



SCIENTIFIC REPORT

TECHNOLOGY TREND REPORT

Research Trends in Social Networks and Their Use

An Analysis Using Academic Citations

With the spread of technologies such as the internet and smartphones, social networking services (SNS) play an active role in society. Because there are various definitions of SNS, the statistics differ depending on what is included in its definition, but according to one survey, 1.35 billion people worldwide were active monthly users of SNS in 2014. The total number of global internet users was 2.92 billion in 2014, so nearly half of these users are using SNS in some form or another.

The primary purpose of SNS is to facilitate communication between individuals, but SNS also contain widely variant and voluminous data, often referred to as “big data.” As a result, some researchers are investigating applications for purposes other than communication by extracting and analyzing the data they need from SNS. In fact, numerous companies are conducting market analyses and pursuing policies to reduce customer complaints using SNS data, and other companies are developing services for these purposes.

We expect to see an increased use of SNS data in the future, but we wondered what the current state of research and development is in this field. Therefore, we analyzed efforts in SNS-related research and development by conducting a cluster analysis, using academic citations for research that targeted SNS-related topics. The database for this analysis consisted of academic articles that were published in English and that included the term “social network” and other keywords such as “internet,” “web,” and “online” in their titles, abstracts, or keywords. We used Scopus—operated by the publisher Elsevier—to gather this data. There were roughly 11,000 relevant articles.

MACRO TRENDS IN SNS RESEARCH

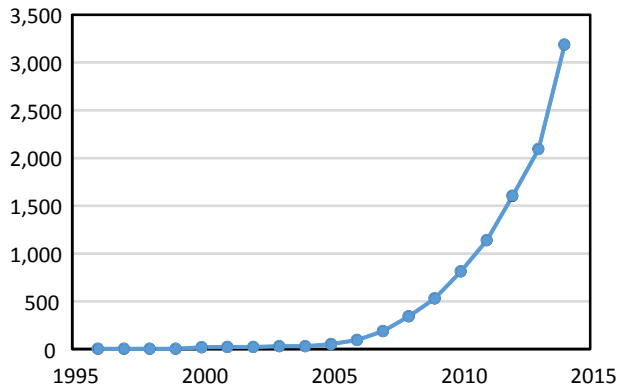


Figure 1 - Number of SNS-Related Articles

Figure 1 shows the number of research papers on SNS published over time. The number of research articles rapidly rose starting in 2006, with more than 3,000 articles published in 2014. Looking only at the trends in the numbers of articles, **it is clear that SNS is currently an active subject of research.** That said, this study is limited to an analysis of articles, but if we were to include the minutes from international conferences and other documents, there would be even more publications to analyze.

Turning to the countries in which the primary research institutions on SNS-related research are located, as Figure 2 demonstrates, **the US has an overwhelming lead in the number of articles published, followed by China and the UK.** Note that Japan is not even in the top ten in this field. While this may be due to the fact that research from Japan is published in the Japanese language, if we consider that China and South Korea—countries that also use Asian languages—have made the top ten, it is undeniable that Japan seems to be lagging.

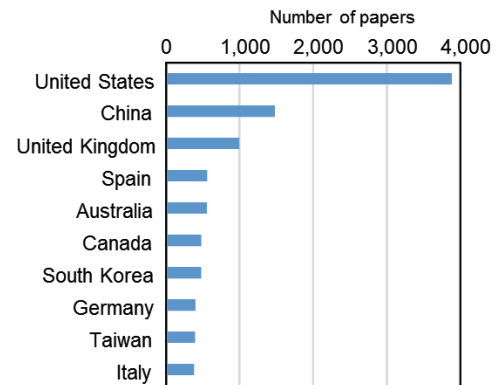


Figure 2 - Key Countries in SNS-Related Research

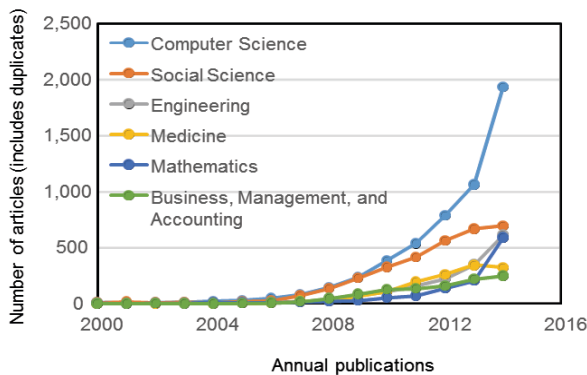


Figure 3 - Changes in the Number of Articles by Research Field

Figure 3 shows the changes in the number of articles published in the key research fields, using the academic journal field categories assigned by Scopus. Looking at these changes, we can see that some fields experienced rapid increases in the number of articles published since 2012, while other fields grew slowly. **The fields with rapid growth are computational science, engineering, and mathematics.** Meanwhile, the slowly growing fields are social science and medicine.

PANORAMIC VIEW ANALYSIS

Cluster Analysis of SNS-Related Articles

We conducted a cluster analysis of academic citations related to SNS, using titles and abstracts. We used tf-idf values to evaluate the feature quantity of documents gathered for our cluster analysis, which provides a visualization of this data based on the degree of similarity among documents. The results of this analysis are shown in Figure 4. The blue circles on the chart roughly show the locations of major research themes.

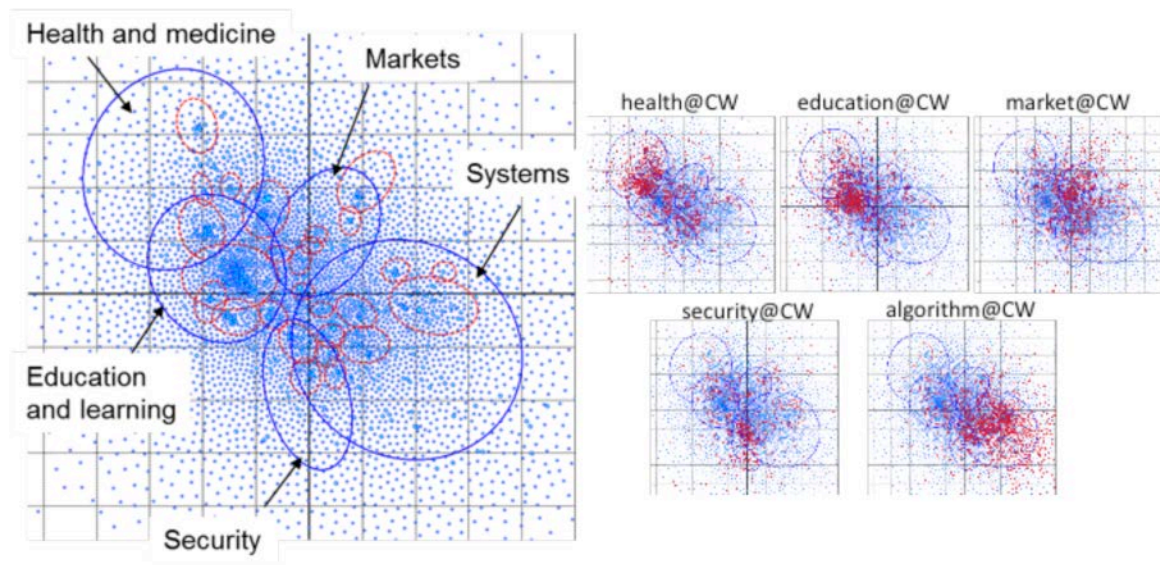


Figure 4 - (L) Cluster Analysis Results for SNS-Related Research; (R) Distributions of Specific Terms

In addition, clusters that include relevant specific terms—keywords deemed by machine processes to represent these documents—are shown marked in red.

The major research regions for SNS-related research are the region pertaining to applications in medicine and health, education and learning, and markets, and the region pertaining to systems, such as algorithms or security. Each of these research regions includes concentrated areas comprised of multiple articles of similar research. For instance, the research region for medicine and health consists of concentrated areas related to HIV, smoking, children's communication, and health information. Meanwhile, the research region for education and learning includes research pertaining to student education, libraries, and librarians, as well as research related to campaigns created by governmental policy. Figure 5 shows the detailed names we assigned to the results of our cluster analysis.

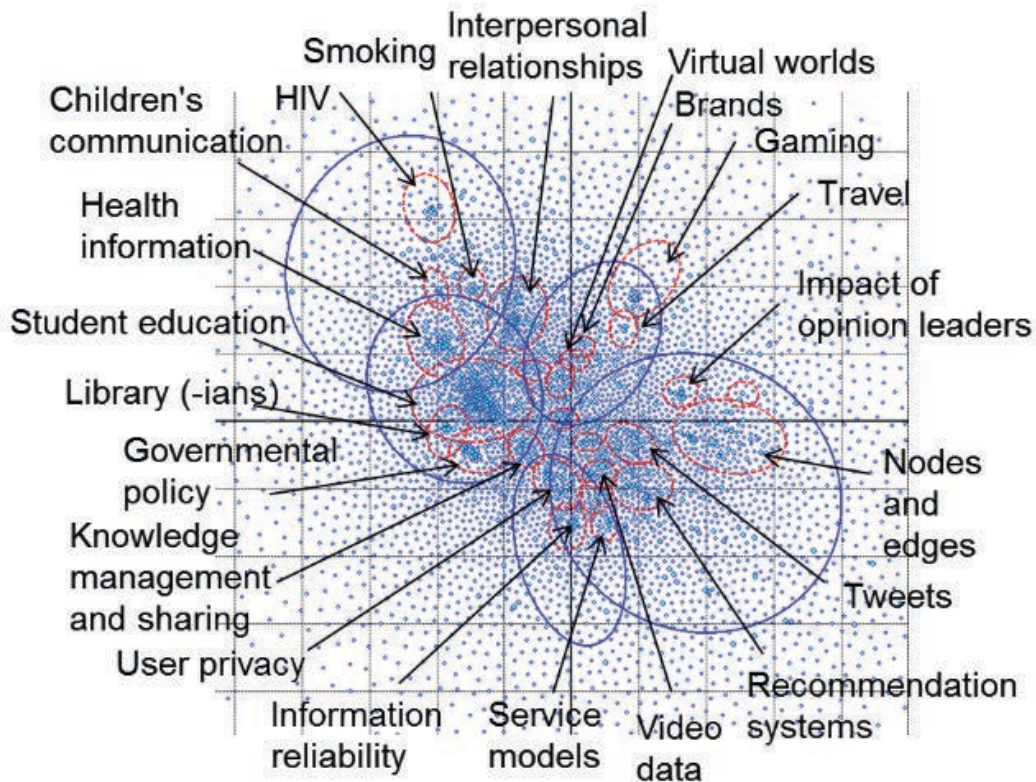


Figure 5 - Names Assigned to the Concentrated Regions in the Cluster Analysis

Main Regions by Country

We created visualizations of the focal regions of SNS-related regions in these key countries, as seen in Figure 6. This figure shows the cluster analysis results using a color contour map, with aggregations of the greatest number of research papers shown in red and declining degrees of density shown in yellow, green, and blue, in that order.

The USA

SNS-related research in the US is **broadly distributed**. Research is particularly concentrated in regions concerning student education, health information, and HIV.

China

For China, we find a special focus on **research fields related to systems**. Some research regions demonstrating high levels of activity include recommendation systems, service models, and the impact of opinion leaders.

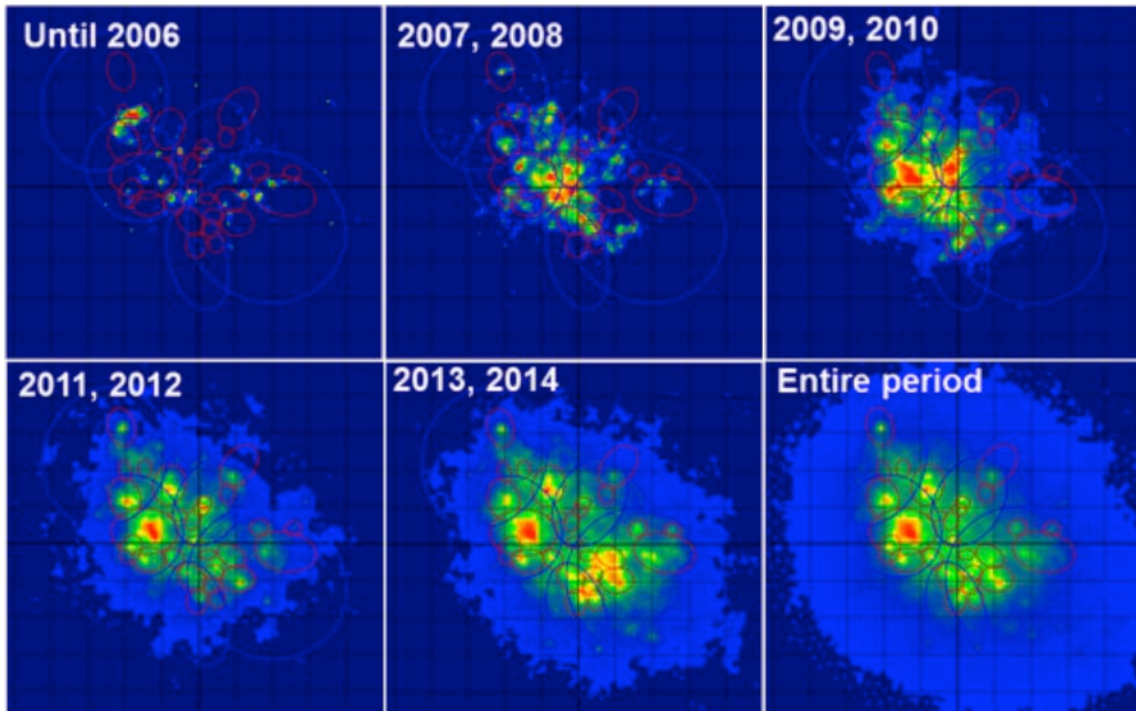


Figure 6 - Research Fields for Five Key Countries and Japan

The UK

In the UK, we find concentrations mainly in the **field of student education**. Otherwise, **health information-related research** has a relatively high number of publications.

Spain

Like the UK, Spain is also mainly conducting research related to **student education**. We also find much research on **tweets and recommendation systems**.

Australia

Australia conducts little systems-related research but has much research on **student education, health information, and alcohol**.

Japan

Japan has a relatively high rate of research on **tweets and on recommendation systems**.

However, it should be noted that this result was based on articles published in English-language academic journals.

Trends in SNS-Related Research

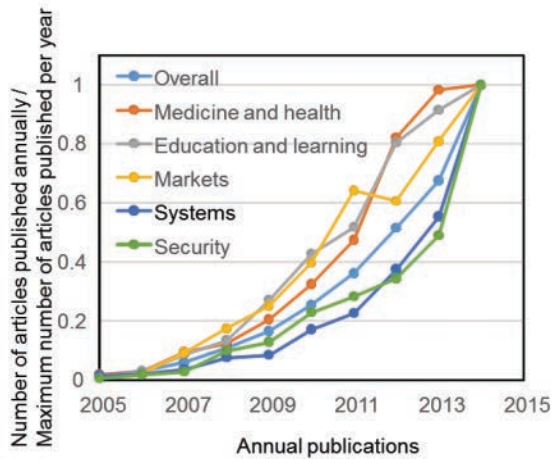


Figure 7 - Annual Changes in Key Research Fields

Figure 7 exhibits the annual changes in the number of SNS-related research articles published, according to the major regions shown in Figure 4. Note that we standardized the data using the maximum value of the number of articles published annually in each region. In addition, Figure 8 demonstrates the visualized results of the changes in research fields for two-year periods, per our cluster analysis, using a color contour map.

In terms of the changes in the research fields shown in Figure 7, we found that

research on medicine / health, education / learning, and markets was the first to increase, followed by research related to systems and security.

Looking at the cluster analysis results in Figure 8, the aggregations of research marked in red grew as time went on. Additionally, the relatively less dense research regions, shown in light blue, got bigger, indicating that the scope of SNS-related research grew.

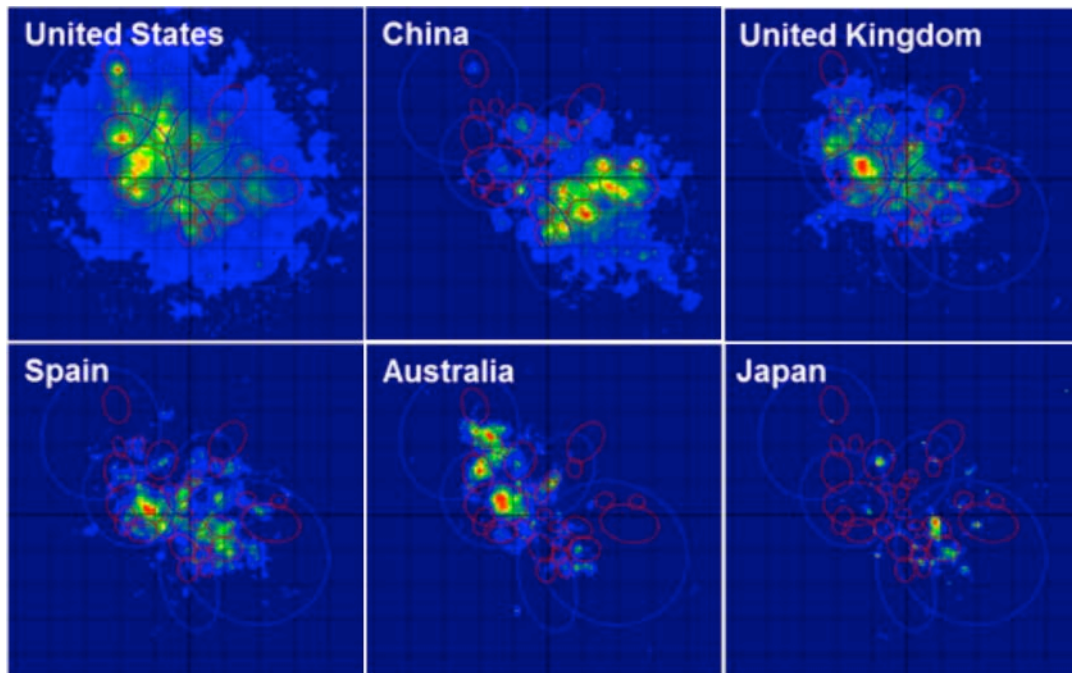


Figure 8 – Visualization of SNS Research Trends Using Our Cluster Analysis

If we look at more detailed changes in annual publications, prior to 2006, research was thinly, broadly distributed across the entire chart, with relatively high concentrations of research found in between medicine / health and education / learning. Then, in 2007–2008, many research papers were published on markets and business, found in the center of the cluster analysis. Later, in 2009–2010, regions related to education / learning were active. In 2011–2012, the volume of research in the market-related region declined comparatively (although it increased absolutely), while research concerning education / learning, health information, and interpersonal relationships increased. Lastly, in 2013–2014, systems-related research increased.

The visualizations of SNS research trends found in our cluster analysis, which are shown in Figure 8, demonstrate how research articles have accumulated, but they do not necessarily show the regions in which research is currently active.

Therefore, we extracted meshes for research that could potentially become active, based on our cluster analysis.

To extract these active meshes, we generated microscopic meshes (around the same size as microscopic concentrated regions) from our cluster analysis results, as seen in Figure 9, and rated each mesh according to the change in the number of articles over time.

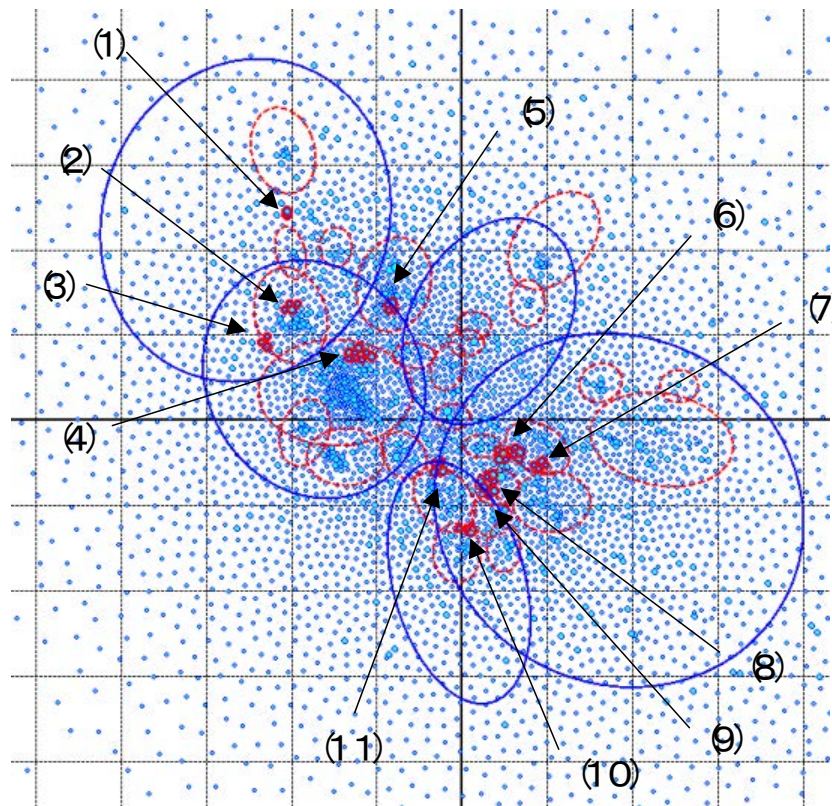


Figure 9 – Growth Ratings per Mesh (this is a representation)

Using the rating for all SNS research as a benchmark, the proportion of the number of articles published in 2010–2014 in contrast to the entire period was 0.768, while the rate of increase from 2010–2014 was 0.705. We extracted meshes for the regions in which research has been increasing in recent years, using regions that had a proportion of articles published in 2010–2014 greater than 0.8 (with more new articles) and a growth rate between 0.1 and 0.7 (a growth rate lower than average). Then, we limited our computation to meshes that include two or more clusters, meshes for 2014—the year with the most articles published, and meshes that consist of 10 or more articles, ending up with 25 compliant meshes. After visually confirming the changes in the number of articles in these meshes, we extracted 11 meshes in which we could see an increase in the number of articles. We used red to mark the clusters corresponding to the extracted active meshes in Figure 10.

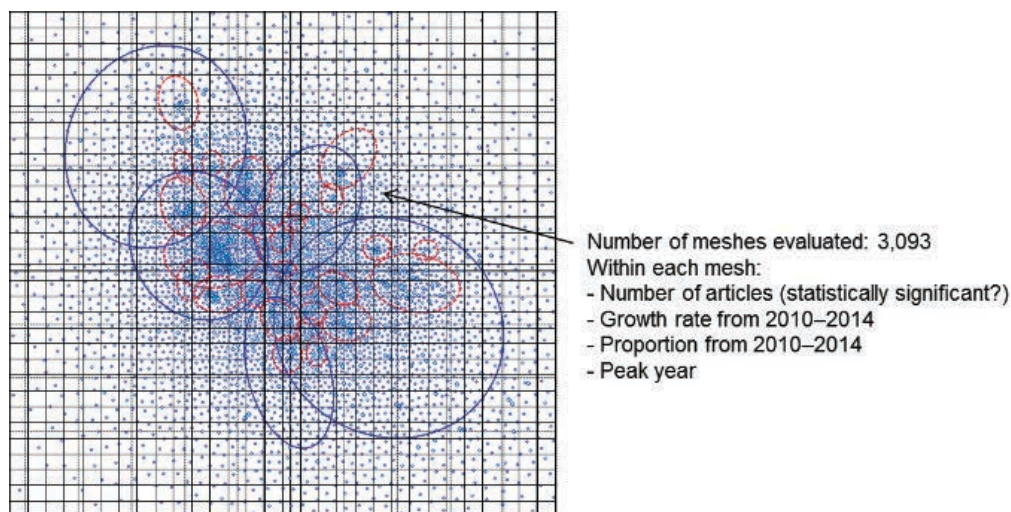


Figure 10 – Active Regions extracted using Mesh Generation

In the results of our ratings using mesh generation, **we see distributions across many regions, with the active meshes being mainly in medicine / health, education / learning, and systems-related research.** The active research themes extracted using this analysis are found below:

1. Bullying and cyberbullying
2. Searches for health-related information
3. Help-related information (particularly from nurses or other medical practitioners)
4. Relationship building among students (e.g., Facebook)
5. Models for SNS sites
6. Categorization and implications of topics
7. Analysis and detection of emotions
8. User behavior and associations with SNS
9. Video sharing and circulation
10. Cloud computing
11. SNS on mobile platforms

From among these active regions, we fit the changes in the number of articles in the mesh for research related to (1) “Bullying and cyberbullying” and (7) “Analysis and detection of emotions” using a growth curve approximation, as shown in Figure 11. **If current trends continue, we predict that research related to bullying will become the most active research theme in around 2017, while research related to the analysis and detection of emotions will become most active in 2016.**

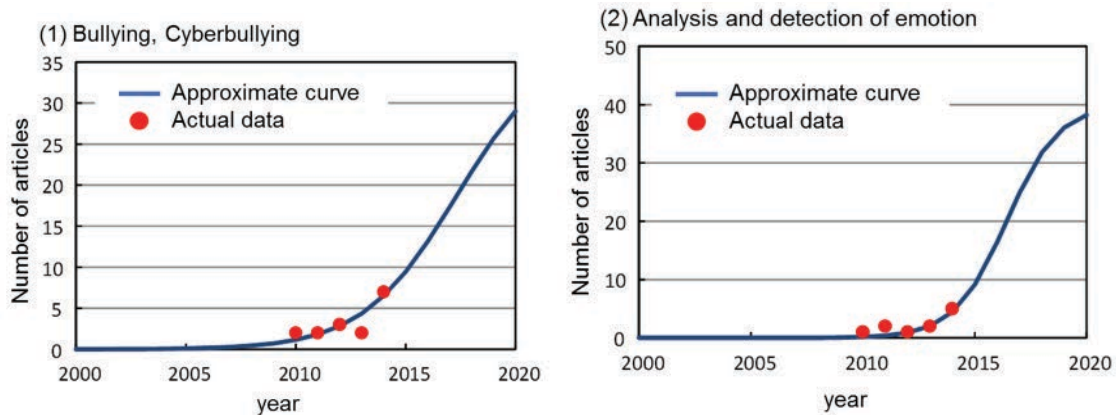


Figure 11 - Changes in the Number of Articles in the Extracted Active Mesh and Approximation Using a Growth Curve

CONCLUSION

We conducted an analysis of research and development trends related to SNS, using cluster analyses based on academic citation data.

The US plays a pivotal role in this research, followed by research institutions in China and the UK, which round out the top ranks. Nevertheless, the research fields engaged in by researchers in the US and China are different. Turning an eye toward Japan, it is undeniable that the country seems to be lagging in this field.

In terms of major trends in research and development, **much research is related to applications in business and marketing, to medicine and learning, and to fields such as algorithms and security. Another theme that has seen active research in recent years is the negative aspects of SNS, such as bullying.** Meanwhile, we also find attempts to gain new kinds of expertise and models from deep analyses of SNS data, as found in research that includes the categorization, analysis, and detection of information, including emotions, on SNS platforms; of information dissemination mechanisms; and of understanding relationship building among SNS users.

Progress in research related to the analysis of latent information, which is based on this type of SNS data, could potentially lead to a deeper understanding of how humans are influenced, resulting from behavioral principles and information.

As mentioned before, SNS-related research saw rapid growth from around 10 years ago. Nonetheless, we believe that SNS will undergo even more changes in the future. In the future, the question of, to what extent can such an unimaginably large volume of data, including that from SNS, be efficiently used, will be crucial for companies, and as users, we need to understand and carefully watch how we can use the information that is transmitted.

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