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THE IMPACT OF MOVIE COLORIZATION BY ARTIFICIAL INTELLIGENCE ON CINEMATIC SYMBOLISM: A CASE STUDY OF SATYAJIT RAY'S 'PATHER PANCHALI'

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ABSTRACT

The objective of image colorization is to add color to a monochrome input picture to generate a colorful outcome, which is a classic and essential issue in visual effects. In cinema, color has a significant role in on various levels. But it was not the fundamental component of cinema. Although color was added in film later, but for a long time people were used to watching movies on their black and white television set.

This study depends on the effort of a Bengali professor based in the United States who used artificial intelligence to colorize Satyajit Ray's 'Pather Panchali' as a quarantine experiment. This research analyzes the use of colorization in 'Pather Panchali' to determine whether the colors work well to emphasize the film's symbolic meaning. It also examines whether there is still a place for sentimentality after colorization and how well AI works at coloring in black and white movies.

The research objectives include evaluating the role that colorization plays in bringing the film's meaning to light with regard to certain situations, examining among specialists the nostalgia/emotions linked with classic black and white films, and gauging experts reaction to the practice of using AI to colorize previously black-and-white movies. This study uses in-depth interviews as a qualitative research approach for gathering expert opinions.

This study concludes that the cinematic symbolism of the black and white version of 'Pather Panchali' is lost in the colorized version. Expert interviews revealed the complex connection between colorization and the film's visual style. The findings emphasize the need for careful consideration and preservation of the original black-and-white format, while also recognizing the advancements and limitations of artificial intelligence in the colorization process.

Keywords: Colorization, Recoloring, Pather Panchali, Symbolism, Artificial Intelligence

1. INTRODUCTION

Films have increasingly moved towards a more realistic style. The introduction of sound heightened the impression of reality for listeners. The next phase was color, which included the chromatic senses. Motion movies may now properly recreate all sensory experiences, both audio and visual. Hence, it was seen that color

and the story had a contentious connection. This is understandable given how recently the use of color has become standard in filmmaking.

The concept of adding color to black and white films is not revolutionary in the modern era. With the advancement of technology, it is now possible to colorize a black-and-white film in a few hours using the artificial intelligence, when earlier it was a very difficult and time-consuming process Lavvafi et al. (2010). But the use of colorization in film has been a subject of debate among filmmakers and film enthusiasts for decades. While the addition of color to films is often seen as a way to enhance the visual appeal and realism of a movie, it is also criticized for altering the original artistic vision of the filmmaker and detracting from the film's intended impact. The purpose of this research paper is to explore the role of colorization in cinematic storytelling, specifically through a case study of Satyajit Ray's 'Pather Panchali', a classic black and white film from the 1950s. The study also plans to look at how recent advances in AI technology have lowered the barriers to entry for colorizing black-and-white films.

According to the news report, Aniket Bera, a 30-year-old professor at the University of Maryland, has published a 2.14-minute video on YouTube of Satyajit Ray's 'Pather Panchali' that has been digitally colorized and upscaled. The video, which was posted on May 14, 2020, was an academic experiment inspired by Bera's admiration of Ray's work. Bera up scaled the footage to 60fps, 4K Ultra High Definition, and digitally colorized it using deep neural networks. He explained that artificial intelligence technology functions similarly to the human brain by analyzing millions of real-world videos to 'dream' of the original hues and details. Completely automated, Bera's method took roughly seven hours Dasgupta (2020). An FTII alumnus, Sriram Raja, has conducted an experiment called #imaginecolour during the lockdown. He coloured the Apur Sansar clip and conceptualised the 'Jaane kya tune kahi' song from Pyaasa in part black-and-white and part sepia-toned. Raja compares his work with amateur independent musicians making 'cover' versions of popular songs TNN. (2020).

In addition to the attempts by Aniket Bera and Sriram Raja to colorize clips of classic Indian films using AI and manual techniques respectively, a full colorized version of 'Pather Panchali' can also be found on YouTube. This version, uploaded by Bjgtjme - Free Movies, is over two hours long and presents the entire film in color. It is not clear what techniques were used to colorize the film, but it has received mixed reactions from viewers Bjgtjme. (2022).

As we become acquainted with and empathize with each character, 'Pather Panchali' builds inexorably to a dramatic climax. Ray invests time and cares into creating a universe that seems real and authentic. No aspect of the picture, from its characters to its speech to its plot, rings fake. The feelings provoked by what happens in 'Pather Panchali' are genuine and authentic, rather than the manufactured results of manipulative formulae. Ray helps us feel along with, rather than simply for, his characters Berardinelli (2016). Attempting to colorize a classic movie like this is both a challenge and a thrilling endeavor. There are a variety of considerations involved in this task that requires a great deal of effort and attention to detail. The creator must consider the original lighting and color palette, as well as the historical and cultural context of the film. Additionally, they must ensure that the colorization process does not compromise the artistic vision of the original director. Despite these challenges, the process can also be exhilarating, as it offers a unique opportunity to reinterpret and breathe new life into a beloved classic.

The significance of this research lies in its contribution to the ongoing debate about the use of colorization in film. The findings of the research will provide

insights into the impact of colorization on the artistic integrity of a film and its intended emotional impact on the audience. The research will also contribute to the understanding of the role of artificial intelligence in film colorization and its potential benefits and drawbacks.

2. ABOUT THE FILM 'PATHER PANCHALI'

'Pather Panchali' is a critically acclaimed Indian film directed by the Oscar award winner Satyajit Ray and produced by the Government of West Bengal, released in 1955. It is Satyajit Ray's directing debut and the first film of the Apu trilogy, followed by Aparajito and Apur Sansar, which portrays the story of the growth and maturation of Apu, a young boy from a poor Brahmin family living in a rural village in Bengal. The film's use of black and white cinematography is seen as a deliberate artistic choice, with Ray stating that he used it to evoke a sense of nostalgia and timelessness in the story TOI. (2022). Featuring Kanu Banerjee, Subir Banerjee, Karuna Banerjee, Pinaki Sengupta, Uma Dasgupta, and Chunibala Devi, the drama film "'Pather Panchali'" received all-time Best Indian Film award from the International Federation of Film Critics (FIPRESCI) E-Times. (2022).

The film is based on the novel of the same name by Bibhutibhushan Bandopadhyay. It is known for its realistic portrayal of rural life in India, also capturing the beauty and hardship of the people and their environment. The story follows the struggles of Apu's family, including his father Harihar, mother Sarbajaya, and sister Durga, as they face poverty, illness, and death, while striving to find joy and hope in their daily lives TOI. (2022). Ray had conveyed a major lesson via the picture that hardship brings out one's heroic potential. It might be Apu or Sarbajaya. What happens to a family when a daughter or sister dies, especially if they are already struggling financially because of economic hardship? The film's small moments of creative peaking make it timeless. It's true that 'Pather Panchali' is a cult film that preserved the humanity of interpersonal connections. So, even though it's about life in rural Bengal, it has universal appeal Getbengala. (2020).

The film 'Pather Panchali' is a masterpiece of Indian cinema and is widely regarded as a landmark in the development of Bengali cinema. Global viewers are connected with the film's common themes of poverty, family, and the fight for survival. According to SatyajitRay.org's report, "Pather Panchali" received critical acclaim and garnered numerous awards, including the President's Gold & Silver Medals in New Delhi (1955), the Best Human Document at Cannes (1956), a Diploma Of Merit at Edinburgh (1956), the Vatican Award in Rome (1956), the Golden Carbao in Manila (1956), Best Film and Direction at San Francisco (1957), the Selznik Golden Laurel in Berlin (1957), Best Film in Vancouver (1958), Critics' Award for Best Film in Stratford, Canada (1958), Best Foreign Film in New York (1959), the Kinema Jumpo Award for Best Foreign Film in Tokyo (1966), and the Bodil Award for Best Non-European Film of the Year in Denmark (1966) SatyajitRay.org. (2024). It has since become a classic of world cinema and is considered as one of the greatest films ever made.

Satyajit Ray, the director of 'Pather Panchali', was one of the most important filmmakers of the 20th century, and the first Indian director to gain international recognition. His works are known for their realistic portrayal of Indian life, and their exploration of themes such as identity, family, and tradition. Ray's influence on Indian cinema and his contributions to world cinema have been widely acknowledged, and he is regarded as one of the greatest filmmakers of all time.

Figure 1

Figure 1 Iconic Train Scene: Original vs. Colorized Comparison
Source YouTube

Figure 2

Figure 2 Durga: Original vs. Colorized Comparison
Source YouTube

3. REVIEW OF LITERATURE

For a long time, it has been debated whether or not to utilize AI to add color to previously shot black-and-white films. It is obvious that there was a gap between the conception and development of color. People expected color in motion pictures to be identical to color in nature, which led to its pervasive use. From the aforementioned points of view, early color films failed miserably in representing "real colors." Thus, by the 1930s, the black-and-white realist codes were well-established. It was familiar to the audience. The introduction of color to the cinema was a radical change that took some getting used to Costa (2011).

Wilson Markle introduced the concept "colorization" in the 1970s to refer to the practice of digitally enhancing previously black-and-white imagery with additional hues. The phrase is now often used to refer to any method of coloring previously black and white photos or videos Koleini et al. (2010). Since 1980, the technique of colorizing black-and-white film and images has gained a lot of traction in the movie business and the world of computer graphics. The fundamental principle behind any and all colorization techniques is to swap out the original monochrome image's luminance (the gray level) for a vector color space Lavvafi et al. (2010).

Several different colorization techniques have arisen since the introduction of digital video processing. Drawing scribbles to spread color to nearby pixels is one such method, but it takes a lot of human input. A different method for adding color to a black-and-white picture involves copying the colors from a reference image into the new one. Colorize grayscale photos using CNNs trained on large-scale image datasets Chen et al. (2018). According to Shiguang Liu, traditional manual coloring method consumes a lot of manpower and material resources, and may not get satisfactory results. Given a source image or video, colorization methods aim to automatically colorize the target gray image or video reasonably and reliably, which thereby greatly improves the efficiency of this work Liu (2022).

Coloring techniques have evolved throughout time and may be grouped into three different types: hand coloring, semi-automatic, and automated coloring. Coloring by hand is an age-old art form that has been utilized to showcase the skills of many creative minds. In 1988, for instance, it took almost two months and about US$ 450,000 to finish coloring the iconic film Casablanca. This approach required investigating historical costume notes from the original movie's set to find the actors' and actresses' most common colors. Black Magic, a commercial software suite designed for colorizing still images, gives the user access to a wide variety of strokes and palettes of colors. One major issue is that all segmentation work must be done by hand Semary et al. (2007).

The semi-automatic approach for adding color to black-and-white photographs was introduced by Levin et al. Similar to the technique reported by Levin in 2004, Li et al. demonstrated a semi-automatic approach for colorizing grayscale photographs. However, this algorithm took advantage of the edges gradients, and advanced gradient directions information available in the grayscale images to fill in the user's scribbles with color Li et al. (2015).

A plethora of research using gradient-steered diffusion, heat transfer equations, and inpainting to facilitate colorization surfaced in the early 2000s. These techniques let users enter simple color strokes, and algorithms would fill up the marked spaces without going over bounds. But a breakthrough was made with the introduction of neural networks, especially convolutional neural networks (CNNs). CNNs are excellent at recognizing objects and can efficiently combine colorization and recognition tasks if trained with large-picture datasets. The literature presents a range of strategies that use several network architectures, including auto encoders and GANs (Generative Adversarial Networks) Titus & N.M (2018)

In their paper, Koleini et al. have discussed the texture based colorization method for black and white videos. In order to make use of MSMD's strengths in edges and texture-related data extraction, they mapped the black and white scenes' Gabor filter-based features to the optimal location within the HLS range using a multi-layer perceptron (MLP). A combination of Gabor filter banks (feature extractor) and a multilayer perceptron (mapper) achieved promising results with the objective of successfully colorizing black-and-white films. In order to ensure that their procedure was accurate, they took into account both the colorization's aesthetic quality and the MSE inaccuracy Koleini et al. (2010).

Older colorization techniques produce movies that have less contrast, seem flatter and whiter, and have washed-out colors. Nonetheless, notable breakthroughs in colorization technology throughout the 1980s brought about advances. Since then, some black-and-white films and TV shows have been given realistic-looking color makeovers. Colorization approaches usually entail assigning colors to particular regions within a frame and monitoring those regions over many frames. For example, neural technology was used in the 2003 release of Black Magic, a

commercial image-colorization program. This tool allows users to choose from various color schemes and patterns, and segmenting pictures is user-driven. Samanta (2023).

In the early 2000s, numerous studies emerged employing techniques like gradient-steered diffusion, heat transfer equations, and inpainting to aid in the colorization process. These methods allowed users to input minimal color strokes, after which algorithms would seamlessly fill the designated areas without exceeding boundaries. However, the advent of Neural Networks, particularly Convolutional Neural Networks (CNNs), marked a significant advancement. CNNs excel in object recognition, and when trained with extensive image datasets, they can effectively combine recognition and colorization tasks. Literature showcases various approaches utilizing diverse network structures such as Autoencoders and GANs (Generative Adversarial Networks) Boutarfass & Besserer (2020).

To colorize a video automatically, Mohiy, Noura, and Alaa.M.Abbas developed a system that did it shot by shot, instead of frame by frame. This allowed for a variety of approaches to be provided, including shot cut identification, motion estimates, and similarity characteristics across pictures, and colorization. The fact that each shot in a movie had common framing cues served as the inspiration for their concept. Therefore, there was no need to go frame-by-frame and colorize the film. It was sufficient to color the first frame of each shot (the key frame) and then use a transferring method to apply those colors to the other frames. Their paper successfully proposed and implemented an end-to-end automatic colorization system tailored to motion pictures, and they came close to realizing their vision Hadhoud et al. (2010).

Mohammad, Seyed Amirhassan, and Payman developed a method for colorizing black-and-white video footage utilizing artificial neural networks and digital image processing methods, with the goal of minimizing the need of a human operator. The suggested method utilized ANN to automatically colorize black-and-white films. While training an ANN took a considerable amount of time, this could be reduced with the help of more powerful computers or more efficient training algorithms. It was estimated that this approach of colorization was almost 50 times quicker than those in which every frame had to be colorized by hand, and that they could colorize a series of 50 frames on average with each colored frame and developed neural networks, which was about two or three seconds of a film. In the actual procedure, a source black and white frame was first manually colorized. After that, they tried a Multi-Layer Perceptron (MLP) neural network with these 2 images as inputs. (A black-and-white film was fed into a machine that was supposed to spit out a color film). Next, the neural network's input was the sequence of black-and-white frames; the network's output was the matching color data for those frames Lavvafi et al. (2010).

4. OBJECTIVES

The aim of this research is not just analyze the satisfactory factor of colorization of 'Pather Panchali', but also discuss the film in terms of accuracy and authenticity. Through this study the researcher tried-

1) To assess significance of colorization in highlighting the symbolism in the film with reference to specific scenes.
2) To dissect the nostalgia/emotions associated with the classic black and white films among the experts.

3) To evaluate the reception of use of artificial intelligence for colorization of grayscale films.

5. RESEARCH METHODOLOGY

For this study, the research methodology employed is a qualitative approach using in-depth interviews with experts in the film industry. The objective of this method is to gather insights and opinions from professionals who have experience and knowledge in the field of film colorization and its effects on cinematic storytelling. The interviews have been conducted in a structured manner, with a pre-determined set of questions related to the research objectives. For the interview, interviewees were provided with a YouTube link to the colorized version of 'Pather Panchali' and a short montage created by Bera for their feedback.

To collect data, we selected participants for the study based on their expertise in film color, symbolism, and the use of artificial intelligence for colorization. Participants were required to work or have worked in the film industry and possess experience with colorization techniques. Participants gave their informed permission before being interviewed via the phone, in person, or through online video chat. In most interviews, five standard questions were used. These five questions are as follows:

- Which version of this film, black and white or color, would you prefer to watch, and why?
- How does the use of color in 'Pather Panchali' enhance the film's narrative and themes?
- Is the colorization adequate for highlighting cinematic symbolism?
- Do nostalgic and emotional aspects remain relevant post-colorization?
- How successful is artificial intelligence in colorizing 'Pather Panchali', and is the outcome acceptable and satisfactory?

Interviews have also been conducted with a small number of students who comprehend film language and who watch films on a variety of platforms in order to ascertain their perspectives and feedback regarding colorization. Thematic analysis was used to assess the data acquired from the interviews. Finding commonalities and organizing them systematically into meaningful patterns that can be used to answer research questions and draw conclusions is at the heart of this strategy. Researchers conducted the analytic procedure through multiple coding phases, with themes and patterns emerging as we progressed with the investigation.

6. DATA ANALYSIS AND INTERPRETATION

- **Interview: 1**

In an online interview, Atanu Ghosh, a National Award-winning filmmaker, shares his perspective on the colorization of Satyajit Ray's 'Pather Panchali'. He states unequivocally that he prefers the black-and-white version of the film, considering it to be the original and therefore significant. As the original film was shot in black and white, he claims that color doesn't add anything to his interpretation of 'Pather Panchali'. Atanu emphasizes that the lighting scheme, tone, texture, and aesthetics of the film were meticulously designed to suit the grayscale format. He believes that imposing color on a film created with black and white

parameters would have a detrimental effect on its overall artistic vision. Atanu Ghosh argues that the movie's colorization dilutes the film's symbolic meaning. He criticizes the artificial appearance of skin tones, backdrops, and props, which lack depth and authenticity. Ghosh contends that the colorization method, which involves wide sampling, cannot duplicate the original's unique subtleties. He further asserts that colorization alters the aesthetics of the original film, going against the artistic and intellectual brilliance of its creators.

Ghosh firmly states that nostalgic and emotional aspects do not remain relevant post-colorization, without providing further elaboration. Moreover, the mise-en-scene would have been drastically altered by the addition of color. Colorizing it, thus, changes its aesthetic value from the original. He believes that colorizing classic black-and-white films can only serve entertainment purposes, highlighting concerns about the violation of the creative and intellectual rights of the director, cinematographer, and art director through the colorization process. He emphasizes the importance of preserving the original black and white version, questions the relevance and adequacy of colorization in enhancing the film's narrative and symbolism, and raises concerns about the violation of artistic value through the use of artificial intelligence in colorization.

- **Interview: 2**

Debasish Sen Sharma, a filmmaker, thespian, and academician, shares his perspective on the colorization of Satyajit Ray's 'Pather Panchali' in a face-to-face interview. When asked about his preference between the black and white and color versions of the film, Sen Sharma expresses a strong inclination towards the black and white format. He explains that this preference is rooted in the audience's familiarity with the film presented in its original black-and-white form, which holds great nostalgic value, particularly for Bengali viewers. Sen Sharma takes an unfavorable perspective on the use of color in 'Pather Panchali' and its influence on the film's narrative and themes, believing that colorization has no substantial impact on the film's narrative or ideas. According to him, the original black-and-white presentation conveyed the intended message and emotional depth effectively, rendering the addition of color extraneous and ineffectual.

The colorization, he says, could do a better job of communicating or emphasizing the film's symbolic aspects. This indicates that adding color does not help bring out the film's more profound significance. Sen Sharma thinks the film's sentimental and nostalgic elements are less effective once they've been colorized. He points out that colorization leads to the loss of the iconic palette, as well as the diminished impact of light and shade effects in certain scenes. As a result, there is a major shift in the picture away from the sentimental aspects of the original black-and-white version. While the AI colorization is technically impressive, Sen Sharma argues that the ultimate result still has an unnatural feel. He emphasizes the difficulty of combating the collective reminiscence engrained in the minds of a generation, indicating that the artificial colors fail to resonate with the viewers' sentimental attachment to the black-and-white version.

- **Interview: 3**

In an online interview, Somdev Chatterjee, an Assistant Professor of Television Production at the Satyajit Ray Film & Television Institute (SRFTI), firmly expresses his preference for the black-and-white version of the film. He thinks it's vital to keep Ray and cinematographer Subrata Mitra's vision intact, and that any kind of

interference, including colorization, messes with the integrity of the film. According to Chatterjee, the black-and-white version its own and requires no additional modifications. Chatterjee expresses skepticism about the effects of color on the film's storyline and ideas while analyzing the usage of color in 'Pather Panchali'. He believes the black-and-white format and Subrata Mitra's skilled cinematography effectively convey the intended message. According to him, the film's use of color clashes with its otherwise harmonious aesthetic.

Somdev doubts the assumption of the question, suggesting that colorization effectively draws attention to cinematic meaning. He wonders whether there wasn't already enough symbolism in the black-and-white version to justify making it colored, and he argues that the picture doesn't need to be colored to make its meaning clearer. Somdev recognizes the possibility for diversity among viewers when examining the significance of nostalgic and emotional qualities after colorization. Having watched the original black and white film so many times, the color version makes him uneasy. He claims that he does not feel more moved by the picture because of the use of color. He stresses the significance of retaining the original vision, doubts the need for colorization to enhance story and themes, and emphasizes the subjective nature of colorization's emotional and nostalgic influence.

- **Interview: 4**

In this interview, Asok Dasgupta, a National and International award-winning cinematographer, documentary filmmaker, and academician, expresses a clear preference for the black-and-white version. He states that the tonal separation is much better in the black-and-white version, implying a stronger visual impact. Dasgupta believes that the use of color detracts from the viewing experience of the film rather than enhancing its storyline and concepts. He specifically mentions that the skin tone of the characters is not accurately rendered on the screen, implying a lack of authenticity. He states categorically that the colorization does not correspond to the intended cinematic symbolism. This indicates that the film's symbolic elements are not effectively conveyed through colorization.

According to Asok Dasgupta, sentimental and emotional qualities are completely irrelevant after colorization. This implies that the emotional impact and nostalgic resonance of the film are diminished or lost through the colorization process. Dasgupta notes that the color screen is not effectively maintained while evaluating the performance of AI in colorizing 'Pather Panchali'. Occasionally, he observes, the film is colored, while a few portions remain black and white. However, he does say that the sight of the green foliage is appealing to the eye. According to his analysis, the colorized version loses cinematic symbolism, nostalgia, and emotion and is inconsistently rendered. The black-and-white version, on the other hand, has greater tonal separation.

- **Interview: 5**

In the interview with Soumya Shubra Das, a multifaceted individual proficient in the domains of filmmaking, acting, and academia, his profound observations pertaining to the process of colorization employed in Satyajit Ray's seminal work, 'Pather Panchali', offer a unique and discerning viewpoint. Das vehemently rejects the color rendition, deeming it a derisive and unsuitable portrayal for a globally renowned masterpiece. He staunchly asserts his stance as a cinema connoisseur and is vehemently against the use of color in 'Pather Panchali.' He emphasizes the

apparent irrationality of such a choice and argues that incorporating color in the film deviates from its original artistic intent, which affects its storyline and themes. Das believes that the use of color impacts the overall integrity of the film. The author emphasizes the careful and detailed preparation that filmmakers engage in when envisioning their films, and argues that the introduction of color undermines the planned monochromatic approach of the director. Das criticizes the efficacy of colorization in accentuating cinematic significance, underlining that cinematic symbolism is not exclusively reliant on color. He contends that the use of color may undermine the original aims of Satyajit Ray, who did not employ color for symbolic reasons in the first monochromatic rendition.

Das critically assesses the significance of nostalgic and emotional elements after the process of colorization. He denounces the artificiality of the colorization, deeming it to be of worse quality than Technicolor and highlighting flaws in the depiction of skin tones, notably in the train scenario. Das argues that skin tone has influenced the surroundings. Durga's skin tone exhibits variations, ranging from pitch black to red-black, and numerous shades in between. In his opinion, the colorization has a negative impact on the sentimental and emotional elements, disturbing the recollections linked to the original monochrome film. Das vehemently opposes the use of artificial intelligence for colorization, finding it infuriating. He argues that certain works, particularly those that embody the unique concepts of directors, need to be conserved. He underscores that AI colorization may serve as an experiment, but it can never replace or be deemed suitable in comparison to the original.

Drawing upon the insights shared in the aforementioned interviews, a comprehensive chart has been devised to highlight preferences across various conditions, encompassing symbolism, emotional aspects, and the acceptance of colorization from both versions. The findings unequivocally indicate a unanimous sentiment among the experts, as none of them express a liking or recommendation for the color version.

Based on the insights garnered from the aforementioned interviews, a second table has been formulated to encapsulate the distinctive viewpoints of the five film experts concerning the defined objectives. Table 1 encapsulates the valuable perspectives provided by these experts.

Table 1

Table 1 Key Points of the Experts for Preferring Black-and-White Version

Interview	Objective 1	Objective 2	Objective 3
Interview 1 (Atanu Ghosh)	Colorization dilutes the film's symbolic meaning	It changes the aesthetic value from the original	The artificial appearance of skin tones, backdrops, and props
Interview 2 (Debasish Sen Sharma)	The loss of the iconic palette diminishes the sentimental impact	Diminishes the impact of light and shade effects, altering the sentimental aspects.	Technically impressive but creates an unnatural feel
Interview 3 (Somdev Chatterjee)	Colorization clashes with the harmonious aesthetic	The integrity of Ray's vision should be preserved.	Skepticism about the need for colorization to enhance story and themes.
Interview 4 (Asok Dasgupta)	It does not correspond to the intended cinematic symbolism	Nostalgic resonance are diminished post-colorization.	AI colorization leads to inconsistent rendering
Interview 5 (Soumya Shubra Das)	Colorization negatively impacts emotional elements	Disturbing recollections linked to the original film	Skin tone has influenced the surroundings

A group discussion and interviews were organized with 45 students from the Department of Mass Communication at St. Xavier's University, Kolkata. Among them, the majority of the students (40 out of 45) expressed dissatisfaction with the colorized version of "Pather Panchali." In a detailed analysis of the data, three primary reactions emerged regarding the colorization of the film. The first is technical. Many students appreciated Professor Bera's efforts to use AI for film restoration and enhancement. However, they noted that AI technology, while beneficial, does not yet match the quality of hand-tinted color. An example they preferred was the colorization in "Mughal-E-Azam," which seemed more natural compared to the sometimes artificial-looking skin tones in "Pather Panchali."

The second reaction is emotional. The students expressed a deep emotional connection with "Pather Panchali" and its creators—Satyajit Ray, Bibhutibhushan Bandyopadhyay, and Pandit Ravi Shankar—who are revered figures. Characters like Apu, Durga, Indir Thakrun, and Sarbajaya are ingrained in their hearts, representing familial archetypes and emotional touchstones. The students felt that any alteration to this deeply emotional content was hard to accept.

Lastly, the reaction is psychological. Colors significantly influence our psychological responses, playing a subtle but powerful role in shaping our film-viewing experience. The students discussed how filmmakers manipulate emotions through the use of color, a technique that should feel natural and unforced. In "Pather Panchali," the imposition of color was seen to distract and diminish the viewing experience, shifting focus in a way that could disrupt the natural engagement with the film.

Apart from that, various surveys and interviews with filmmakers and film critics, conducted by multiple media houses, have consistently opposed the colorization of 'Pather Panchali'. This widespread sentiment reflects a strong preference for preserving the film in its original black-and-white format. Film critic and author Amitava Nag notes that a significant survey conducted by the Kolkata-based TV channel, 24 Ghanta, revealed an overwhelming 96% of participants believed that 'Pather Panchali' does not require colorization to enhance its quality or appeal to modern audiences. Nag also mentions that the debate over the colorization of black-and-white films began in Hollywood during the 1980s Chatterji (2020). Filmmaker Sandip Ray, son of Satyajit Ray, has labeled it as "artificial," though he acknowledges the difficulty in creating overly tacky results due to technological advancements. Ray expresses discomfort with the departure from the eternal black-and-white frames, citing a lack of consistency and a deviation from the original directorial vision. He emphasizes consulting the original cinematographer to maintain authenticity and understand the tonal quality Dasgupta (2020). Professor Madhuja Mukherjee, a Film Studies lecturer at Jadavpur University and filmmaker, has strongly criticized the colorization of 'Pather Panchali'. She argues that it undermines the original work of cinematographer Subrata Mitra by obliterating the film's nuanced gray scales and lighting variations. According to her, the colorization homogenizes skin tones, merges elements inappropriately, and flattens the visual depth, likening the effect to being "washed with chlorine" Chatterji (2020).

7. FINDINGS AND CONCLUSION

The findings of this study indicate that the colorization of ‘Pather Panchali’ does not adequately emphasize the cinematic symbolism depicted in the original black-

and-white version. Experts expressed concerns about the artificial appearance of skin tones and the lack of depth in certain backdrops and props. It was observed that the colorization process did not effectively replicate the specific nuances of the original film, leading to disconnect between the colorized version and the intended symbolism.

Furthermore, the research revealed that the nostalgic and emotional aspects associated with classic black-and-white films do not remain relevant post-colorization. Experts voiced displeasure with the colorized version, emphasizing the significance of preserving the original aesthetic and the emotive impact it has on audiences. It was felt that the inclusion of color detracted from the director, cinematographer, and art director's aesthetic vision and intellectual brilliance.

Analysis of the use of AI to colorize black-and-white films revealed both its strengths and weaknesses. While experts acknowledged the technical sophistication of the colorization process and the capabilities of artificial intelligence, they raised concerns about its inability to replicate the original black-and-white format's authenticity and aesthetic value. The colorization was done more for the sake of audience enjoyment than to improve the film's aesthetic or symbolic value.

Numerous articles could be written about the role and importance of colors in visual storytelling. However, focusing on the main issue, the decision to colorize 'Pather Panchali' lacks creativity. If Satyajit Ray had chosen to colorize the film himself, he likely would have approached it differently. The original script, production design, and costumes were all crafted with a black-and-white format in mind. This underscores the complexity of colorization and restoration of classic films; it involves much more than merely adding colors. Recent successful colorizations in India, such as 'Mughal-e-Azam' and 'Naya Daur', which are both epic dramas, contrast with 'Pather Panchali'. The latter film's nuanced, lyrical, and realistic nature demands not just technical expertise, but also a deeper level of creative engagement Sarkar (2020).

In conclusion, this study highlights the relevance of colorization, symbolism, and AI in the context of 'Pather Panchali' by Satyajit Ray. Expert interviews elucidated the nuanced relationship between the film's colorization and its original aesthetic intent. The findings underscore the importance of preserving the original black-and-white format while recognizing both the potential and limitations of artificial intelligence in colorization. More investigation into the effect of colorization on cinematic storylines and the emotional involvement of viewers is required.

8. RECOMMENDATION

Based on the analysis and insights derived from the interviews with film experts regarding the colorization of classic black-and-white films, specifically focusing on Satyajit Ray's 'Pather Panchali', the following recommendations are proposed in alignment with the study objectives:

- It is crucial to uphold and respect the original artistic vision of filmmakers, especially for classics that have significant cultural, historical, and cinematic value.
- Colorization could be considered for specific instances where it genuinely enhances the narrative, symbolism, or viewer experience without detracting from the original aesthetic and emotional impact.
- The emotional and nostalgic aspects associated with the classic films must be preserved.

- Before undertaking colorization projects, it is advisable to engage with the film community, including directors, cinematographers, film historians, and the audience, to gauge their perspectives and preferences.
- The colorization process should navigate ethical and legal considerations, particularly regarding the intellectual property rights of the original creators.

By adhering to these recommendations, the film industry can navigate the delicate balance between innovation and preservation, ensuring that the legacy of classic films is honored while also exploring new dimensions of storytelling through colorization.

CONFLICT OF INTERESTS

None.

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