



Research on virtual reality real-time intelligent e-sports news

CHEN Yuehong^{1,2}, ZHENG Fei²

¹: School of Humanities, Social Sciences and Law, Harbin Institute of Technology, Heilongjiang Harbin;

²: Is a postgraduate student at School of Architecture, Harbin Institute of Technology

Abstract: As the virtual reality of news on the subject, content, technology development, and in the spread of 4.0 era background and 5 g technology under the background of rapid development, such as the whole news every link in the chain, more and more cases of artificial intelligence technology, on the one hand, to liberation of human, improve the production efficiency greatly, on the other hand also can be implemented in the news on the accuracy and timeliness of the giant leap. This article is mainly on the research at home and abroad virtual reality real-time news and news on the basis of current situation of the development of artificial intelligence, the story is set in an important transition period and suitable for virtual reality as medium of e-sports, and deep learning prediction model of the artificial intelligence technology is applied to real-time virtual reality in the form of e-sports news, constantly optimize the performance of the real-time prediction model through the experiment and e-sports predictive report form. The research aims to fill the gap of in-depth reporting in the direction of intelligent production of e-sports news, design and implement an interactive virtual reality application that integrates prediction, real-time and interactive functions, and realize the production and dissemination of virtual reality intelligent news.

[CHEN Yuehong, ZHENG Fei. **Research on virtual reality real-time intelligent e-sports news**. *Rep Opinion* 2021;13(3):1-8]. ISSN 1553-9873 (print); ISSN 2375-7205 (online). <http://www.sciencepub.net/report>. 1. doi:[10.7537/marsroj130321.01](https://doi.org/10.7537/marsroj130321.01).

Keywords: Virtual reality real-time news prediction model for e-sports news

Project: This paper is a phased achievement of the National Social Science Foundation project "Virtual Reality News Research under the Perspective of Communication Science"(No. 18BXW102).

In recent years, the application of virtual reality and artificial intelligence in the field of journalism has shifted from scattered to systematic standardization, and gradually incorporated into the news production system as a routine element. Along with this, immersive journalism has deepened in concept construction and practical exploration, [1]And artificial intelligence has injected fresh impetus into the news industry at every stage of the production chain, but there are few cases of combining the two, and some even argue that virtual reality news can only give people fragmented and outdated information. [2]In fact, there have been many applications and practices of virtual reality real-time news at home and abroad, but most of them remain in the stage of 360-degree panoramic video live news, and there are few attempts in the field of e-sports news. The research content of this paper aims at Promote the development of virtual reality, real-time news, based on the emerging technologies such as artificial intelligence, before its perfect to can completely replace the media people, with timeliness is the main pursuit of news value, cooperate with interaction and immersion experience of virtual reality, trying to set up a virtual reality environment preliminary complete

system of intelligent real-time news.

1. Content structure of virtual reality real-time news at home and abroad

In recent years, the application of virtual reality and artificial intelligence in the field of journalism has shifted from scattered to systematic standardization, and gradually incorporated into the news production system as a routine element. Along with this, immersive journalism has deepened in concept construction and practical exploration, [1]And artificial intelligence has injected fresh impetus into the news industry at every stage of the production chain, but there are few cases of combining the two, and some even argue that virtual reality news can only give people fragmented and outdated information. [2]In fact, there have been many applications and practices of virtual reality real-time news at home and abroad, but most of them remain in the stage of 360-degree panoramic video live news, and there are few attempts in the field of e-sports news. The research content of this paper aims at Promote the development of virtual reality, real-time news, based on the emerging technologies such as artificial

intelligence, before its perfect to can completely replace the media people, with timeliness is the main pursuit of news value, cooperate with interaction and immersion experience of virtual reality, trying to set up a virtual reality environment preliminary complete system of intelligent real-time news. [3]From the second half of 2016, CCTV.com started to enter the virtual reality news session, gradually leading the trend of 360-degree panoramic video and picture news reports, and actively provided users with panoramic live broadcast services in major time points such as the National People's Congress and the Rio Olympic Games. [4]However, Xinhua News Agency once realized the interactive experience of video virtual reality live broadcast in the way of panoramic report in the "9 • 3" military parade in 2015, and such virtual reality live broadcast was mostly praised by the audience. It can be said that in terms of real-time broadcast of 3D panoramic news, the domestic and foreign technology and practical status quo have been transferred to a more mature commercial system. At present, virtual reality real-time news at home and abroad is almost similar in terms of news content and news material selection, both of which mainly focus on the reports of some major activities and the scene of grand sports events. After analyzing the existing cases of virtual reality news, it can be found that most virtual reality news will inevitably sacrifice interactivity and immersion if it emphasizes real-time and authenticity, while it will inevitably need timeliness if it emphasizes interactivity and immersion. Lags behind Internet information and even traditional media, which is an unresolved problem encountered by virtual reality news [5], admittedly, sporting events, and political events of 360 - degree panoramic real-time news and virtual reality interactive documentary low timeliness of news have their focus, big probability in the future will be according to the specific user need to form two different direction of the virtual reality development path, news and timeliness of high real-time news itself will be according to the story and the specific content of different there are some technical FaZhanDian and distinguish in the form of the show.

For now, usually for virtual reality real-time news at home and abroad are to achieve by 360 - degree panoramic news broadcast, for a 360 - degree panoramic news with virtual reality can through understanding the distinction between 2 d pictures turn 3 d model and 2 d video turn panoramic video related algorithm and get a deeper understanding of technology practice. Actually strictly virtual reality 3 d immersive real-time news and news, although in the panoramic video to each position to the full view objects and scenes, but does not implement free roaming, scene can only according to the user's head

movement change rather than foot move, even if can change the user's location, and through the 360 - degree camera predefined Angle switching operations. However, virtual reality news is more common in documentaries that require more resources, and it needs to be realized through 3D modeling, real-time rendering and other technologies. After the completion of such virtual reality news production, users can realize the free experience of news with a multi-dimensional and comprehensive perspective. However, the continuous development of 360-degree panoramic news is still of great significance, and it can replace the virtual reality news of some subjects at present, so as to meet the needs of users to experience more vivid and real news. Therefore, it is particularly necessary to discuss how to conduct in-depth research on virtual reality real-time news based on existing technologies and according to the specific characteristics of different themes, so as to give full play to the characteristics and advantages of virtual reality on the basis of ensuring timeliness.

2. Second, the choice of virtual reality real-time news theme

As mentioned above, for news requiring high real-time performance and immersion, most of the existing virtual reality real-time news technologies can only display the news in a semi-immersive way, but seldom have aesthetic attraction and interactive experience. If they want to achieve is to emphasis on real time, real and can ensure the interactive flow experience virtual reality news, there are a few ideas can be discussed: first, the need to look forward to the future technology after a breakthrough to achieve efficient and dynamic modeling, real-time rendering system, news producers could prepare in advance and in real time will timely convey to the audience, the condition of the apply to can know in advance the news site, can also use the known information set up in advance need JingBie, construction and other objects. Second, with the application of 5G, Internet of Things, artificial intelligence and even higher technologies in daily life, the news production process at all levels, such as news capture, production, writing, production and reporting, will be highly intelligent. It speeds up the efficiency and speed of the production of virtual reality news, and is suitable for the production of highly visualized data news such as financial news, similar to the existing production methods of various intelligent videos and picture news, which is based on artificial intelligence to produce virtual reality news in the form of a general template automatically. Third, virtual reality technology development to a certain extent, virtual reality devices, and on the basis of the developed application become normalized all kinds of entertainment, popularity even under the similar to the

current era of smartphones, virtual reality technology to simulate the "reality" and real life is also need real-time news coverage of the environment, and the two are inseparable, this step is temporarily unable to and, in terms of ethics, also need to be more argument and discussion.

From the current point of view, the content that needs to be studied in VR real-time news can be divided into two aspects: one is to use continuous iteration of real-time high-definition panoramic Mosaic and 5G technology to realize real-time news scene simulation with higher degrees of freedom, which is suitable for some news types that focus on "presence"; Second, for information and data-sensitive news, it needs the development of artificial intelligence and other technologies to realize the normalization of virtual reality and tool-oriented news, which can also help the evolution of the media form of news in the future era to enhance its interactivity and autonomy. There are certain differences between the two directions, but at the same time there are overlapping parts. For example, the panoramic live broadcast of major political events, especially in China, is relatively solemn and solemn. It does not need too many interactive functions, and users can have more autonomy in perspective. For another example, in concert, traditional sports events, e-sports events and other news types with relatively high entertainment value, in addition to restoring the sense of on-site immersion as much as possible, there are more possibilities to expand in terms of interactivity and real time.

Study of virtual reality news both at home and abroad scholars put forward about virtual reality at present the development of the news, including a few relatively unified view: homogeneity serious news content and subject matter, news timeliness is insufficient due to technical reasons, not ideal audience feedback and interactivity, extreme lack of virtual reality news professional talents and so on. Of course, these temporary defects of virtual reality news cannot be solved overnight, but they can be promoted through continuous research and practice. For example, targeted measures can be taken for each small entry point, so as to gradually improve the whole virtual reality news system. Therefore, the research idea of this paper starts from the news subject matter, seeks different directions from the existing virtual reality news subject matter, improves the depth of news content on the premise of ensuring timeliness, and focuses on the real-time feedback and interactive experience of the audience.

On November 18, 2003, e-sports was officially established as the 99th sports event in China by the General Administration of Sport of China. In 2007, the total box office of Chinese films was 55.911 billion

yuan. In the same year, the scale of China's e-sports market reached 77 billion yuan, and e-sports surpassed film to become the main pillar of China's entertainment industry. As the documentary says, games are not only entertainment, and all aspects of excellent games are rich news subjects, which are also the news content favored by young people. Virtual reality technology is in line with the sense of participation and interaction of the video game itself, so there is every reason to look forward to the future environment and way of e-sports news report. With all kinds of large-scale e-sports projects gradually developing from immature to mature, MOBA (Multiplayer Online Tactical Competition) has gradually become the most mainstream form of e-sports in China, occupying half of the world's e-sports. Dota as the basic framework laid the foundation of MOBA games e-sports and its sequel Dota2 because of its rich game mechanics, changeable competition strategy and excellent ornamental game may be long and stable development, and in a few years ago he had to support real-time virtual reality, make it more suitable for this study as a full test of applying virtual reality end news reports. Not only MOBA games, but also all kinds of 3D games, such as shooters, MMOGs, etc., as long as the games with fine modeling are almost equipped with the function of first-person perspective or even based on the first-person perspective, which is the biggest natural convenience that is not available in any other virtual reality news field. Late in many natural advantages and good development premise, through the combination with the characteristics of virtual reality and the technology to design a deep learning will predict, real-time, interactive function integration platform becomes a reality, can anticipate e-sports news spread through the expansion of form and content, and to promote more in the field of intelligence reports, implement comprehensive intelligent real-time news production and transmission.

The content of e-sports news belongs to the news with high frequency of real-time update. According to different categories, there are different professional knowledge. It is relatively manpower consuming, and only with a certain threshold can the collection, compilation and distribution of e-sports news be completed, which is similar to the news in the field of traditional sports. Taking Sina e-sports sports news website as an example, the common e-sports news covers many aspects, the core of which is the e-sports events themselves, and the news of information and exclusive interviews accounts for a large proportion. Timeliness, professionalism and standardization of e-sports news can broaden the horizons of a large number of audiences, get a deeper understanding of the scenes and behind the scenes of e-sports affairs,

the allocation of professional team personnel and valuable artistic content of the game itself, and also change the impression of e-sports in the cognition of social groups. Existing mainstream media tournament direction gradually turned for the better, but still lack the depth of investigation, visiting and research, etc., for the audience to understand corresponding less, often there is the problem of biased, e-sports and traditional sports are very similar, actually is under a so-called carrier of the game, by a formal system under the rules, professional staffing intellectual physical activity, especially pay attention to tactics and teamwork, there are also many people play space, so the news content is more worthy of deep mining. E-sports, born in the digital Internet, has an extremely wide spread range under the current development background. [6] Current esports news reports, there are still many questions in the field of professional players, for example of e-sports pan entertainment news reports, the traditional media reported limit the spread of the larger proportion is low, the competition system spread too strong lead to audience on only focus on major events, the lack of competitive game production event propagation caused by lack of localization elements and so on. [7] But through the combination of virtual reality and artificial intelligence and other technologies, e-sports news in the current media era background It should form a complementary relationship with technical means to maximize its due advantages.

3. Intelligent realization of real-time e-sports news

As mentioned above, in the content of e-sports news, there is no doubt that the content of e-sports itself is the core, and also the news content that attracts the most attention of the audience. The most important content of the e-sports game is the fresh and specific game, including the win and loss of the game, the team of the two sides, against the various data and the situation and so on. At present, most of the real-time news about the match is manually updated by the responsible personnel of various official media accounts or "We Media". The content usually contains real-time description of the match situation, such as the score of the current match, the economic situation of both sides and the situation of the scene, etc., and few in-depth predictions and explanations of the match. While foreign predictive reports occupy the mainstream, New York Times, The Times and other famous news media have a large length or even occupy the whole page of predictive and analytical news reports. [8] The main research content of this paper is to enrich the content of e-sports news from the direction of competition prediction results, and to enhance the production and dissemination of real-time news by using the rapidly developing big data, deep

learning and other technologies. [9] For professional teams, the prediction of match results can be used to formulate and adjust match strategies based on factors such as the weight of winning rate reflected in complex data. For the organizers of the event, they can prepare the program effect in advance according to the prediction, and carry out a variety of lines, interviews and records, such as light urgency and slow weight. For the audience can greatly improve the interactivity of the e-sports game, avoid the fatigue caused by the passive watching of the game due to a long time fixed posture at the scene; And for the game manufacturers, can refer to the data forecast version update and adjustment. Only from the perspective of news, predictive reporting, explanatory reporting and investigative reporting belong to the in-depth reporting system, [10] It has appeared since the 1930s and has been repeatedly called by scholars as "a product in line with the needs of the development of The Times", especially in the context of the widespread use of big data. However, its influence is still not as profound as the latter two. Predictive reporting has a variety of definitions, but the general features include "scientific inference and speculation on the constantly developing things based on the existing facts and data, focusing on the variability and uncertainty of the facts. [11] Traditional predictive reports mainly involve the fields of economy, politics, sports and science and technology. Specific examples include the prediction of the outcome of international sports events such as the Olympic Games, the inference of the results of political elections in various countries, and the prediction of large-scale market movements of financial and financial stock prices. People often encourage the media industry to use emerging technologies such as big data to write news reports. The birth of data journalism reshapes the form of reports, [12] And through the machine Automatically crawling a large amount of data, processing and analyzing the data, and based on this, intelligent prediction can make news reports more scientific and readable. On this basis, this paper adds real-time factors to make news reports more timely.

E-sports as emerging direction in the sport, but few news report is based on large data and deep learning algorithm to predict, e-sports domain and to explore automatic writing news reports examples are also few, a few provides automatic writing battle report news website core technology is that after the game analysis of automatic video to get the data or gather the real time data in the social network to form the news, and the text generation direction is only all data set into a template, the mitigation of data between weight there are also problems, overall poor visibility and readability. In the past, the application of neural network in the field of news is mostly in the direction

of topic clustering, comments and public opinions, etc., and it can clearly distinguish the attributes of various kinds of news by using its characteristic of being applicable to the processing of various large-scale Chinese text corpus. Apart from this, this article hopes that through the deep learning model, in play, the combination of a large amount of data read, study and training, complete the prediction of real-time data, finally combined with the corresponding data analysis and judgment to generate a paper with real-time, high readability of the news text and its application of virtual reality interactive news access to bring users real-time news interaction experience.

As implemented in this study, firstly need to crawl through network data and storage and processing, the use of data from Dotamax website, this website is for professional data of e-sports game Dota2 website, in addition to providing Dota2 game hero within the professional game, passers-by game, game and so on a large amount of data, also can provide professional team game real-time data, the current time is the game team information. In order to get the real-time prediction model, the prephase crawl data needs to be against details including the name of the hero, team name, and so on, due to the web page structure is relatively complex and busy, fetching the data are divided into four large storage in mysql: live is game information, team, game hero inside information, the previous game, which was broadcast live snapshot every few minutes scraping, constantly updated, to be used for real-time prediction model. After obtaining and storing the data, it is necessary to preprocess the data. Initial data contains 134 dimensions and 29197 rows, you first need to remove invalid data first, after processing of 29035 lines, 103 d data after rearranging the index into numpy vector, remove win, MVP value depending on the situation as a y value, can separate the training set, the corresponding y value by 1, 2 labels into 0, 1. However, there are still different evaluation indicators in data, and their dimensions and units may be different. Therefore, in order to improve the comparability among characteristic indicators, and to make the process of seeking the optimal solution more smooth, more correct convergence, and improve the calculation accuracy, the data need to be normalized. Finally, the data set was randomly divided into training set and test set according to 8:2, with a total of 23,228 training data and 5,807 test data.

The prediction model consists of two separate models with different forecasting subjects. One is real-time winning rate prediction and the other is real-time MVP prediction. Each model experiment will be divided into two groups: one group will only use the predictions with all information in the table as

the reference group, and the other group will include the predictions with external input of hero win rate information. The DNN model, namely the multi-layer perceptron model, was used in the experiment. The models used for effect comparison were 5 classical classification algorithms in Sklearn: Naive Bayes, Logical Regression, Support Vector Machine, Random Forest, and XGBoost. The final experimental results were as follows.

The experimental results show that the multi-layer perceptron model has a better performance in the real-time prediction of the outcome and MVP to a certain extent. After the experiment and the optimized prediction model are trained and encapsulated, the previously acquired data and prediction results for real-time information can be used to generate the text content of virtual reality news. Because this default application scenario is the actual e-sports news reports, and the data to a text generation algorithm since 2003 has research scholar in the creation and improvement for wide and deep, most scholars use the scientific research the complex neural network for automatic generation of these algorithms in text fluency, diversity is usually good, but the accuracy is still lacking, and as sample text also often have some subjective tendency, therefore, in the practical application based on template and the rule of text generation still account for the mainstream, For example, in recent years, major domestic and foreign companies such as AP, Auto Insight, Baidu, Sina and other automatic news writing. The news content suitable for template generation is nothing more than financial information, sports game data, etc., which does not rely too much on manual intervention and the professional level of news editors. In terms of the existing cases, there are problems such as fixed and rare application fields, low reusability between different fields, and monotonous news content. To sum up, the data-to-text generation in this study does not adopt neural network to automatically generate, but combines automatic data acquisition and manual formulation of rules and templates for reporting text to improve the accuracy of news content. The first part of the news content is to replace the real-time crawling data with a simple template to broadcast the real-time e-sports news short message, such as the real-time win rate of a hero in a professional team this month, or the win rate of a professional team in this month, etc. The second part is based on the real-time prediction results brought by the experimental and optimized encapsulated prediction model, which can output a relatively complete real-time news report after a variety of pre-set template processing.

Table 1 Winning rate prediction model accuracy results

The model name	No hero win rate introduced	Introduce hero win rate
Naive Bayes	0.94782	0.94920
Logistic regression	0.97624	0.97262
SVC	0.96814	0.96487
Random forests	0.95660	0.96022
<u>Xgboost</u>	0.96849	0.97434
DNN	0.97192	0.96563

Table 2 Accuracy results of MVP prediction model

The model name	No hero win rate introduced	Introduce hero win rate
Naive Bayes	0.66954	0.66833
Logistic regression	0.75840	0.75857
SVC	0.75082	0.75598
Random forests	0.72447	0.72017
<u>Xgboost</u>	0.75857	0.75271
DNN	0.77780	0.76589

4. Realization and optimization of virtual reality news interactive application

As the media of news reports, virtual reality can give full play to its excellent characteristics of immersion and strong interaction, and it is extremely suitable for interactive news reports, and the subject can be relatively entertaining. The e - sports competition and other sports events, highly enjoyable. It can be said that the scene of the electric sports game enthusiastic watching atmosphere and the game itself is not divided. The interactive application design in this study aims to make a slight improvement in the direction of real-time interactive experience and achieve the goal of promoting the development of virtual reality real-time news.

In terms of system functions, the interactive application of virtual reality for e-sports news aims to provide personalized services for target user groups as an independent application with strong integrity after

the popularization of real-time live broadcast of virtual reality, which is realized through Unity3D. In the end, its main functions are divided into three modules: Tianhuai Pavilion, Nightmare Studio and Meat Mountain Experience Pavilion. In Tianhui Pavilion, you can view the attributes and background stories of heroes, the functions and Settings of in-game items, and enjoy the official music released in the game. Night Yan studio in the core functions of real-time reporting news content is relatively rich, users can real-time access to detailed information on team integral, hero winning list during the month, want to focus on any status updates, live broadcast of the games for both historical record a summary of the analysis, you can also learn from news reporting real-time game winning prediction, and the detailed situation of the current view game realtime interactive experience, through the current total head the score, the game time, the team, each member detailed KDA

data and so on for the outcome and MVP independent forecasts, can choose to compare the intelligent prediction, So as to have the interactive guessing experience that can be obtained when watching e-sports matches; Meat Mountain Experience Pavilion can watch rich 3D panoramic videos, control the pause, play and switch of videos, and watch the live broadcast of panoramic e-sports matches.

At the same time, in terms of design principles, the virtual reality interactive news application for the majority of e-sports fans belongs to the category of new media application. The main interactive design includes two aspects: one is the interactive function in the virtual reality environment, the other is the sound effect interaction of news speech synthesis. In the design process, following some basic principles of interaction design can make users' interactive experience more perfect and comfortable. Interaction design is the improvement of functions, experiences and details made by the pointer to the feelings and experiences of the user and the interface when they communicate and interact. In the design process, first of all need to user demand, in-depth understanding of user characteristics elements, so that they can uphold the principle of user-centered design, and secondly also need to follow the general principles of interaction design, the industry has a lot of mature theory for reference, such as gold eight principles, nelson ten principles, etc., need to constantly in the process of the whole design according to the comparison and improvement. Finally, the effect evaluation of virtual reality interactive news application is mainly completed through summative evaluation. Specific evaluation scales, evaluation criteria and evaluation parameters or indicators are set according to different testing purposes. Interaction design works can usually test their usability, ease of use and other indicators, so as to judge whether human-computer interaction has brought a good user experience. In the process of user experience of news works, it is also necessary to carry out some experiments to evaluate the effect of news itself and user feedback, that is, to verify the accurate and real-time transmission of its content, the attributes of the media itself and the effect in the process of communication. Through the PSSUQ system scale and a semi-structured interview questionnaire results prove that the interactive system compared to other forms of news has a better effect, but still need to pay attention to and strengthen the building of news content and embodied in the process of the design and the optimization of mistake proofing, the fault-tolerant mechanism with perfect, improving the satisfaction of the user. Generally speaking, the communication effect of the system is in line with the expected goals, but there is still room for improvement and discussion

in the design of some functions, which also requires further development and improvement of system resources, interaction and functions. In short, the interactive system of virtual reality scene news spatial and temporal reproduction integrates various communication characteristics, such as authenticity, attraction and artistic quality, which not only breaks the boundary of time and space, but also meets the audience's demand for aesthetic experience, and greatly improves the audience's interactive efficiency. It not only strengthens the audience's perception experience and rational cognition, but also helps the audience to make better value choice and plays a positive role in the social public opinion control level, which opens up a sustainable construction road for the improvement of the development of the news industry and brings it infinite opportunities and possibilities.

In a nutshell, virtual reality, real-time news is in the form of a high degree of commercial high-speed development, but on the ideological understanding, need to traditional media, national government level and more investment will it as a professional in the field of high potential industry development, down-to-earth to devote resources to promote the transformation unceasingly, in artificial intelligence and other high-tech impact under the time background of virtual reality news show the real value.

References

1. See Li Xiaojing. Predictive reporting in China: current situation, problems and prospects. *Modern communication*, 2, 2004.
2. See Wa Zijun, Application and Development of Virtual Reality Technology in News Reporting, *New Media Research*, No.3, 2017.
3. See Yan Yue, Zhang Jing, "Seeing is Void": A Brief Analysis of Domestic VR News Production -- A Case Study of VR Channel on Upstream News Client ", *Audio-visual*, No.1, 2019.
4. See Zumuretikuri Mutalifu, Application of Virtual Reality News in CCTV News Report, Satellite TV and Broadband Multimedia, No.2, 2020.
5. See Yitong Yao, Comparative Analysis of the Status Quo of VR News at Home and Aabroad, Master's Dissertation, Zhejiang University, 2019.
6. See Yang Yue, "E-sports and e-sports industry in the new era", *Sports Science*, No.4, 2018.
7. See Xiao Yang, A Study on the Communication of E-Sports Events in China under the New Media Environment, Master Dissertation, Shenyang Normal University, 2019.
8. See Li Xiaojing. Predictive reporting in China: current situation, problems and prospects. *Modern communication*, 2, 2004.
9. See Xu Shuang, The Development Strategy of

- Predictive Reporting in the Era of Big Data, Master Dissertation, Anhui University, 2015.
10. See Xu Mengmian, Predictive Reporting Predictions and Solutions in the Era of Big Data, Science and Technology Communication, No.13, 2017.
 11. See Liu Yinglu, Characteristics of Predictive Sports News Report in the Age of Big Data, Western Radio and TV, No.16, 2016.
 12. See Lei Gang, Wang Mengke, Chen Weilong, "The Generating Logic of Real-time Data News: Knowledge Mining and Visual Design", Decoration, No.3, 2019.

3/2/2021