

US006182114B1

(12) United States Patent Yap et al.

(10) Patent No.: US 6,182,114 B1

(45) **Date of Patent: Jan. 30, 2001**

(54) APPARATUS AND METHOD FOR REALTIME VISUALIZATION USING USER-DEFINED DYNAMIC, MULTI-FOVEATED IMAGES

(75) Inventors: Chee K. Yap; Ee-Chien Chang, both of New York, NY (US); Ting-Jen Yen,

Jersey City, NJ (US)

- (73) Assignee: New York University, New York, NY
- (*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.
- (21) Appl. No.: **09/005,174**
- (22) Filed: Jan. 9, 1998
- (51) Int. Cl. G06F 15/16 (52) U.S. Cl. 709/203; 709/246 (58) Field of Search 709/217, 219,
- 709/246, 247, 203; 707/10; 382/103, 233, 235, 232, 240, 302

(56) References Cited

U.S. PATENT DOCUMENTS

4,622,632		11/1986	Tanimoto .
5,341,466		8/1994	Perlin .
5,481,622	*	1/1996	Gerhardt et al 382/103
5,568,598	*	10/1996	Mack et al 382/302 X
5,710,835	*	1/1998	Bradley 382/233
5,724,070	*	3/1998	Denninghoff et al 382/235 X
5,861,920	*	1/1999	Mead et al 382/232 X
5,880,856	*	3/1999	Ferriere
5,920,865	*	7/1999	Ariga 707/10

OTHER PUBLICATIONS

Tams Frajka et al., Progressive Image Coding with Spatially Variable Resolution, IEEE, Proceedings International Conference on Image Processing 1997, Oct. 1997, vol. 1, pp. 53–56.*

- E. C. Chang et al., "Realtime Visualization of Large . . . " Mar. 31, 11997,pp. 1–9, Courant Institute of Mathematical Sciences, New York University, N.Y. U.S.A.
- E. C. Chang et al., "A Wavelet Approach to Foveating Images", Jan. 10, 1997,pp. 1–11, Courant Institute of Mathematical Sciences, New York University, N.Y. U.S.A.
- S.G. Mallat, "A Theory for Multiresolutional Signal Decomposition . . . ", IEEE Transactions on Pattern Analysis and Machine Intelligence,pp. 3–23, Jul. 1989, vol. 11, No. 7, IEEE Computer Society.

News Release, "Wavelet Image Features", Summus' Wavelet Image Compression, Summus 14 pages.

R.L. White et al., "Compression and Progressive Transmission of Astronomical Images", SPIE Technical Conference 2199, 1994.

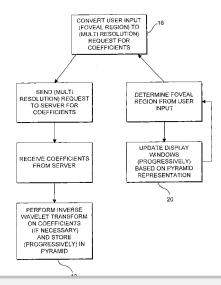
(List continued on next page.)

Primary Examiner—Zarni Maung
Assistant Examiner—Patrice Winder
(74) Attorney, Agent, or Firm—Baker Botts, L.L.P.

(57) ABSTRACT

A client apparatus which enables a realtime visualization of at least one image. The client apparatus includes a storage device which stores first data corresponding to a multifove-ated representation of an original image, and a user input device which providing second data corresponding to at least one visualization command of at least one user. In addition, the client apparatus includes a processing arrangement which generates third data corresponding to a multi-foveated image using the first data, the second data and a foveation operator.

8 Claims, 6 Drawing Sheets

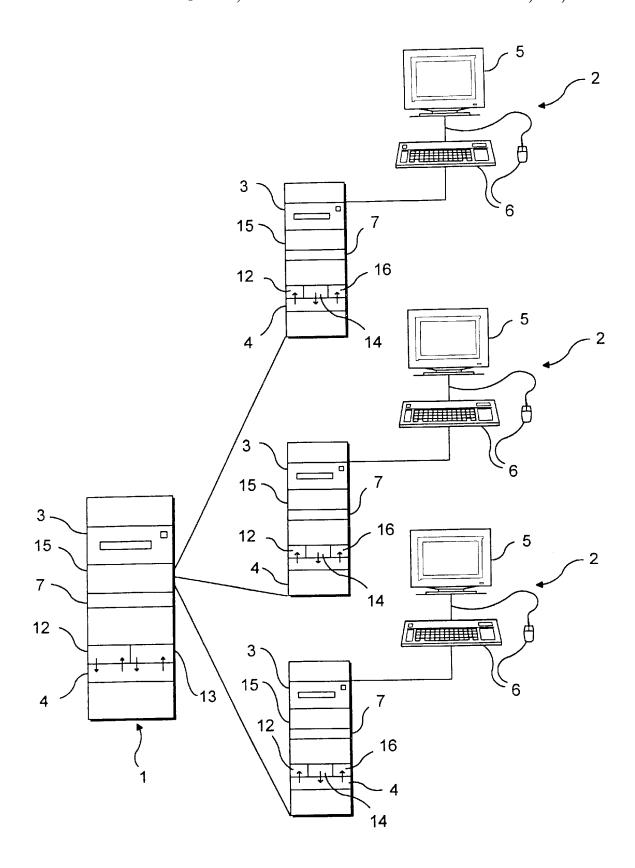




OTHER PUBLICATIONS

- E.L. Schwartz, "The Development of Specific Visual . . . " Journal of Theoretical Biology, 69:655–685, 1977.
- F.S. Hill Jr. et al., "Interactive Image Query . . . " Computer Graphics, 17(3), 1983.
- T.H. Reeves et al., "Adaptive Foveation of MPEG Video", Proceedings of the 4th ACM International Multimedia Conference, 1996.
- R.S. Wallace et al., "Space-variant image processing". Int'l. J. of Computer Vision, 13:1(1994) 71–90.
- E.L. Schwartz A quantitative model of the functional architecture: Biological cybernetics, 37(1980) 63–76.
- P. Kortum et al., "Implementation of a Foveated Image . . . " Human Vision and Electronic Imagining, SPIE Proceedings vol. 2657, 350–360, 1996.
- M.H. Gross et al., "Efficient triangular surface . . . ", IEEE Trans on Visualization and Computer Graphics, 2(2) 1996.
- * cited by examiner





F I G. 1



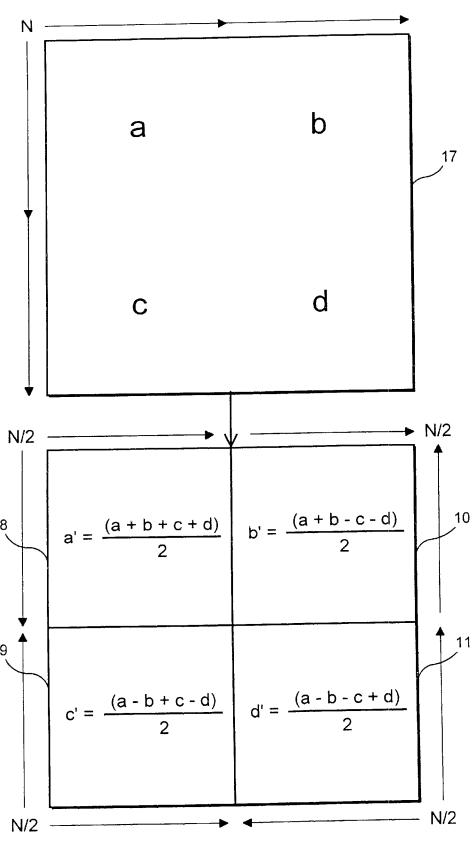


FIG. 2A

US 6,182,114 B1

$$a = \frac{a' + b' + c' + d'}{2} \qquad b = \frac{a' + b' - c' - d'}{2}$$

$$c = \frac{a' - b' + c' - d'}{2} \qquad d = \frac{a' - b' - c' + d'}{2}$$

$$a' = \frac{(a + b + c + d)}{2} \qquad b' = \frac{(a + b - c - d)}{2}$$

$$c' = \frac{(a - b + c - d)}{2} \qquad d' = \frac{(a - b - c + d)}{2}$$

F I G. 2B



DOCKET

Explore Litigation Insights



Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time** alerts and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.

