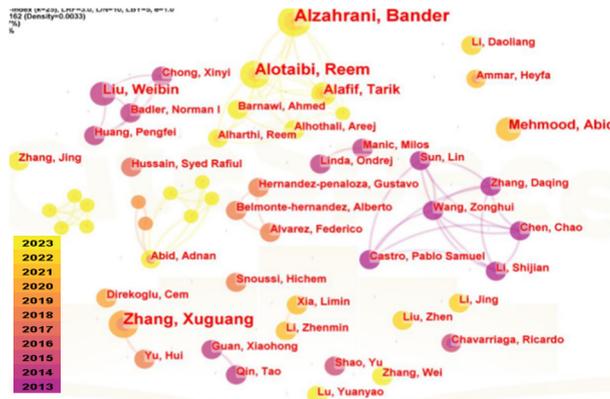


Fig. 3. Distribution of publications based on authors

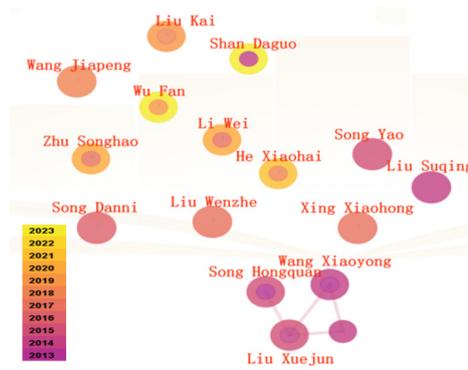


Fig. 4. Distribution of publications based on authors (CNKI data)

### 3.3 Research Institution Analysis

To a certain extent, the research capabilities of an institution can be gauged by the number of peer-reviewed papers its research teams publish. We identified the top seven organizations based on publication counts and highlighted those with more than seven citations. The graph includes 292 nodes, with 229 relationship nodes. The Chinese Academy of Sciences, Beihang University, and King Abdulaziz University were the top three publishing institutions with 19, 14, and 13 articles, respectively. This information is presented in Fig. 5.

The top three institutions in terms of published articles in CNKI were the Nanjing University of Posts and Telecommunications, the Southeast University, and the Huazhong University of Science and Technology. They published 12, eight, and six articles, respectively. The Nanjing University of Posts and Telecommunications began publishing in this field in 2013, making it the earliest institution. While all of the top five publishing institutions were universities, there were no joint publications. However, some universities, such as Sichuan University and Henan University, have

collaborated with other universities and institutions. This information is depicted in Fig. 6.

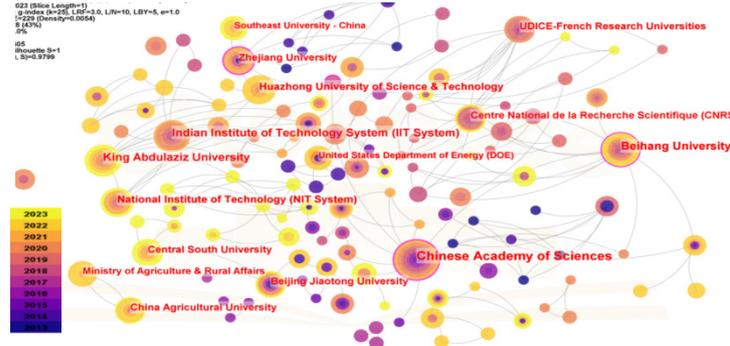


Fig. 5. Distribution of publications based on research institutions

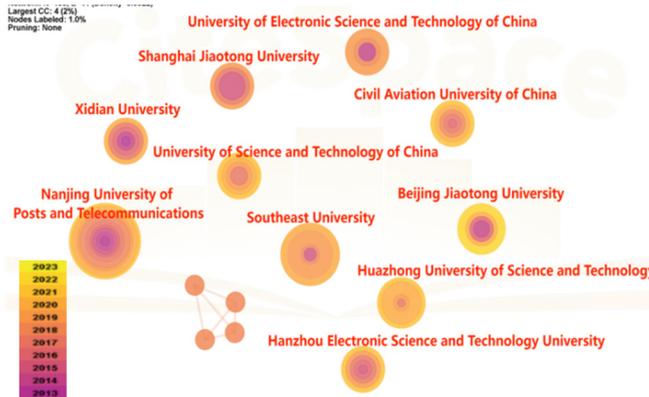


Fig. 6. Distribution of publications based on research institutions (CKNI data)

### 3.4 Research Country Analysis

To some extent, the number of papers published in a country can reflect the its research ability in the associated fields. The top ten countries, at a macro level, in terms of the volume of articles, are illustrated in Fig. 7. Notably, China, the United States, and India rank among the top three countries in terms of number of publications.



Fig. 7. Distribution of publications based on countries (WoS data)

### 3.5 Analysis of the research keyword co-occurrence

Keywords serve as indicators of the core perspectives and content within an article. Our analysis focused on keyword co-occurrence in research literature from various stages over the past 5 years. This analysis unveiled evolving research trends and advancements in the field of artificial intelligence for Abnormal Behavior Detection at each stage.

As illustrated in Fig. 8 below, the top 3 keywords with significant contributions over the past five years are presented. The figure clearly indicates that feature extraction has gained heightened attention in English journals, particularly over the last two years.

#### Top 3 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2018 - 2023
principal component analysis	2018	2.3	2018	2019	
neural networks	2019	3.46	2019	2020	
feature extraction	2020	3.29	2021	2023	

Fig. 8. Highlight contributing words from 2018 to 2023

As shown in Fig. 9 below, the top 3 keywords with notable contributions over the past five years are presented. The figure indicates that papers published in Chinese journals have emphasized behavior recognition and classroom monitoring fields, particularly in the last two years.

#### Top 3 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2018 - 2023
Key frame	2019	0.75	2019	2020	
Action recognition	2021	0.84	2021	2023	
Classroom monitoring	2021	0.56	2021	2023	

Fig. 9. Highlight contributing words in CNKI from 2018 to 2023

### 3.6 Field Investigation

Field investigations in Guangxi and Guangdong covered universities, companies, and residential areas. Interview insights revealed diverse usage. Universities Focus on access control.

Enterprises Prioritize access control, fire warnings, and detecting specific abnormal behaviors. Residential Areas Rely on video monitoring for real-time records.

## 4 Conclusion

Leveraging the CiteSpace visual analysis tool, the research characteristics and trends in abnormal behavior detection based on video surveillance were examined by analyzing research outcomes from the CNKI database and the core collection of the WoS database. The findings revealed the following insights: (1) The quantity of literature focused on abnormal behavior detection based on video surveillance exhibits a consistent upward trend over time; (2) In China, institutions with numerous research achievements include the Nanjing University of Posts and Telecommunications, the Southeast University, and the Huazhong University of Science and Technology; (3) Globally, the institutions with the largest number of publications are the Chinese Academy of Sciences, the Beihang University, and the King Abdulaziz University; and (4) China, the United States, and India stand out as the top three countries in terms of number of publications. (5) Highlight contributing words in the last two years indicate that domestic journals place more emphasis on the field of behavior recognition and classroom monitoring. Conversely, foreign journals have shown greater attention to feature extraction during the same period.

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