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영화 클라이맥스 패턴의 데이터시각화를 통해 분석한 장면 배열

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Scene Arrangement Analyzed through Data Visualization of Climax Patterns of Films

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[요 약]

본 연구에서는 국내에서 성공한 영화들의 쇼트 분석을 통해 흥행한 영화의 클라이맥스부분에서 공통된 편집 패턴 분석을 찾아 씬(작은 이야기 단위)의 구성이 잘 기획되어 있는지 데이터 시각화 연구를 한다. 이 연구는 편집패턴들의 모형을 참조하여 영화 전체에 클라이맥스 표현 패턴이 몇 개로 구성되어 있는지 분석하는 것으로 쇼트이미지들의 자동 수집과 수집된 데이터들의 샷사이즈 자동 분류 시스템을 설계하고 이 시스템을 통해 클라이맥스 패턴 중심으로 하나의 씬을 이루고 있음을 증명한다. 작은 이야기인 씬의 구성이 클라이맥스 패턴으로만 판단하기 어려워 배우들의 대화를 통해 씬을 찾아 비교분석을 하였다. 배우들 간의 대화 기반 씬 예측을 위한 character-net은 등장인물들 간의 대화 내용을 추적하여 인물들 간의 대화 형성을 네트워크 망 모양으로 시각화할 수 있다. 망 모양의 시각화를 통해 큰 이야기와 작은 이야기의 구성을 분석할 수 있으며, 씬 수에 따른 밀집도로 영화의 흥행 여부를 예측할 수 있다. 이 두 가지 연구를 비교하여 영화의 기획 구성 및 제작 방법에 기여를 할 것이라 판단한다.

[Abstract]

This study conducts data visualization of common climax patterns of Korean blockbuster films to analyze shots and evaluate scene (subplot unit) arrangement. For this purpose, a model of editing patterns is used to analyze how many climax patterns a film contains. Moreover, a system, which automatically collects shot images and classifies shot sizes of collected data, is designed to demonstrate that a single scene is composed based on a climax pattern. As a scene is a subplot and thus its arrangement cannot fully be analyzed only by climax patterns, dialogues of starring actors are also used to identify scenes, and the result is compared with data visualization results. It detects dialogues between particular actors and visualizes dialogue formation in a network form. Such network visualization enables the arrangement of main subplots to be analyzed, and the box office performance of a film can be explained by the density of subplots. The study of two types comparison analysis is expected to contribute to planning, plotting, and producing films.

색인어 : 클라이맥스 패턴, 데이터 시각화, 작은 이야기 단위, 대화 형성, 편집 패턴
Key word : Climax patterns, Data visualization, Density of subplot, Dialogue formation, Editing patterns,

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Ⅰ. Introduction

Korean TV drama, film, and video content are gaining sensational popularity in many countries in Asia and Europe. This success is attributable to well-organized integration and implementation of scenario planning, shooting, and editing skills, and special effects. To contribute to the continuous development of Korean Wave content, this study attempts to visualize scenarios and editing techniques for big data analysis. Our attempt is a preliminary work of building up an intelligent film analysis system that will support preliminary analysis of scenarios, scripts, and continuities before producing films or TV dramas. In the U.S., the Walt Disney Company and the Carnegie Mellon University jointly developed a multi social camera automatic editing software that picks out well-made scenes among footages of the same object shot by multiple cameras and supports re-editing [1]. The 180° rule is applied as the re-editing principle, where images of a main character are selected from images of the same contents and are re-edited without breaking the rule. Although the intentions of the Walt Disney Company are different from our intentions in this study, they also used big data analysis and deep learning algorithms. In the field of intelligent systems, the latest trend is collecting and analyzing big data to find out patterns in human-made content and applying the patterns thus discovered to machine learning for automatic processing of complex and difficult contents. This study also utilizes the continuity editing rule, which is one of editing techniques, to analyze film content. Many films and TV dramas commonly show climax patterns that break the continuity editing rule. The plot of a film can be evaluated depending on how the rule is violated in the time flow and dialogues of actors.

In this study, shots of some Korean blockbusters are analyzed and common editing patterns are identified by the data visualization method. In the beginning, shot data were manually collected by using Daum PotPlayer, and the camera shot sizes were classified to derive regular patterns [2]. Models of editing patterns were used to see how many climax patterns are contained in a single film. As sufficient shot image data could not be gathered manually, an automatic system was designed that collects shot images and classifies shot sizes [3]. This study conducts a visualization analysis to detect how many climax patterns are extracted in a single film and demonstrates that a single scene is organized based on a climax pattern. In films and TV dramas, a scene is a subplot, and multiple subplots form a sequence. Accordingly, a sequence is defined as a main plot gathered many subplots. However, as the arrangement of scenes, which are subplots, cannot be fully identified by climax patterns, this study also utilizes a character-net for comparative analysis in order to show that a subplot is organized around a climax and to predict that a single subplot constitutes a scene. The character-net detects dialogue between particular actors and visualizes dialogue formation in a network form. Such network visualization enables the arrangement of the subplots to be analyzed, and the box office performance of a film can be explained by the density of subplots (scenes). Consequently, this study performs a comparative analysis between the number of climax patterns, which are automatically classified, and the network diagram based on actors' dialogue, which is obtained by using the character-net. The box office performance of a film can be predicted based on the correlation of the results.

Ⅱ. Film editing techniques and dialogue-based scene arrangement

2-1 Climax patterns of films

Recently, in many countries around the world, big data gathering and deep learning techniques have been actively introduced to promote the production of video-based contents. Many foreign countries started to standardize script work to develop the film industry as early as 10 years ago. As a result, scenario and script templates were collected and redundant ideas were minimized, and open database including ScreenWriting and StudioBinder for cooperation were established [4]. Thus, script data of the existing films can be easily collected online, content redundancy can be conveniently detected, and meta data can also be utilized and analyzed. These works actually have a conclusive effect on the success of the film industry. Benini explained the plot of TV dramas by devising a method of estimating the depth of a shot [5]. Fig.ure 1 shows the result of the primary study. Climax patterns occur when the rule of continuity editing between shots, close-up, middle shot, full shot, and long shot is violated [2]. However, as this study analyzes shots within a selected scene, it is not possible to identify how many climax patterns appear in the entire film.

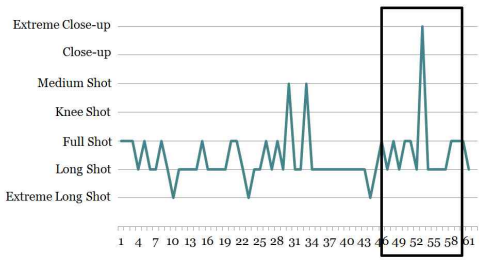

Fig. 1. Climax pattern based on shot list continuity

2-2 Dialogue-based scene and editing-based scene (subplot)

The character-net creates a network of characters(actors), accumulates their dialogues, and then identifies an actor-based storyline by using the share of dialogue concerning a particular event between actors [6]. In order to find out the secrets of well-made scenarios and the production of blockbusters, this study focuses on how many stories are developed in the network of actors. Figure 2 is a statistical representation of actors' relationships shown in a sequence from Dancing with Wolves, which was obtained by using the character-net. Figure 3 shows the variation in shot size of the shot images extracted from the same sequence. In Figure 3, the dotted line boxes mark the climax patterns. As shown in Figures. 2 and 3, subplots are developing around the main actor and three climax patterns appear.

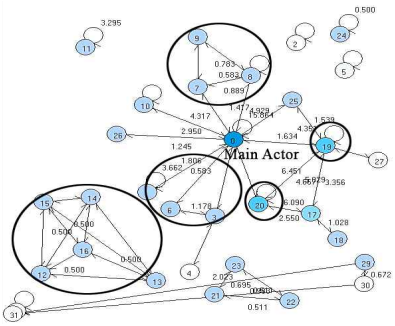

Fig. 2. Relationship between actors in Dancing with Wolves

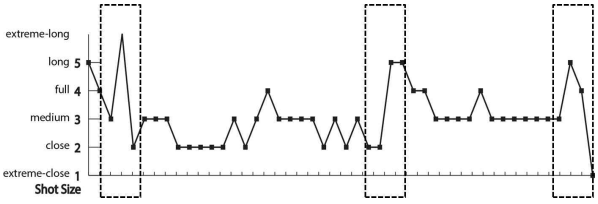

Fig. 3. Climax pattern in Dancing with Wolves

Ⅲ. Automatic shot size analysis system

3-1 Deep learning for film editing techniques

As big data-based analyses of audio and video content have gained more success owing to deep learning models, the application of deep learning technology is extended to not only searching but also processing and visualizing significant videos and images [7]. Optical Character Recognition (OCR) and CSSL , which are open source translation techniques of Facebook, use a deep learning analysis of big data [8], [9]. Millions of shot image data sets are needed to analyze how many scenes containing a climax pattern exist in a single film. For this reason, this study sets up a deep learning model that can automatically analyze shot sizes of image data. Among many types of deep learning like GAN and RL , Convolutional Neural Network (CNN) is used in this study, as it is most widely used in image processing. Although, CNN is excellent in recognizing objects, further training for recognizing shot size images is needed. As each pixel of pictures or video images has its own color value, pixels should be represented in a very high dimensional vector to be processed. As 30 by 30 image information demands a 900-dimensional vector, and a lot of computation is necessary for image processing and learning, which was impossible a few years ago. However, the recent development of software and hardware including graphic cards has produced CNN and R-CNN, which convert a small zone of an image into a pattern or kernel, and applies it to the entire area [10]. Figure 4 illustrates the CNN-based image processing. An inter-dimensional geometric relation in data is depicted that reduces the voluminous calculation for image processing and training for a small area [10]. In other words, the convolution and pooling operation of a small image filter are iterated for multiple filters of each layer, and the recognition result for an object is expressed stochastically in the final layer.

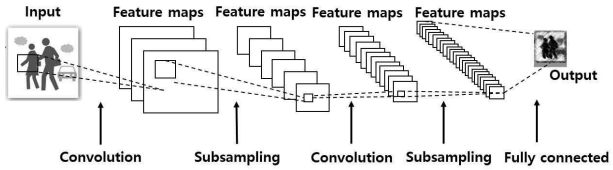

Fig. 4. The image processing structure of CNN

Table 1 presents an environment for developing a CNN-based deep learning model. Google's TensorFlow is an open source library for machine learning and is implemented by C++, but its main API is in Python. TensorBoard can be used for statistical analysis, learning analysis, and code debugging [11].

Many detected shot images showed little difference in brightness between the foreground and background. These images could hardly be classified with the CNN method. In particular, as is usual in films, many images illuminated only a part of the face by dim or Rembrandt lighting. Accordingly, the brightness of the image data needed to be adjusted before automatic analysis. In addition, when classifying shot sizes, the close-up images had a large object and thus label processing was easy, but in the case of the shot images over the full size, the labels of objects were difficult to recognize. Generally, the CNN technique can perform label processing of humans or animal data, but the shot size

analysis cannot classify the shapes of objects, although it can distinguish the sizes of the objects. Thus, further training was needed. Besides, as knowledge could not be extracted from generalized learning data, color compensation and the R-CNN method were also conducted.

Table 1. Environment of deep learning

contents	Environment
HW	GPU:GTX-1080ti
Language	python
Library	Tensorflow
API	object-detection API

Ⅳ. Subplot arrangement shown by climax pattern and dialogue relationship

Figure 5 shows the relationship between actors of Ode to My Father. It indicates that subplots exist around a climax pattern. Figure 6 presents three-dimensional visualization of subplots at various angles. Here, the subplots were analyzed by focusing on dialogues between actors and using the character-net. Both Figures 5 and 6 show irregularity of shot size variation. This is because subplots are continuously developed around a main character, as shown in the dialogue-based visualization of Figure 6.

Figures 7 and 8 deal with Thieves. There are three or four drastic changes, and as shown in Figure 8, 3 main characters are the centers of story development. As the story proceeds in three branches, the variation in the graph of Figure 8 is less drastic than that of Ode to My Father.

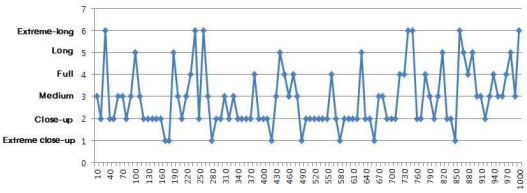

Fig. 5. Subplots around climaxes in Ode to My Father

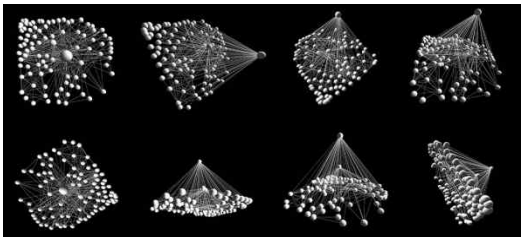

Fig. 6. Dialogue-based subplots in Ode to My Father

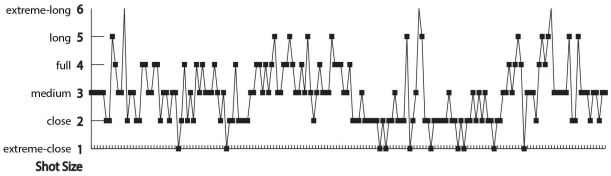

Fig. 7. Subplots around climaxes in Thieves

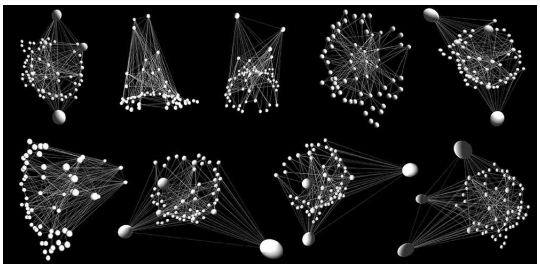

Fig. 8. Dialogue-based subplots in Thieves

Ⅴ. Conclusion

This study analyzes Dancing with Wolves, Ode to My Father, and Thieves by visualizing subplot arrangements from two perspectives. Satisfactory accuracy has not been achieved in analyzing the number of subplots. However, the data visualization of the density of subplots and organization could be presented based on climax pattern and dialogues between actors. The result until now is not complete yet, but when further studies improve image detection, the plot planning and production of films will be also enhanced.

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