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2015년도 한국통신학회 하계종합학술발표회 프로그램

|일시| 2015년 6월 24일(수) ~ 26일(금)

|장소| 라마다프라자 제주호텔 2층

|주최| 한국통신학회

|협찬| 해동재단 SAMSUNG SK telecom LG전자 QUALCOMM GSI |주|엠에이 Make it Advance |주|엑스퍼넷 EXPERNET

KICS 한국통신학회

[14C-15] 아두이노를 이용한 식물공장용 모니터링 시스템
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[14C-16] R-peak의 특성값을 이용한 심전도 신호에서의 특이심박 검출
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[14C-17] 분산 저장 시스템을 위한 완전그래프 기반 부분접속복구 부호
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[14C-18] 신호 도래각 추정 기법을 이용한 미상 채널 추정 연구
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[14C-19] 군 이동통신망에서 기지국 임의 이동 시 적정출력에 관한 연구
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[14C-20] 희소표현을 통한 비디오 기록으로부터의 고해상도 이미지 복원
Ni Pavel, 박상준, 장환철, 이승찬, 강주성, 이홍노(광주과학기술원)

[14C-21] VoLTE 사용자간 비정상 전화 연결
고은혜(한국인터넷진흥원)

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신춘성, 이정훈, 이상원(전자부품연구원)

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최규상, 유민수(한양대학교)

[14C-27] Perfromance Analysis Of An Obective No Reference Video Quality Assessment Method
성치혁, Muhammad Arslan Usman, 신수용(금오공과대학교)

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[14C-29] 4G LTE 망에서의 MMS 서비스 취약점 및 대응 방안 연구
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[14C-30] 사용자 상태 정보 요청 메시지를 이용한 VoLTE 보안 취약성 및 대응 기술
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[14C-31] Suricata의 Multi-Threading 효율성에 관한 실험적 연구
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[14C-32] A Study on the Real-time Motion Estimation Algorithm for HEVC
박태욱, 이성수(숭실대학교)

[14C-33] CPU/GPU/Memory 유효 작업부하를 이용한 DVFS 기법
박평식, 윤현민, 전경수, 유민수(한양대학교)

희소표현을 통한 비디오 기록으로부터의 고해상도 이미지 복원

Ni Pavel, 박상준, 장환철, 이승찬, 강주성, 이흥노*

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High-Resolution Image Reconstruction from Old Video Recordings via Sparse Representation

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요 약

Recovering high-resolution picture of old video recording will improve experience of watching old videos on modern HD capable devices. Converting video to higher pixel rate will not give desired results. Therefore accurate enhancement of color information gives better result of mapping individual pixel to higher resolution without losing contrast of image. Our Proposed algorithm is based on sparse representation of set of low-resolution images. We show effectiveness of proposed algorithm and image quality improvement after altering color information of images by analyzing moving objects and scene.

Ⅰ. 서 론

In this paper we propose a method to convert old low-resolution video recordings to higher resolution. Conversion to higher pixel density does not produce more information it is simple discretizing of low-resolution image. In such case color, contrast, and shape information will remain same if not reveal new undesirable artifacts. However accurate enhancement of color, contrast, and shapes information will give naturally looking picture. This Proposed algorithm can improve overall image quality by analyzing set of similar video frames. Our algorithm is based on Compressive Sensing (CS) [1] and was tested on old hockey recording of 1987 Canada Cup an International Ice Hockey Tournament.

Compressive Sensing is a signal processing technique which utilizes sparsity of a signal. Through optimization a signal can be recovered given that it has sparse representation in some domain [2].

The paper organized as follows. In Section II we describe our mathematical model. In Section III we present experimental results, applications and conclusion of our work.

Ⅱ. 본론

As illustrated in Fig. 1, first low quality video (360x480 pixel) is fragmented into series of frames each individual frames are converted into 1080x1920 pixels format. Then frames are segmented into squares of 90x96 pixels which used as an input to the algorithm. First video split into independent frames, we extract edge information from each frame to separate object from background and analyze moving objects in the scene Fig. 2. Next proposed algorithm run to correct color information by analyzing related pixels from different frames. Algorithm performs correction in 2 steps for object (hockey player) and background independently using two specifically designed dictionaries.

Mathematically we can formulate our problem as combination of linear equations

$$y = Ax \tag{1}$$

where y is an original low-resolution image, A is a over complete dictionary, $x = Fs$ is a high-resolution image, F is a projection matrix between different frames, s is a sparse vector. Estimate of x can be found by using compressive sensing algorithms. That is color information for high-resolution image can be recovered from linear combination of columns of matrix A with each column representing features from similar images.

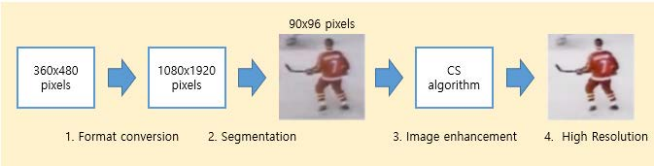

Fig 1.Scheme for CS algorithm

Ⅲ. 결론

In our experiment we used old video recordings of ice hockey tournament, total video duration is about 2 hours. We did remove all irrelevant frames and chose 150,000 frames of actual game. Further each frame was cut into 90x96 square images.

In Fig. 2, show results of our algorithm. Sobel edge detection was used to find edge information in original images. Edge information were used to accurately extract color information. Then color features used as a columns of matrix A. In the output it' s visible that color information is improved and overall image perception is much better.

This paper presents new algorithm based on sparse representation to improve image resolution of old videos by enhancing color information. Experimental results demonstrate that image was significantly improved and modification of color information produced overall enhancement of image which can be enough to watch such picture in new HD format. In the future we would like to focus on developing more accurate projection operator which will help increase accuracy of mapping color information through different frames.

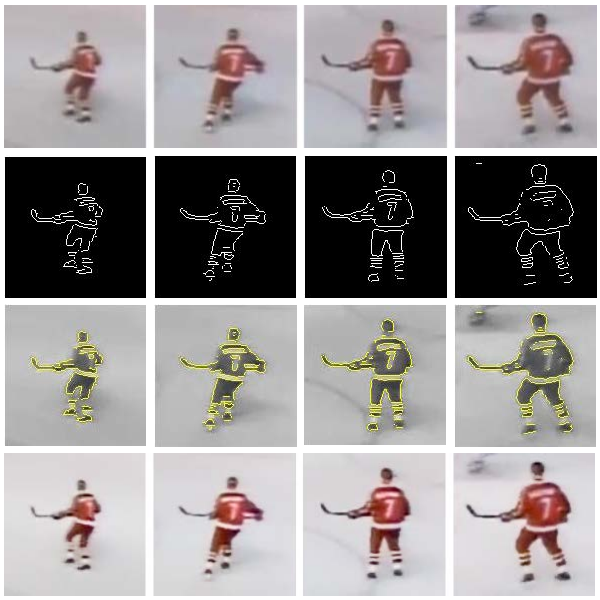

Fig 2. Image of enhancement process. From top to bottom: a) original images of hockey player. b) detection of edge c) overlapping edge on original image d)high resolution image after enhancement step. The color of object and background was modified using Sparse representation algorithm.

ACKNOWLEDGMENT

This research was supported by Leading Foreign Research Institute Recruitment Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Science, ICT and Future Planning (MSIP) (2009-00422). And this research was a part of the project titled 'Development of Ocean Acoustic Echo Sounders and Hydro-Physical Properties Monitoring Systems', funded by the ministry of Ocean and Fisheries, Korea.

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