The Use of AI-Based Augmented Reality in the Work of Journalists

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Abstract
Over the years, with the development of smartphones, new technologies such as social media and user-generated content have been used in news content. The press and the media are accustomed to using cutting-edge technology to improve news accuracy, help news gathering and increase the efficiency of news production. With the rise of AI technology, more and more fields rely on AI to improve service quality. We built a prototype, added AI applications such as multiple-person tracking and crowd counting in the news production process, and used those AI-generated information marks on the screen as AR instructions to show how the new technology can help news production. We also initiated questionnaire surveys and interviews to assess the impact of these technologies on people. Finally, we reported some interesting findings that came from people from different backgrounds and found that they have different attitudes toward these new technologies.

Keywords: Augmented Reality, Artificial Intelligence, Drone, Journalism

Introduction

The media and journalism often apply new technologies earlier than other fields. By 1600, the popularization of printing made it possible to print a large number of newspapers in Europe. In the 19th century, due to the Industrial Revolution, mass production was realized, which also led to the development of commerce and entertainment, which laid the foundation for modern newspapers. The invention of radio and television in the 20th century triggered the second revolution in the press.

It was the Internet era in the 2000s. Many websites are flourishing and various web services are provided on various platforms. At the same time, news production and broadcasting have also been digitized, and film production has changed from original movies to digital media, which is called the "integrated TV newsroom" (Powell, 1998). This is called the third revolution in the press.

With the development of information technology, the Internet came out in the 2000s, cloud computing and big data came out in the 2010s, and the main Internet devices began to shift from PCs to smartphones. It impacts journalism as well. Social media such as Facebook, Twitter, Instagram, and user-generated content have become one of the main sources of news, and smartphone apps have become the main media for people to read news (Engelke, 2019). There are many research papers on this matter. Cloud computing, big data and the improvement of computing power enable machine learning technology to implement algorithms based on deep neural networks, which is called "deep learning." This has brought a wave of prosperity to machine learning and a resurgence of artificial intelligence.

With the development of various deep learning architectures for different applications, artificial intelligence technology has also been widely used in different fields. Journalism is undoubtedly one of the earliest fields of application of artificial intelligence. Many documents show that artificial intelligence technology is used in different stages of the news production and broadcasting process, and issues of privacy and work rights have also been widely discussed (Broussard et al., 2019). The technological revolution that AI brings to journalism is called the fourth wave of revolution in journalism.

In addition, aerial images of drones are now widely used in news screens, especially in large landscapes or parades. XR (AR, VR and MR) has also emerged due to the maturity of technology, and has become an important part of the future display technology. However, in the field of TV news production in Taiwan, they mainly rely on post-production to produce video effects instead of real-time AR technology.

Our research will combine AR display, AI real-time recognition technology, and drone streaming as an attempt to help provide a possible future option for TV news production and broadcasting. We also use questionnaire surveys and interviews to understand the views of TV reporters and the public on these technologies in the field of news production and news broadcasting, so as to provide practical references for future design of this application.

TV News Production Process

According to previous research on Taiwan’s TV news production (Lin, 2014) and pre-interview information, the TV news production routine and the TV news production process are listed in Table 1, Figure 1 and Figure 2, respectively.

Index	Task
1	News topic collection
2	Editor's meeting
3	News interviews to shoot stories and obtain footages
4	News scripts writing
5	News text editing and modification
6	Video editing and post-production
7	Video subtitles, materials and effects editing
8	Shooting news report videos
9	News post-production
10	News broadcast

Table 1: Taiwan's TV news production team's routine

After the Taiwan government allowed the application of TV channel licenses in the 1990s, many new TV channels were established in Taiwan. Among them, the comprehensive channel and the news channel both broadcast news. For comprehensive channels, traditionally, they will broadcast morning, noon, and evening news. News channels broadcast news throughout the day, and there will be news and politics programs at night. The routine of Table 1 will be executed at least three times a day, and in this way the whole day's news will be completed. When we look at this routine, we will find that news videos play a very important role in the production of TV news.

Figure 1 illustrates Taiwan's TV new production process. In this illustration, we can see that the sources of news materials are divided into "stories" and "footages" through different processing procedures and then integrated into a piece of TV news for broadcast. These processed TV news videos will also be archived in the file system and uploaded to the Internet news platforms or mobile APPs for news audiences to watch.

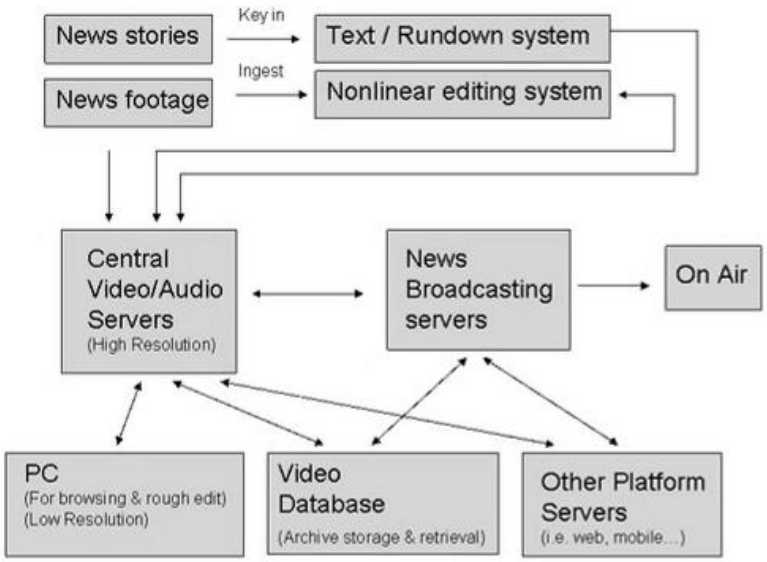

Figure 1: Taiwan's TV news production process (Lin, 2014)

Figure 2 more directly shows the composition and architecture of the digital system of TV news process and the types of devices actually used. The scripting task and the digital shooting task are a pair of news interview partners to obtain news information together. The

post-production process will make non-linear editing of the news video. The TV news production team then completed the news video on the central audio-visual server before the news was officially broadcast.

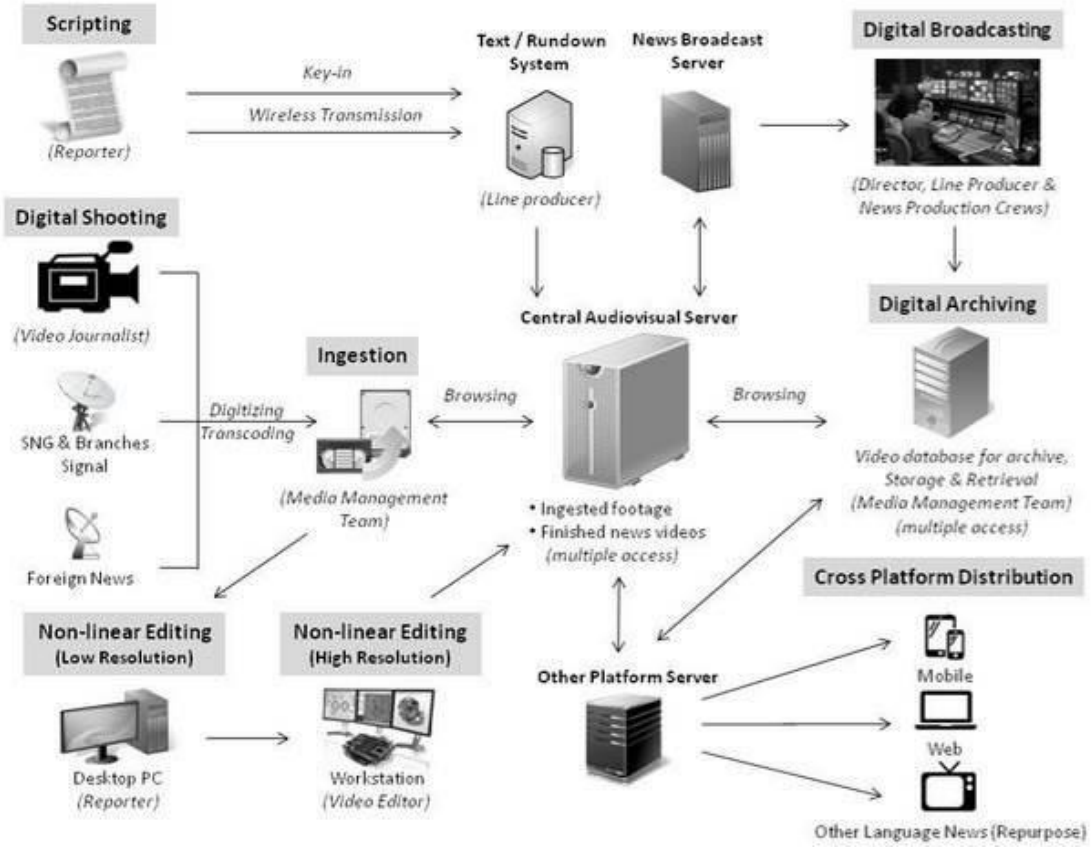

Figure 2: Taiwan's digital workflow and digital process of TV news after adopting integrated newsroom (Lin, 2014)

The Study

Since news videos are indispensable for TV news, and computer vision related fields happen to be one of the most mature technologies of artificial intelligence at present, we hope to use additional information generated by AI and use AR to present information in real time in the "digital shooting" steps. It is used to provide interviewers with more information to assist them in conducting interviews, and to help us understand the impact of new technologies, such as artificial intelligence and augmented reality, on user experience and human-computer interaction on TV news production process and journalism.

Figure 3 is the system architecture modified from Figure 2, showing how we implement AI and AR in the current TV news production process. When AI is introduced into news interview work, due to the convenience of real-time identification, we can get more information from real-time photographic images to make things interesting. The information obtained from the real-time recognition of AI can be fed back to photographers and interview reporters through AR to increase the depth and breadth of the news.

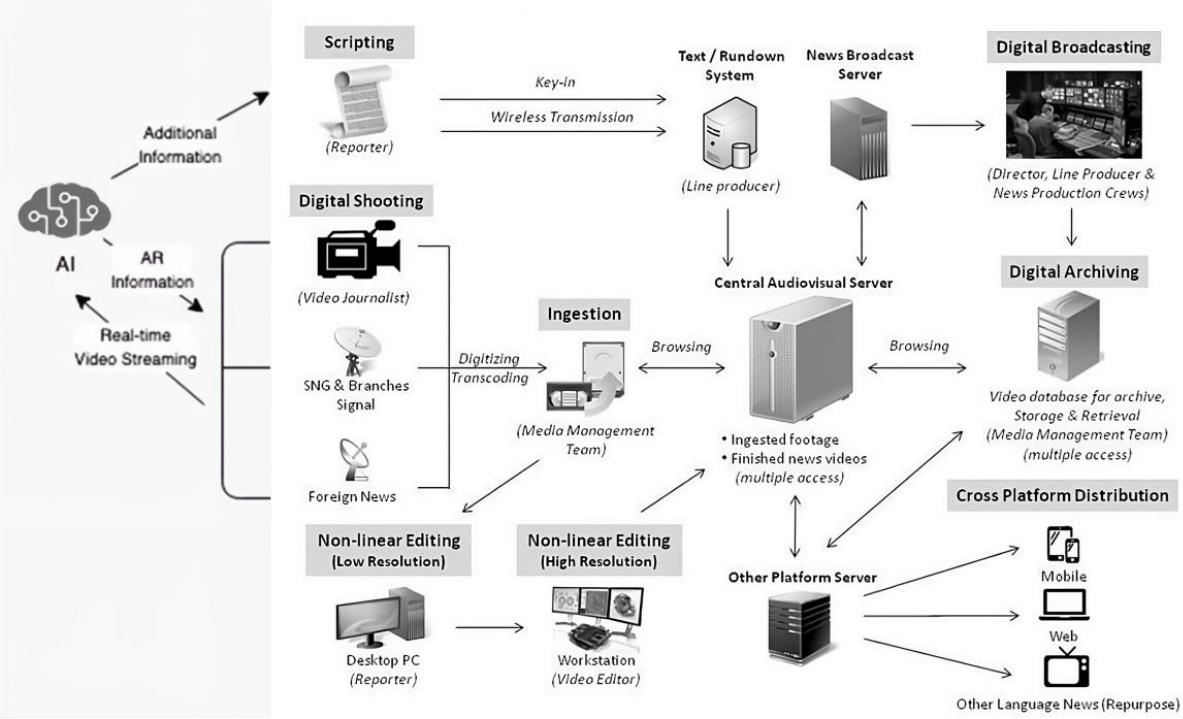

Figure 3: Digital workflow and digital process of TV news that powered by AI and AR (Modified from Figure 2, which is marked as grey background)

The best case is that we can directly implement AI and AR in the TV news production and broadcasting process to actually test the impact of the news production and broadcasting team on the new technology to change the workflow and assist them in their news editing work. However, the changes in the workflow of TV news channels and the introduction of another new system into the news production and broadcasting system have a major impact. Therefore, we planned a pilot study to apply AI real-time recognition to news films, and through extensive questionnaire surveys and in-depth interviews to evaluate news production and broadcast staff and the general public's ideas about AI and AR joining the news production process.

Approach 1: Visualization of Person Tracking

When we are watching the news of some people, we may not know who it is? When a journalist is tracking a person, it is also possible that the target may be lost or an accident may occur during the fast movement. If we can use person tracking technology of AI to help identify and use AR markers, it might be helpful for such a situation. Figure 4 depicts such a situation. An important foreign guest visits our country. It is identified and tracked by AI technology, and can be marked on the video with AR.

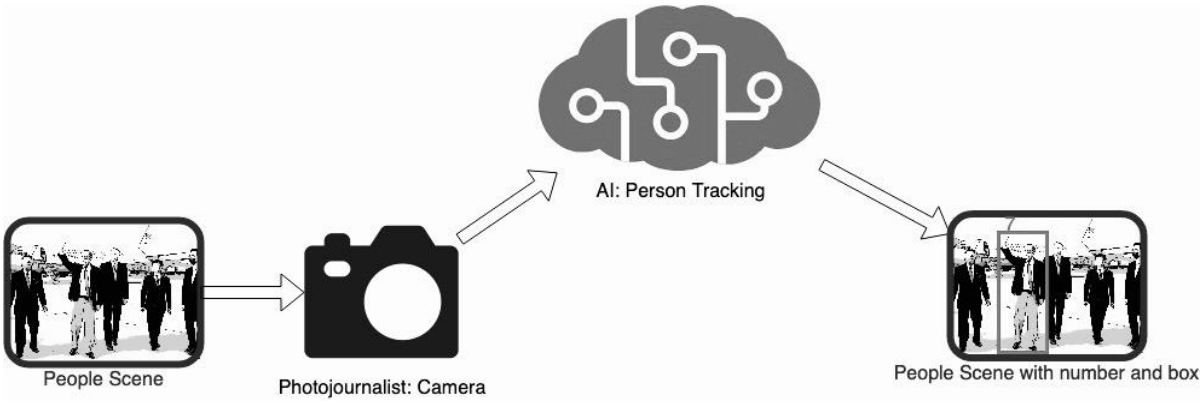

Figure 4: AR Display of Person Tracking Workflow

Method

We chose the Fair MOT (Zhang et al., 2021) model as our model for Person Tracking. When many people are walking in there are parts that can the screen, sometimes the images of people will overlap. In addition to the object tracking technology, the model must also have the re-identification capability to ensure that the person can be identified after being obscured by another person's image and is regarded as the same person.

In addition to modify Fair MOT into the real-time person tracking model, we also used the trained model to generate AR marked video images. In Figure 5, the left side is the original video frame, and the right side is the video frame of the AI information marked by AR. In this way, we can show the video to the subjects and ask them to participate in questionnaire surveys and interviews.

Figure 5: AR Display of Person Tracking Video.
(Video source: https://www.youtube.com/watch?v=khOTj1dxZ7k)

Approach 2: Visualization of Crowd Counting

Assume the following situation. The K party that initiated the political demonstrations claimed that their activities involved 1 million people. The ruling party D said that only 20,000 people participated in the event. The local police station, which maintained the order of the event, said it estimated that there were about 50,000 people in the event. Which is true? Finally, TV channels with different political stances quoted estimates from different sources, and voters and TV viewers felt very troubled. This is not a joke, this is what happened in reality. The combination of drone aerial photography with fixed and stable flight speed, real-time crowd counting AI model and AR display make reliable estimates possible in Figure 6.

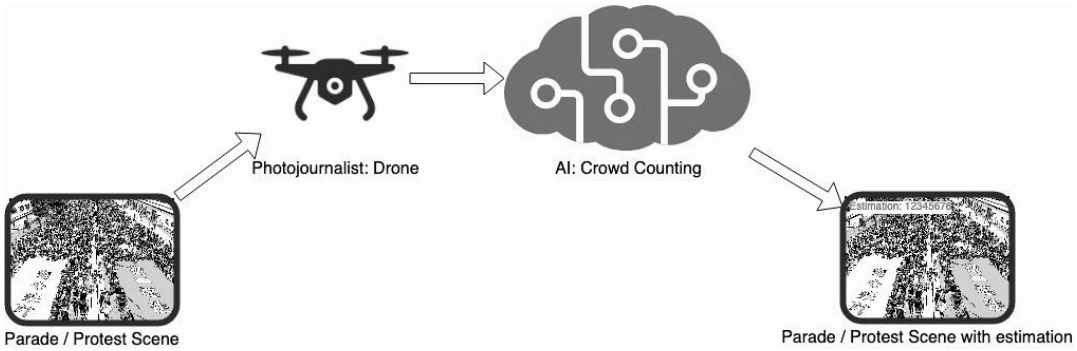

Figure 6: AR Display of Crowd Counting Workflow

Method

Crowd Counting is based on object recognition. When the model recognizes people in crowd counting, there are parts that can be processed because of the limited number or size. DSNet (Dai et al., 2021) uses the continuously varied scales reserves information and connect the dilation layer densely. In Figure 7, the left image is the original video frame, and the right image is its dense scale image, on which we draw the estimated text as AR information. We invite participants to fill out the questionnaire after watching the video.

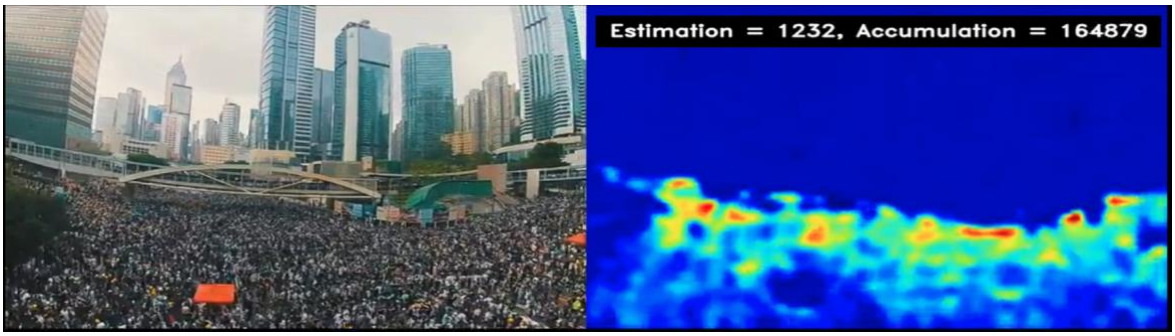

Figure 7: AR Display of Crowd Counting Video. In the left is the drone streaming image, while in the right is the dense scale map image of the drone streaming image. (Video source: https://www.youtube.com/watch?v=PCyrJTmUpNQ)

Questionnaire

Table 2 is the questionnaire we used in the research. In Section 1 we obtain the testee's authorization and related basic information. In Section 2 we try to understand the subject's thoughts on the current news. In Section 3, we introduced the AI technology and AR display on Person Tracking to evaluate the subject's response. In Section 4, we used AI technology and AR display in the scene of Crowd Counting to evaluate the subject's views on the introduction of this new technology into the news production and broadcasting process.

Index	Question	Option
Section 1: Basic Information of Participant		
1	Do you understand the purpose of the research and are willing to authorize your survey data for research reference?	Yes / No
2	Gender	Physiological male / Physiological female

Index	Question	Option
3	Age	Under 19 / 20 ~ 29 / 30 ~ 39 / 40 ~ 49 / 50 ~ 59 / Above 60
4	Education	Elementary school and below / Junior high school / Senior high school / College or university / Graduate and above
5	Whether to study news and communication related departments or work in news communication?	Yes / No
6	Continued from the previous topic, years of journalism related studies or professional experience?	Less than 1 year / 1 ~ 3 years / 4 ~ 6 years / 7 ~ 9 years / More than 10 years / Not related
7	Current main job	Non-communication related / Communication students / Communication related industry supervisor / Full-time anchor / Text reporter / Photojournalist / Director / Assistant Director / Editor / Sound control staff / Producer / Image processing expert / Professor or teacher / Other
8	Secondary/part-time job (optional)	None / Communication students / Communication related industry supervisor / Full-time anchor / Text reporter / Photojournalist / Director / Assistant Director / Editor / Sound control staff / Producer / Image processing expert / Professor or teacher / Other
Section 2: General TV News Production Questions		
9	I think the current news production and broadcasting process is fine	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
10	I think it is easy to collect news footages	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
11	I think it is easy to verify the information	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
12	I think it is easy to produce a piece of news	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
13	I think TV news is fair	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
14	I think TV news is not biased	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
15	I think TV news is complete	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
16	I think TV news is correct	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
17	I think TV news is reliable	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree

Index	Question	Option
Section 3: TV News Production Process Powered by AI, Person Tracking Please read the description: This technology uses artificial intelligence to track the characters in the video. It helps the news production and broadcast process to be identified and output more quickly, and it can also avoid human errors. Please watch the following video. Video: US Secretary of Health Azar visits Taiwan.		
18	I think this technology is convenient for news	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
19	I think the application of this technology to news is fast	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
20	I think the application of this technology to news is accurate	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
21	I think the application of this technology to news can increase viewership	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
22	I think the application of this technology to news can increase news credibility	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
23	I think the application of this technology to news can fill in the lack of news pictures	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
24	I think this technology has a positive impact on the news production process	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
25	I think the application of this technology to news can win advertising budget	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
26	I think the application of this technology to news can improve media professionalism	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
27	I think the application of this technology to news will affect the way and type of data collection	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
28	I think the application of this technology to news will reduce the workload	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
29	I think this technology applied to news videos can replace SNG videos	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
30	I think this technology should be used in the news production process	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
31	I think this video is fair	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
32	I think this video is not biased	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
33	I think this video is complete	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree

Index	Question	Option
34	I think this video is correct	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
35	I think this video is reliable	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
36	I would like to watch news that use this video	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
37	I will promote or share news about using this video	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
Section 4: TV News Production Process Powered by AI, Crowd Counting Please read the description: This technology uses artificial intelligence technology to analyze the rally pictures taken by aerial cameras to identify the number of participants in real time, help the news production and broadcast process to obtain data on the number of people more quickly, and increase the credibility of the numerical calculation. Please watch the video. Video: Protest in Hong Kong.		
38	I think this technology is convenient for news	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
39	I think the application of this technology to news is fast	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
40	I think the application of this technology to news is accurate	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
41	I think the application of this technology to news can increase viewership	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
42	I think the application of this technology to news can increase news credibility	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
43	I think the application of this technology to news can fill in the lack of news pictures	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
44	I think this technology has a positive impact on the news production process	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
45	I think the application of this technology to news can win advertising budget	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
46	I think the application of this technology to news can improve media professionalism	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
47	I think the application of this technology to news will affect the way and type of data collection	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
48	I think the application of this technology to news will reduce the workload	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
49	I think this technology applied to news videos can replace SNG videos	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree

Index	Question	Option
50	I think this technology should be used in the news production process	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
51	I think this video is fair	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
52	I think this video is not biased	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
53	I think this video is complete	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
54	I think this video is correct	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
55	I think this video is reliable	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
56	I would like to watch news that use this video	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree
57	I will promote or share news about using this video	1: very disagree / 2: disagree / 3: normal / 4: agree / 5: very agree

Table 2: Questionnaire on the new technology used in the new TV production process

Analysis and Discussion

A total of 38 people are surveyed in this questionnaire survey. The gender ratio is 26 women and 12 men, of which 63.1% are not related to news production or communication, and only 5 of them are current journalists.

The survey results are very interesting for the current TV news production and broadcast views, 81.5% of people think there is no problem with the current news production process. More than half of people think it is easy to collect news materials and produce a piece of news. However, 65.7% of people think it is difficult to verify whether a piece of news is correct (Figure 8). In the era of smart phones, it is really not difficult to collect information and record videos. There are also many people who set up personal news channels on platforms such as YouTube. But with the development of artificial intelligence, tools such as DeepFake (Güera & Delp, 2018) are also very convenient to use to generate fake videos, and we are currently unable to deal with this problem perfectly (Karnouskos, 2020).

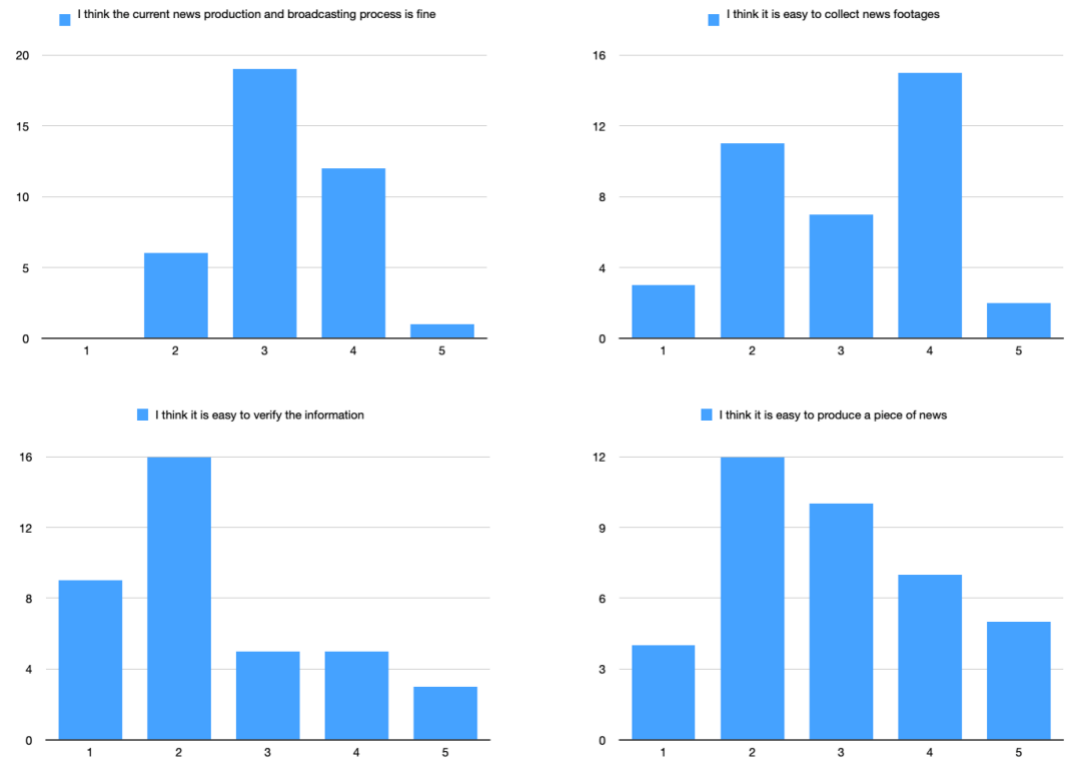

Figure 8: Survey results on current TV news production views

Regarding the content of TV news, 81.5% of people think that TV news is unfair, 84.1% of people think that TV news is biased, 71% of people think that the content of TV news is incomplete, and 73.6% of people think that the content of TV news is not fair. It is correct, and 86.8% of people think that the content of TV news is unreliable. Figure 9 expresses people's distrust of TV news content.

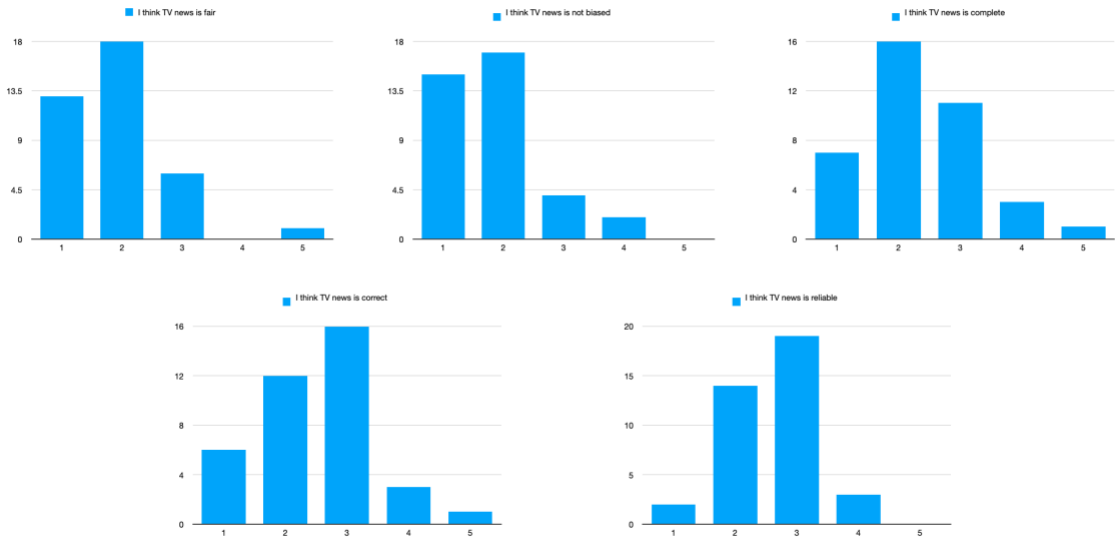

Figure 9: Survey results on current TV news views

Due to the special political and national conditions in Taiwan, most of Taiwan's television media environment is not only due to the different positions of domestic political parties, but also faces attacks from China's information warfare and fake news.

In the following chapters, we will separately analyze and discuss the questionnaire survey on joining AI and AR applications such as Person Tracking and Crowd Counting.

Person Tracking

For the Person Tracking technology with AI and AR, as shown in Figure 10, most of the testees consider it positively helpful in terms of news convenience, news production speed, and news accuracy.

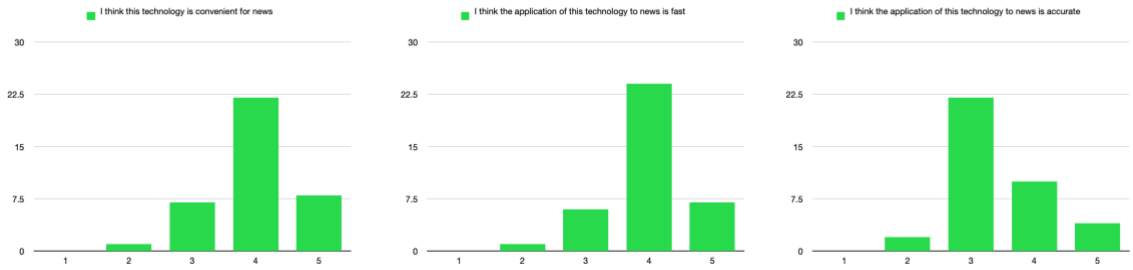

Figure 10: Survey results on Person Tracking

Adding Person Tracking based on AI and AR, from Figure 11, it can be seen that news programs are considered to be significantly helpful in news ratings, news credibility, and lack of news.

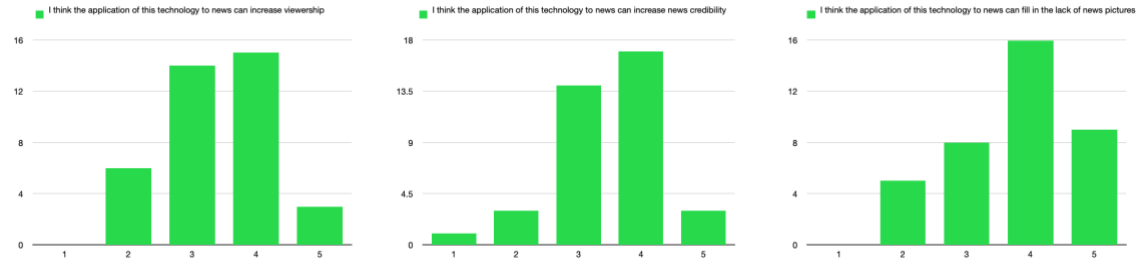

Figure 11: Survey results on the application of Person Tracking to news programs

The results in Figure 12 are interesting. Most of the test subjects think that using Person Tracking is positively helpful to the news production process and news professionalism. But it is not so helpful for fighting for advertising budget.

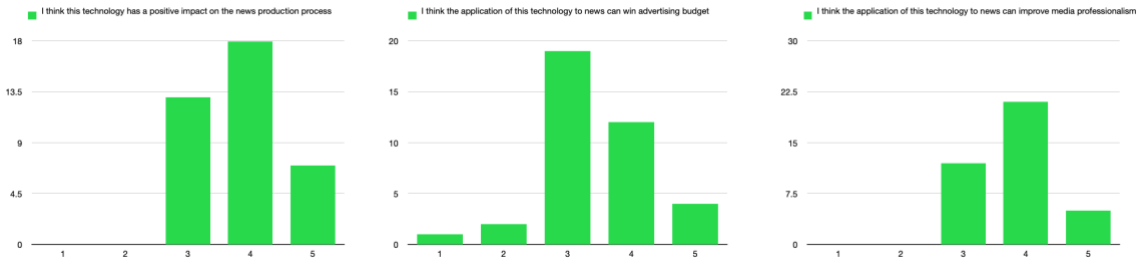

Figure 12: Survey results on the application of Person Tracking to the news production process

Figure 13 shows that the use of Person Tracking is considered helpful in helping news data collection and reducing the burden of news production workload, and it should be used in news production. But this technology cannot replace the functions of SNG cars.

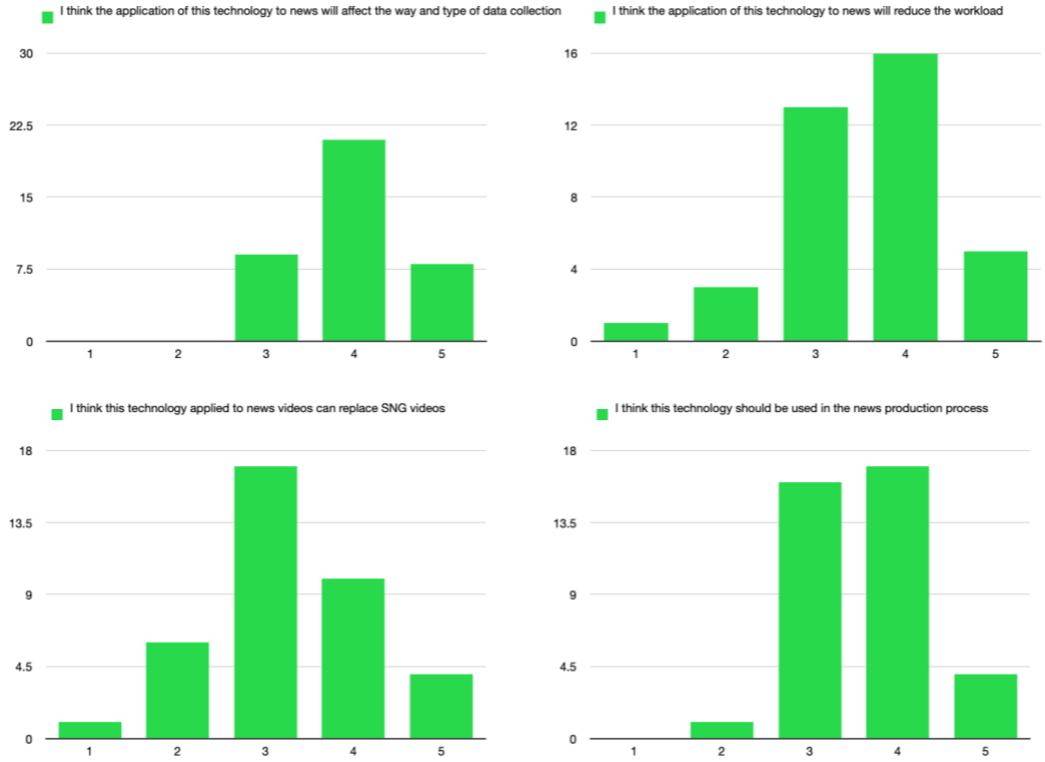

Figure 13: Survey findings on the application of Person Tracking to journalism

It can be seen from Figure 14 that the testees believe that the news produced by Person Tracking technology is fairer, less biased, more complete, more accurate, and more reliable.

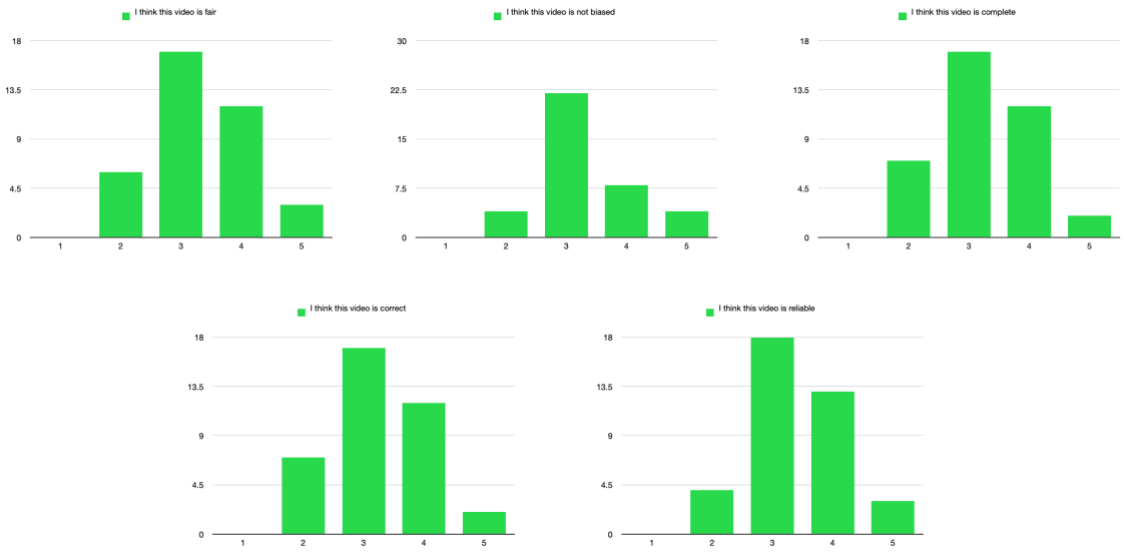

Figure 14: Survey results on the news produced by Person Tracking

The audience will want to watch the news marked by Person Tracking and be willing to share it (Figure 15). Therefore, we believe that the application of this technology has great potential in the news production process.

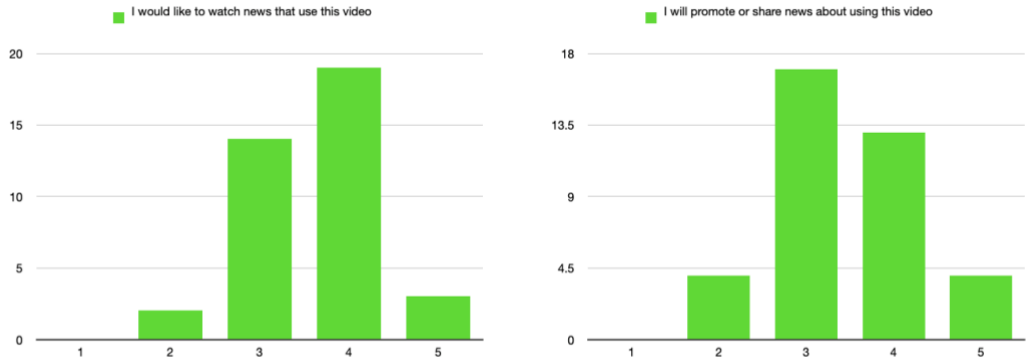

Figure 15: The survey results are like the application of Person Tracking to news

Crowd Counting

In Figure 16, we can see that the subjects gave positive affirmation to the use of Crowd Tracking with AI and AR, believing that this new technology can provide convenience, make news production process faster, and be more accurate.

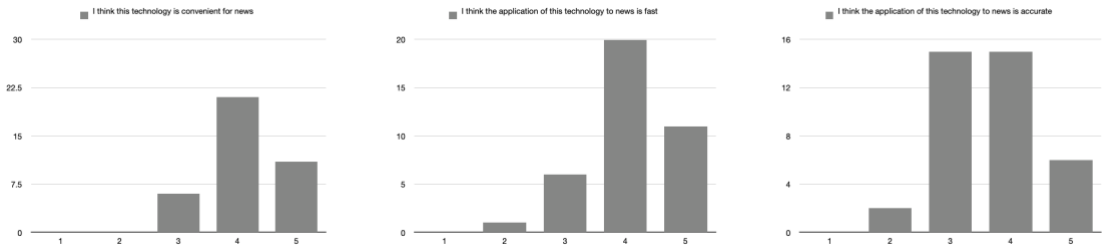

Figure 16: Survey results on Crowd Counting

For news programs, using Crowd Counting can increase ratings and news credibility, and can make up for the lack of news images (Figure 17).

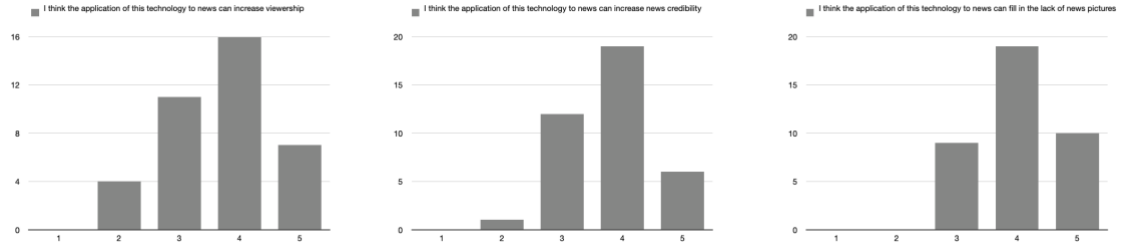

Figure 17: Survey results on the application of Crowd Counting to news programs

For the news program production team, the introduction of Crowd Count is also considered to have a positive impact, which can help news data collection and also help to obtain budget (Figure 18).

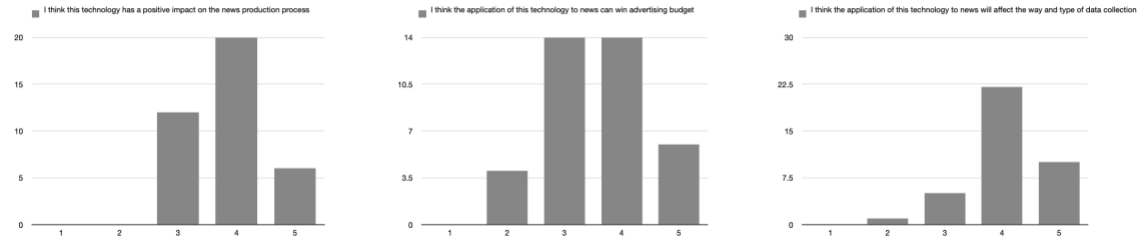

Figure 18: Survey results on the application of Crowd Tracking to the news production process

For the news production process, as shown in Figure 19, using Crowd Counting can help increase journalism professionalism and reduce the burden of journalism. Even unlike Person Tracking, more than half of the people agree that this project can replace the broadcast of SNG cars. Therefore, it is recommended to use it in the news production process.

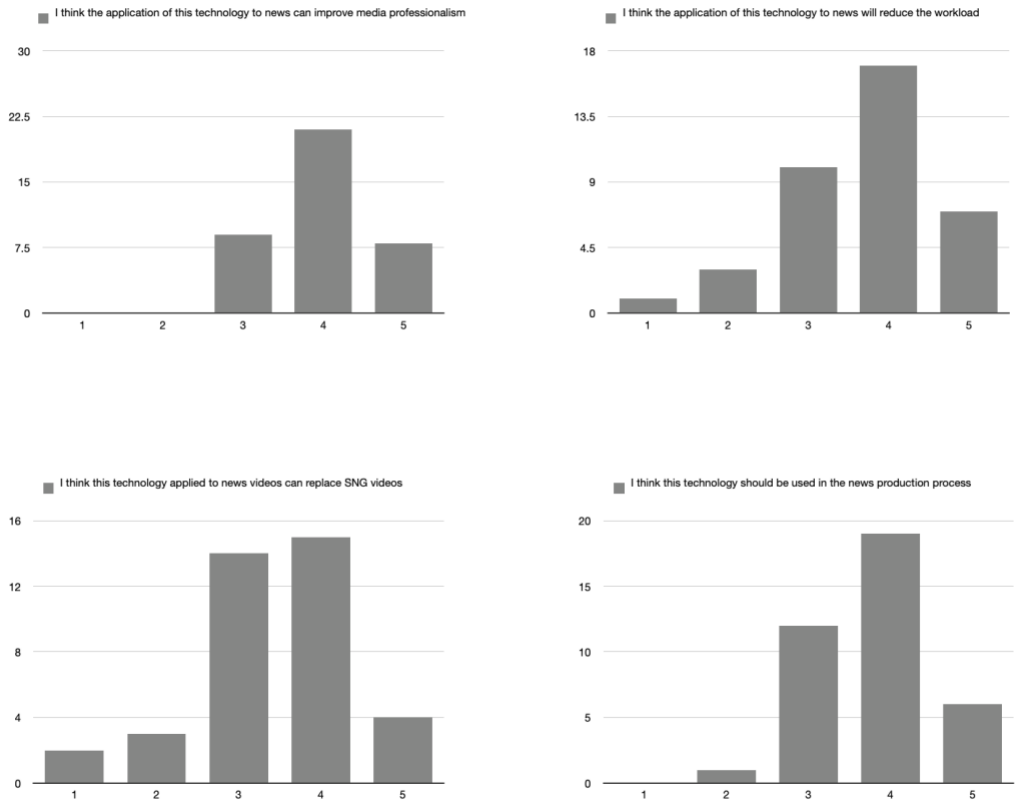

Figure 19: Survey results on the application of Crowd Counting to journalism

For news content, in addition to thinking that it is fairer, less biased, more correct, and more reliable, news integrity is also better after the introduction of Crowd Counting (Figure 20).

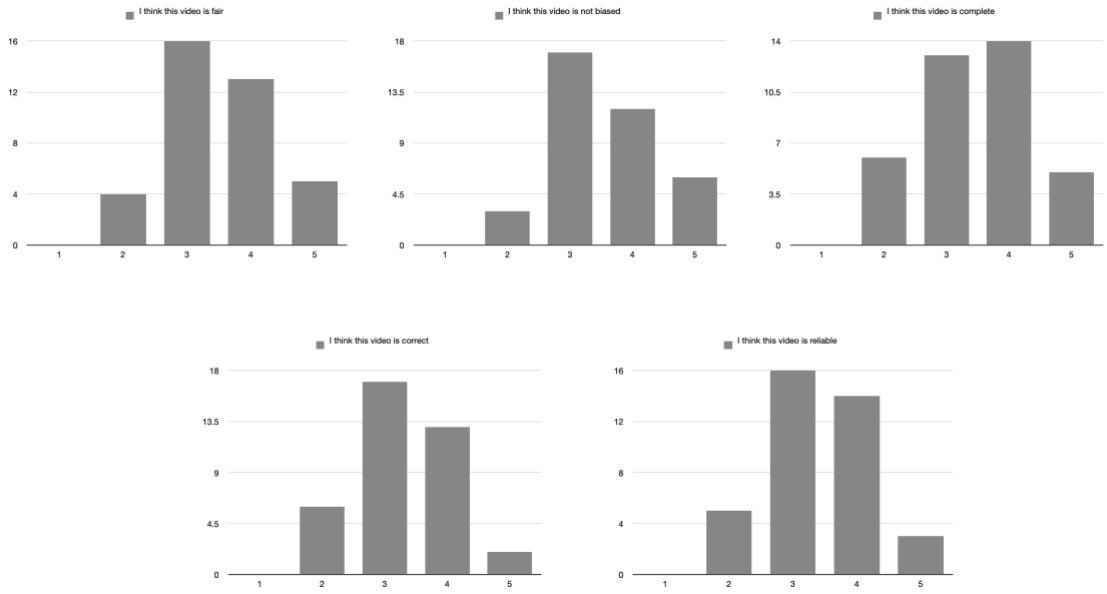

Figure 20: Survey findings on the news produced by Crowd Counting

People are also more willing to watch and share news produced by Crowd Counting technology (Figure 21).

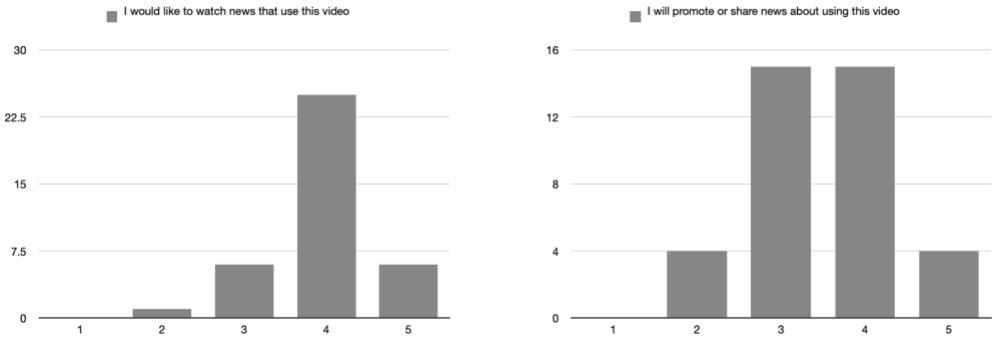

Figure 21: The survey results like the application of Crowd Counting to news

Conclusion

In addition to the questionnaire survey, we also interviewed two TV channels and one Internet news channel, and randomly selected 5 of the 38 questionnaire survey subjects for interviews.

In the TV channel section, they stated that the Person Tracking marker box would block their sight, and for the number of parade activities, they would use the numbers provided by the organizer, so they do not need the assistance of Crowd Counting technology with AI and AR. The opposite is the Internet news channel. They welcome these technologies to help them provide better online news services.

The interviews with the test subjects also provided us with a good reference. Some people believe that Crowd Counting is an indispensable technology in news production, so it can provide accurate statistics for large-scale events, rather than each media reporting a different number of people in the same parade. At the same time, the calculation of the number of people must be instant, which is very important for those who are concerned about the parade. The other is that Person Tracking must provide characters in the news screen, otherwise the audience may not understand what the news screen wants to represent? Another question is how to use Crowd Counting to ensure that the estimated number of people will not be wrong? If the estimated number of people differs greatly from the actual number of people, is there a reliable technology that can make up for it in real time? This is also one of the themes of journalism and communication research (Koivula et al., 2020).

Let's compare people's views on TV news with the use of AI and AI technology-assisted news (Figure 22). We can find that after the introduction of new technologies, people think that such news content is fairer, less biased, and more complete. More correct and more trustworthy. Therefore, we have enough reasons to believe that using AI and AR technology rooms in news production and broadcasting process is very helpful. These are all the directions we can work on in the future.

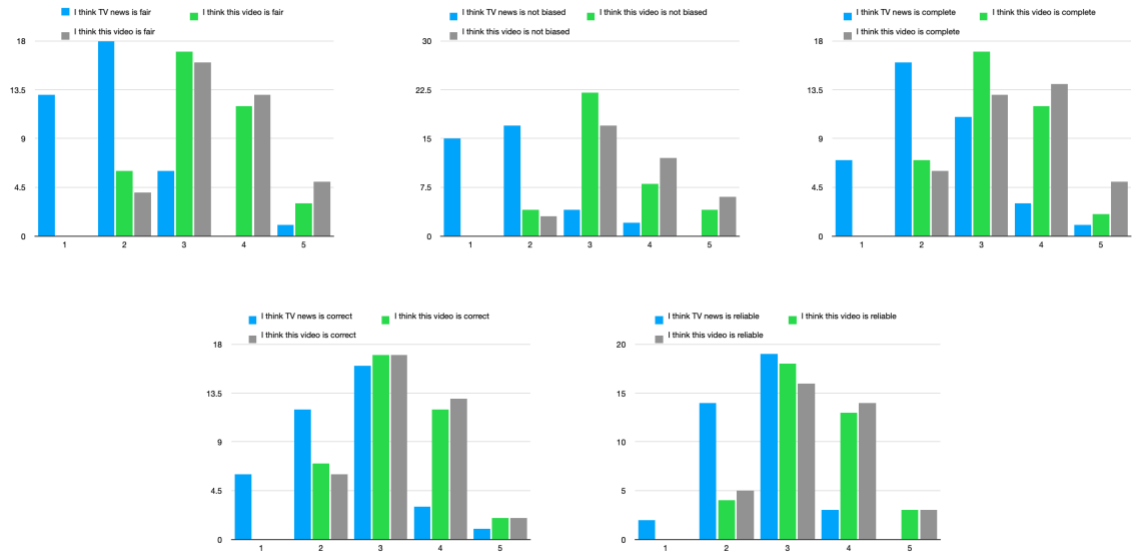

Figure 22: Compare views on current TV news, news using Person Tracking, and news using Crowd Counting. The blue is the current TV news, the green is the news using Person Tracking, and the gray is the news using Crowd Counting.

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