Leveraging Big Data Algorithms to Improve Content Quality and User Experience in Large- Scale Video Production

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Abstract. The explosive growth of video data presents a significant challenge in terms of managing and processing large amounts of visual information in the TV and film production industry. Algorithmic video editing techniques have become crucial in this big data context to efficiently generate informative video content. While many existing works have focused on cost reductions and efficiency improvements, relatively less attention has been paid to user experience and overall video quality. In this study, we conducted a user survey to explore the impact of algorithmic video editing to the user experience and video quality in TV and film production. A total of 110 respondents participated in a 10-point Likert Scale survey to express their views on key dimensions such as content quality, aesthetic appeal, consistency, reliability, information, total waiting time for video production, and likelihood of recommending videos to their friends. The results of the empirical investigation showed that the use of algorithms in editing videos can not only effectively reduce the waiting time but also enhance content quality and user experience in large-scale video production. Participants reported significantly higher satisfaction with algorithmic editing than with raw footage or conventionally edited videos

Keywords: algorithmic editing, content quality, user experience, conventional editing, and Likert Scale

1 Introduction

Starting from the era of big data, the explosive growth of digital content has led to the timeliness problem of manual editing. The focus is on emphasizing the importance of algorithms replacing manual labor, and the main discussion is about the advantages of algorithms vs. traditional methods in the era of big data. However, considering industry factors, there is a need for someone to investigate user experience and identify practical issues. Try to focus on big data-related problems, such as efficiency, user experience, and content availability. Algorithmic video editing is transforming video production by improving efficiency, quality, consistency, and reducing costs. The use of algorithms in video editing helps in analyzing the raw footage, selecting the most relevant shots, and ensuring that the final video presented to the audience is aesthetically appealing and informative (Jost & Le Pévédic, 2022). Algorithms are more efficient

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because they learn using patterns and are more capable of identifying mistakes that may be difficult to capture using the human eye (Kang & Lou, 2022). For instance, Chinese media stations are relying on algorithmic video editing to identify and remove potential artificial intelligence-generated "deep-fakes" (Huber et al., 2019). This study examines how the use of algorithmic video editing in television and film production improves content quality and user experience. While algorithmic video editing promises various benefits, including the possibility of reducing costs, most media houses are still struggling to build AI-enabled systems. Shin et al. (2020) found that only a few media houses and film production companies have prioritized the use of AI in improving not just the content quality but also attracting more users. One of the key challenges that media houses face is insufficient data to support key decisions such as implementing robust AI systems (Jost & Le Pévédic, 2022). Since the management has to account for their decisions, data helps in quantifying and justifying decisions that can generate more income for an organization (Kang & Lou, 2022). The purpose of this essay is to generate data that managers can use to support the implementation of algorithmic video editing in their video productions. The paper also provided new data that students and other researchers can use to grow their knowledge of key technologies likely to improve the media and communication industry.

2 Literature Review

2.1 Algorithmic Video Editing (AVE)

Shin et al. (2020) define algorithmic video editing as a form of video editing that follows a specified schema or nonlinear plan. Algorithms are rules that should be followed when calculating, editing, or selecting items to solve a problem (Huber et al., 2019). The use of algorithms is not a new technique because it has been in the industry over the last three decades (Prasantha, 2020). However, the modern form of algorithms is more advanced and capable of solving complex projects, including going through big data from various sources to pick up what is relevant and reject irrelevant parts (Jost & Le Pévédic, 2022). Algorithmic video editing is part of machine learning techniques where both rules and patterns are used to make accurate decisions regarding the production of entertaining and informative videos (Kang & Lou, 2022). The Chinese media industry is already getting ahead of other counterparts around the world by using artificial intelligence in various aspects of media, including anchoring. Conventional video editing is lacking in both precision and speed. Most media houses and film production companies deal with large amounts of raw footage from the fields (Shin et al., 2020). Once the footage is filed by various reporters and videographers, the editors have to look into each piece of footage to remove irrelevant and potentially offensive parts (Huber et al., 2019). For instance, the editors must bleep any part of the video where there is profanity, swearing, or offensive content. However, it takes time to edit the videos properly and avoid embarrassing moments where a television has to pulldown its video and apologize because it contains offensive or controversial content (Boichanka, 2020). According to Kang & Lou (2022), most media houses address the challenge by hiring additional staff, eventually increasing the cost of production and making the media less attractive to advertisers. Most media houses are considering the use of technology to enhance accuracy even when handling big data.

2.2 Impact on Video Production Industry

The use of algorithms in editing videos has enhanced efficiency, reducing the amount of time and effort needed to produce a video. According to Gupta et al. (2021), algorithms have helped in addressing the issue of inefficiency which is very common with the conventional methods of video editing. Both media and film production companies now consider the use of algorithms as an effective solution to challenges that have affected video production for years (Jost & Le Pévédic, 2022). For instance, AI-enabled software such as Premier Pro has witnessed a significant surge in the number of downloads and installments within the media and film production industries (Kang & Lou, 2022). Enhanced efficiency enables media houses to produce more video and generate more income within a short period (Huber et al., 2019). Algorithmic editing also saves effort that can be used in other areas such as analyzing content to meet the needs of the viewers.

According to Rebecca et al. (2022), algorithmic video editing is also effective in improving consistency and reducing the cost of production. Consistency is one of the key metrics used by media houses to gauge their impact on the viewers (Shin et al., 2020). A consistent media house is also likely to gain the trust of key stakeholders such as viewers and advertisers. However, conventional editing techniques may harm consistency by exposing media and film production companies to various threats, including issuing constant apologies for wrong videos (Kang & Lou, 2022). There are also cases where synchronization becomes a problem, forcing news anchors to give reports without accompanying footage (Jost & Le Pévédic, 2022). Apart from enhanced consistency, algorithmic video editing has also enabled media and film production companies to reduce the overall cost of production. According to Gupta et al. (2021), a single AI-enabled software such as Premier Pro can perform the roles of 10 or more human editors. Rather than paying human editors, many companies are opting for algorithmic machines to lower the overall cost of production.

Algorithmic video editors have also enhanced the overall quality and made video editing more scalable. The use of nonlinear techniques enables algorithmic editors to scale the production based on the demands (Jackson, 2016). For instance, if the media requires a two-minute video, the algorithmic editors can reduce the frames to ensure the entire content fits within the required timeline (Huber et al., 2019). However, if the media requires longer footage that runs for 10 minutes or more to provide details, the algorithmic editors are capable of up-scaling their search and framing procedures to produce longer and more informative content (Kang & Lou, 2022). The software used in analyzing the videos also enhances content quality by selecting the most relevant shots, making the final product more aesthetically appealing and informative (Mikucki & Manovich, 2021). Algorithmic editors may also assist media houses to attract younger viewers by giving them high-quality and informative content.

2.3 Application in the Media Industry

One of the areas where algorithmic video editing has become more crucial is the identification and removal of "*deep fakes*". According to Filimowicz (2022), a *deep fake* is an artificial-intelligence-generated video that appears real and convincing, although the content or characters can be misleading. For instance, artificial intelligence can pick the voice and image of a person and produce a video that appears real but fake or misleading (Filimowicz, 2022). A good example is a video showing presidents speaking at events that they did not attend, or giving misleading views on controversial subjects. According to Shin et al. (2020), it is becoming very difficult even for media houses and film production companies to identify a *deep fake* video. The use of algorithms can help in identifying and removing *deep fakes* from the footage, reducing the chances of being aired as official content (Gupta et al., 2021). The algorithms can also assist in

identifying *deep fakes* used by other organizations and issuing correct information to minimize the chances of misleading viewers.

2.4 Current Research Gaps

After reviewing the available research regarding the use of algorithmic video editing, gaps were found in areas such as content quality and user experiences that have not been addressed adequately in the previous studies. Most studies treated algorithmic video editing as a new and evolving technique whose effects are still unknown or difficult to single out. For instance, there are several factors other than video editing that attract viewers to television or films. To single out video editing as the main contributor to user experience may be misleading without considering other crucial factors. Most researchers also treated algorithmic video editing as an area that requires better analysis in the future to develop accurate positions regarding their impact on viewers.

3 Methodology

The research explored how the AVE can be adapted for large-scale video production and issues in terms of user experiences and quality. At least five dimensions covering content quality and user experience among 110 participants. The questions were drawn from a 10-point Likert Scale asking participants to rate the video content using figures between 1 and 10. The detailed breakdown of the methodology is as follows.

3.1 Research Design

A descriptive research design was chosen for this study because it explores key characteristics of algorithmic editing that make it valuable to users, media houses, and video production companies. The descriptive was also suitable because very little is known about the effectiveness of algorithmic video editing in media houses. The main areas of focus included content quality and user experience. The participants also had a chance to explore areas such as consistency, reliability, and chances of recommending the video to their friends or family members. Descriptive research also provides key insights that can be used in future studies to improve specific areas of concern. Media houses and film production companies can also rely on the outcomes of this study to improve their video editing techniques.

3.2 Research Participants and Procedure

A total of 110 participants were recruited by an external organization to participate in the study. Random sampling was used to identify and recruit all the participants. A survey method using a 10-point Likert Scale was developed for this study. The 10-point Likert Scale asked the participants to rate content using numbers between 1 and 10, where 1 indicated poor quality and dissatisfaction while 10 represented the highest quality and satisfaction. The participants were shown three types of 2-minute videos which were supposed to be rated based on their level of satisfaction. The first video (Raw Footage) represented raw videos obtained from the field presented as they are. The second video (conventional editing) represented videos that have been

edited without any rules or schema, using conventional techniques. The third video (algorithmic editing) represented a video that has been edited using algorithms, including background sounds.

The participants were asked to watch each video for 2 minutes before responding to the Likert questions. A short video length was chosen to give participants an easy time in responding to the questionnaires. The reliability and validity of the Likert Scale questions were determined using expert analysis and criterion-referenced tests. Besides, data from previous studies have given Likert Scales strong reliability and validity. Final responses were then collected from the participants and analyzed using the SPSS tool. The final results were shown in tables and graphs as shown under the figures and graphs below. The graph indicates how the participants reacted to each video quality they watched using dimensions such as content quality, aesthetic appeal, consistency, reliability, and recommendation.

The equation that was used in this study was as follows:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon \quad (1)$$

A linear regression equation was used in this study to determine the relationship between variables. For instance, the study examined the relationship between content quality and editing techniques used by the media house or film production company. The study also examined the relationship between user experience and the editing techniques such as conventional or algorithmic editing. The R-value for both relationships returned about 0.886 indicating a strong positive correlation. In other words, the editing techniques determine both content quality and subsequent user experience.

4 Results and Discussion

The participants indicated strong confidence in the use of technology to improve content quality. The response showed a strong approval (8.0) for algorithmic editing in improving the overall content quality. Most respondents were dissatisfied with the raw footage because it lacked consistency or direction. It was difficult for the participants to contextualize the raw footage without some editing or background voices to add meaning. The algorithmic editing improved quality by cutting out fewer necessary sections and putting frames in ways that complement each other. It was easier for the participants to follow the content using algorithmic than conventional editing. It also took a shorter duration for the participants to review the third video (algorithmic editing) because it was more straightforward and consistent. The findings are consistent with the (Kang & Lou, 2022) analysis in which algorithmic editing produced higher quality videos than conventionally edited videos.

4.1 Content Quality

Algorithmic editing also streamlined the production process, reducing the use of manual and tedious work, especially when dealing with large data. The videos that were presented to the participants were mostly obtained from social places, depicting various activities that people do during vacations. The raw footage presented video frames in no orderly manner. However, the conventionally edited video took longer to produce because of the manual work involved in putting the frames together in ways that can be meaningful to the audience (Huber et al., 2019). Conventional editing became even more tedious when dealing with large amounts of data (Shin et al., 2020). However, working with algorithms in editing reduced the overall editing time by more than 80%, making the work more efficient. Algorithmic editing is more likely to save a

significant amount of time and assist media houses to release timely information (Jost & Le Pévédic, 2022). The manual editing was also subject to various errors and omissions, leading to repeated editing to correct the affected frames.

4.2 User Experience

The study showed that more users were willing to share the third video (algorithmic editing) with their friends on various social media platforms. More than 90% of the participants gave aesthetic appeal about 9.5 on the Likert Scale rating, indicating significant satisfaction. The participants found algorithmic editing more appealing because it presents video frames in ways that make significant sense to the audience. The algorithms arrange all the frames in ways that assist the audience to build a story (Eugeni & Pisters, 2020). The algorithms also rejected all the irrelevant footage to assist in building a consistent and reliable story (Kang & Lou, 2022). The aesthetic appeal was also enhanced by the minimal to zero errors that users can find in the edited videos (Gupta et al., 2021). Apart from being aesthetically appealing, the users also found algorithmic editing more informative.

Algorithmic editing also improved user experience by answering most of the questions they develop as they watch the video. According to Gupta et al. (2021), algorithmic editing can only work effectively after undergoing significant training to enhance accuracy, consistency, and efficiency. The purpose of algorithmic training is to analyze data, identify patterns, and align the algorithms to the audience's needs (Bieda & Panchenko, 2022). The media and film production companies are developing videos for their audiences (Diakopoulos, 2015). This means both the content quality and presentation style should meet the needs of the audience. Algorithmic editing is built in ways that provide answers to questions that users may develop as they watch videos (Shin et al., 2020). For instance, frame 1 may be designed to generate curiosity among the audience while the next frame provides an answer to the curious questions raised by the audience. In situations where there is a need to translate, algorithmic editing ensures that the sounds match the actions to minimize confusion.

4.3 Ethical Concerns

Although algorithmic editing may improve both content quality and user experience, it may raise potential concerns about the biased selection of content to meet the media house narrative (Jackson, 2016). For instance, the algorithms may only select videos that a media house themes appropriate while leaving out sections that contradict the house's position on certain issues (Fizek, 2022). Apart from amplifying harmful biases, the use of algorithms may encourage discriminative decisions and inequality (Mikucki & Manovich, 2021). Before using any algorithms, media houses must examine the rules or schema to avoid biases.

Table 1. Likert Scale Rating System

Table: Comparative Discussion based on Likert Scale Rating System (1-lowest and 10-highest)

Dimensions	Raw Footage	Conventional Editing	Algorithmic Editing
Content Quality	3.5	6.0	8.0
Aesthetic Appeal	1.5	4.0	9.5
Consistency	2.0	3.5	9.0
Reliability	2.5	4.5	8.5
Informative	1.9	5.8	9.3
Recommendation	3.5	5.5	7.5

Table 1 shows the rating system which is called as Likert Scale rating system mentioning and comparing the Raw footage, Conventional editing and Algorithmic based editing. The scaling values were given from "0" to "10". The parameters were discussed such as content quality, Aesthetic appeal, Consistency, Reliability, Informative and Recommendations. From this table, the authors can decide that Algorithmic editing shared the maximum value for the parameters given in there compared to Raw footage and conventional editing. Figure 1 showcases the values in chart type to show the changes in the values compared to pre test scores and post test scores. Figure 2 shows the same values in visualization method. With plain eyes we can see the change curve climbed up after post intervention tests. Figure 1 says the same thing with visualization method for better understanding. We can see here the chart representing that all the values of algorithmic editing stands above the conventional editing and Raw footages.

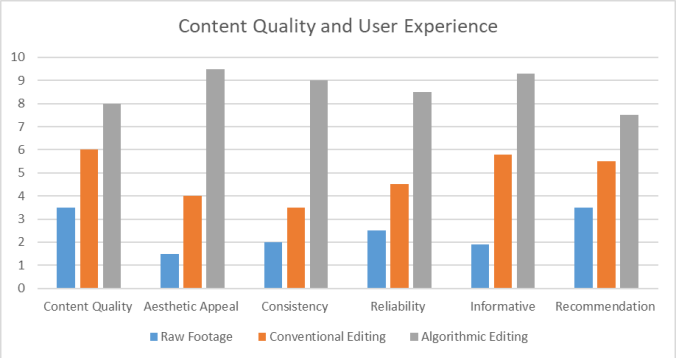

Fig1. Graph showing the content quality and user experience.

5 Conclusion

The use of algorithmic video editing in large-scale video production generates vast amounts of data that can be leveraged to achieve further optimization on efficiency, quality, consistency, and cost reduction. This paper investigates the application of algorithmic video editing and analyzes its impact on content quality and user experience. Our research shows that the use of algorithmic video editing can not only provide effective video production, but also enhances the content quality and user experience by uncovering key insights from vast amounts of video data. The research participants reported higher levels of satisfaction with algorithmic editing than either raw footage or conventionally edited videos since algorithms automatically identify and remove profanity or controversial content in large-scale visual data, resulting in more reliable, informative, and shareable videos. Our study recommends media houses and film production companies prioritize utilizing big data technologies to improve video quality, generate more insightful analytics, and increase the potential for attracting a wider audience.

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References

[1] Bieda, I., & Panchenko, T. (2022). A Systematic Mapping Study on Artificial Intelligence Tools Used in Video Editing. International Journal of Computer Science and Network Security, 22(3), 312-318.

[2] Boichanka, D. (2020). The Algorithmic Production of the Visual: Portrait Mode, Instagram, and the Automation of Mobile Photography. Journal of Creative Industries and Cultural Studies: JOCIS, (5), 30-49.

[3] Diakopoulos, N. (2015). Algorithmic accountability: Journalistic investigation of computational power structures. Digital journalism, 3(3), 398-415.

[4] Eugeni, R., & Pisters, P. (2020). The artificial intelligence of a machine: Moving images in the age of algorithms. NECSUS_European Journal of Media Studies, 9(1), 91-100.

[5] Filimowicz, M. (Ed.). (2022). Deep Fakes: Algorithms and Society. Routledge.

[6] Fizek, S. (2022). Through the Ludic Glass: Making Sense of Video Games as Algorithmic Spectacles. Game Studies, 22(2).

[7] Gupta, A., Khan, F. F., Mukhopadhyay, R., Namboodiri, V. P., & Jawahar, C. V. (2021, December). Intelligent video editing: incorporating modern talking face generation algorithms in a video editor. In Proceedings of the Twelfth Indian Conference on Computer Vision, Graphics and Image Processing (pp. 1-9).

[8] Huber, B., Shin, H. V., Russell, B., Wang, O., & Mysore, G. J. (2019, May). B-script: Transcript-based B-roll video editing with recommendations. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (pp. 1-11).

[9] Jackson, W. (2016). Digital video editing fundamentals. Apress.

[10] Jost, C., & Le Pévédic, B. (2022, June). How to integrate interactions into video editing software? In Proceedings of the 2nd Workshop on Multisensory Experiences-SensoryX'22. SBC.

[11] Kang, H., & Lou, C. (2022). AI agency vs. human agency: understanding human–AI interactions on TikTok and their implications for user engagement. Journal of Computer-Mediated Communication, 27(5), zmac014.

[12] Mikucki, J., & Manovich, L. (2021). The Age of Algorithms: Interview with Professor Lev Manovich. Central European Journal of Communication, 14(2 (29), 343-349.

[13] Prasantha, H. S. (2020). An Approach for Frame Rate conversion of a Video. International Journal of Advances in Engineering and Management (IJAEM), 2(5), 607-612.

[14] Rebecca, J. B., Ramalingam, V. V., Sugumaran, V., & Rajkumar, D. (2022). Predictive analysis of online television videos using machine learning algorithms. Fundamentals and Methods of Machine and Deep Learning: Algorithms, Tools and Applications, 237-257.

[15] Shin, D., Zhong, B., & Biocca, F. A. (2020). Beyond user experience: What constitutes algorithmic experiences? International Journal of Information Management, 52, 102061.