

Title	カメラモーション推定のためのビデオ解析およびスポーツビデオでの魅力的瞬間の自動抽出への応用
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論文題目	A Video Analysis for Camera Motion Estimation and its Application to Automatic Retrieval of Attractive Moments in Sport Videos		
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### 論文の内容の要旨

Videos are main sources of information and entertainment. They are presented in sequence of visual and audio information. For entertainment purposes, entertaining videos (e.g. sport videos) are made by video makers in order to entertain viewers whose cannot watch at the stadium because of their limitations. In order to access the video in a short time, several researchers begin to make an automatic system that can index attractive moments in the entertaining videos based on the human perspective. By the ideas of uncertainty in game information and motions in computer vision, a new research in the study area of information science is established. The contributions of this research are discussed in the two chapters of this thesis:

Chapter 3 presents a new algorithm of computer vision model to make computers understand the camera motions in each video frame automatically. To understand the camera motions, a 2D motion vector histogram is used instead of 1D motion vector histograms as described in existing works. The properties and behavior of the 2D motion vector histogram are analyzed in order to recognize the camera motions. Compare with 1D motion vector histograms, it shows that the 2D motion vector histograms can recognize more types of the camera motions.

Chapter 4 presents a mathematical model to show how the attractive moments can be retrieved by the camera motions. Based on the idea of changing in game information, the attractive moments are potentially occurred when the game information is changed. Since video makers notice the attractive moments, they operate the cameras in order to guide the viewers for attentions. From all camera motions, zooming camera motions potentially retrieve several attractive moments in soccer games. For example, score attempting, foul, player claim to the referee's judgment, etc. Finally, we generate a shortening video application based on this idea.

Keywords: Attractive images, Camera motions, Computer vision, Image processing, Video analysis.

### 論文審査の結果の要旨

This PhD thesis proposes a new algorithm of computer vision model to make computers automatically understand the camera motions in each video frame. To understand the camera motions, a 2D motion vector histogram is employed instead of 1D motion vector histograms. The properties and behavior of the 2D motion vector histogram are analyzed in order to recognize the camera motions. Compared with 1D motion vector histograms, experimental results in this study show that the 2D motion vector histograms can recognize more types of the camera motions.

Moreover, the thesis presents a mathematical model to show how the attractive moments can be automatically retrieved by the camera motions. Focusing on the information on the outcome of the game under consideration, attractive moments potentially will occur when the information on the game outcome or certain events in a game is changed. Since sports video makers will be able to notice the attractive moments, they operate cameras in order to guide the viewers for attentions. Applying this idea to the domain of soccer sport, from all camera motions zooming camera motions potentially retrieve several potentially attractive moments. Examples include score attempting, foul, and player claim to the referee's judgment. Thus, a shortening video with a focus mainly on the potentially attractive moments was generated, and it was confirmed by assessment with human subjects that the proposed idea is promising. This implies a potential to apply the proposed algorithm of computer vision model into the entertainment recognition from the sports videos.

Therefore, we came to a conclusion that this is an excellent dissertation and we approve awarding a doctoral degree to the candidate, Mr. Pawin Prasertsakul.