



US006859564B2

(12) **United States Patent**
Caron

(10) **Patent No.:** **US 6,859,564 B2**
(45) **Date of Patent:** **Feb. 22, 2005**

(54) **SIGNAL PROCESSING USING THE SELF-DECONVOLVING DATA RECONSTRUCTION ALGORITHM**

Hadar et al "Restoration of Images Degraded by Mechanical Vibrations", Electrical and Electronics Engineers in Israel, 1995, Eighteenth Convention of Mar. 7-8, 1995-3.4.4.*

(75) Inventor: **James Norbert Caron**, Silver Spring, MD (US)

* cited by examiner

(73) Assignee: **James N. Caron**, Silver Springs, MD (US)

Primary Examiner—Yon J. Couso

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 590 days.

(57) **ABSTRACT**

A signal processing algorithm has been developed in which a filter function is extracted from degraded data through mathematical operations. The filter function can then be used to restore much of the degraded content of the data through use of any deconvolution algorithm. This process can be performed without prior knowledge of the detection system, a technique known as blind deconvolution. The extraction process, designated Self-deconvolving Data Reconstruction Algorithm (SeDDaRA), has been used successfully to restore digitized photographs, digitized acoustic waveforms, and other forms of data. The process is non-iterative, computationally efficient, and requires little user input. Implementation is straight-forward, allowing inclusion into all types of signal processing software and hardware.

(21) Appl. No.: **09/783,075**

(22) Filed: **Feb. 15, 2001**

(65) **Prior Publication Data**

US 2002/0156821 A1 Oct. 24, 2002

(51) **Int. Cl.**⁷ **G06K 9/40**

(52) **U.S. Cl.** **382/264; 382/280**

(58) **Field of Search** 382/264, 260, 382/254, 280, 276, 275; 358/447, 461; 345/611

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,729,631 A * 3/1998 Wober et al. 382/232
5,974,194 A * 10/1999 Hirani et al. 382/262

OTHER PUBLICATIONS

Yitzhaky et al "Identification of Motion Blur for Blind Image Restoration", Electrical and electronics Engineers in Israel, 1995, Eighteenth Convention of, Mar. 7-8, 1995-3.4.3.*

Yitzhaky et al "Evaluation of the Blur Parameters from Motion Blurred Images", Electrical and Electronics Engineers in Israel, 1996, Nineteenth Convention of Nov. 5-6, 1996, pps 216-219.*

The novelty of the invention is the application of a power law and smoothing function to the degraded data in frequency space. Two methods for determining the value of the power law are discussed. The first method is by educated guess where the value is deemed a constant of frequency that ranges between zero and one. This approach requires no knowledge of the original data or the degradation and is quite effective. The second method compares the frequency spectrum of the degraded data to the spectrum of a signal with the desired frequency response. This approach produces a superior result, but requires additional processing.

12 Claims, 6 Drawing Sheets

