MOTION COMPENSATED DE-INTERLACING FOR BOTH REALTIME VIDEO AND STILL IMAGES

Dimitri Van De Ville[1], Wilfried Philips[2], and Ignace Lemahieu[3]

Ghent University
[1,3]ELIS - MEDISIP - IBITECH [2]TELIN
Sint-Pietersnieuwstraat 41
B-9000 Ghent, Belgium

ABSTRACT

The interlaced video scan format suffers from major flaws such as visual artifacts and unsuitability for devices such as LCD displays, video printers, computers which require or prefer the progressive scan format. De-interlacing algorithms convert a video signal from the interlaced scan format to the progressive scan format. Next to simple spatial interpolation, two categories of de-interlacing techniques are available: motion adaptive and motion compensating methods. The latter have more potential to produce better results but are also more complex since they require accurate subpixel motion estimation. This paper presents a motion compensating de-interlacing technique based on the Irani and Peleg superresolution algorithm. Appropriate weighting terms are introduced to take into account the interlaced scanning format. Two operational modes are derived: a single iteration mode for realtime video de-interlacing, and a multiple iteration mode for enhanced still image generation.

1. INTRODUCTION

Interlaced video consists of even and odd fields; even fields contain the even-numbered lines while odd fields contain the odd-numbered lines. Even and odd fields alternate in time. Interlacing was introduced in the early days of television and it is still maintained today in spite of the number of disadvantages.

First of all, several visual artifacts decrease the picture quality of an interlaced video sequence. For example, flicker artifacts occur when regions with high vertical frequency details are aliased onto high temporal frequencies, resulting in annoying flicker. Twitter artifacts happen when fine vertical details appears to "twitter" up and down. Line crawling occurs when diagonal edges slowly move in the vertical direction. The display's line structure becomes very visible and seems to "crawl" across the edge that is being tracked.

Furthermore, interlaced video is unsuitable for devices which require or prefer the progressive scan format, e.g., video printers, computers, plasma and LCD displays, which would display the missing lines as black.

Finally, interlaced video complicates many image-processing tasks such as standards conversion. Also, the performance of video coding algorithms suffers from the interlaced scan format [1].

An interlaced video signal can be converted to a progressively scanned format by de-interlacing techniques. These techniques interpolate the missing lines of the fields and try to reduce the aforementioned artifacts in the displayed video signal. Many techniques have been proposed to improve de-interlacing by making the interpolation dependent on motion. Motion adaptive techniques rely on a motion detector (which can be implicit as in most median-based methods [2–4]). The motion detector produces a signal which indicates the "presence of motion". Motion compensating techniques make use of the motion field itself. The potential benefit of using information of other (moving) fields require accurate subpixel motion estimation [1, 5, 6].

This paper presents a motion compensating de-interlacing technique, based on the superresolution algorithm of Irani and Peleg [7]. Two operational modes are shown: a single iteration mode suited for realtime video de-interlacing, and a multiple iteration mode for enhanced still image generation. In Sect. 2 we introduce the new technique. Section 3 show some preliminary experimental results. Finally, conclusions are drawn in Sect. 4.

2. DE-INTERLACING

After introducing the interlaced video signal, the applied motion estimator is described. Next, the motion compensating de-interlacing scheme is presented based on an iterative superresolution algorithm. Appropriate choices are made to make the method suitable for de-interlacing.

Dimitri Van De Ville is a Research Assistant with the FWO Flanders, Belgium.

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