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(54) **IMAGE CONGEALING VIA EFFICIENT FEATURE SELECTION**

(71) Applicant: **General Electric Company**, Niskayuna, NY (US)

(72) Inventors: **Xiaoming Liu**, Schenectady, NY (US); **Peter Henry Tu**, Niskayuna, NY (US); **Ya Xue**, Niskayuna, NY (US)

(73) Assignee: **General Electric Company**, Schenectady, NY (US)

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G06K 9/00	(2006.01)
H04N 9/07	(2006.01)

(52) **U.S. Cl.**

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(58) **Field of Classification Search**

CPC G06K 9/00

USPC 382/164, 171, 173, 179, 197; 348/169, 348/267; 711/206, 208, 209

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,020,930	A	2/2000	Legrand	
7,274,803	B1 *	9/2007	Sharma et al.	382/107
7,711,155	B1	5/2010	Sharma et al.	
7,742,623	B1 *	6/2010	Moon et al.	382/103
7,898,522	B2 *	3/2011	Hildreth et al.	345/156
7,912,246	B1	3/2011	Moon et al.	
7,921,036	B1	4/2011	Sharma et al.	
7,930,204	B1	4/2011	Sharma et al.	
7,974,869	B1	7/2011	Sharma et al.	
7,987,111	B1	7/2011	Sharma et al.	

(Continued)

OTHER PUBLICATIONS

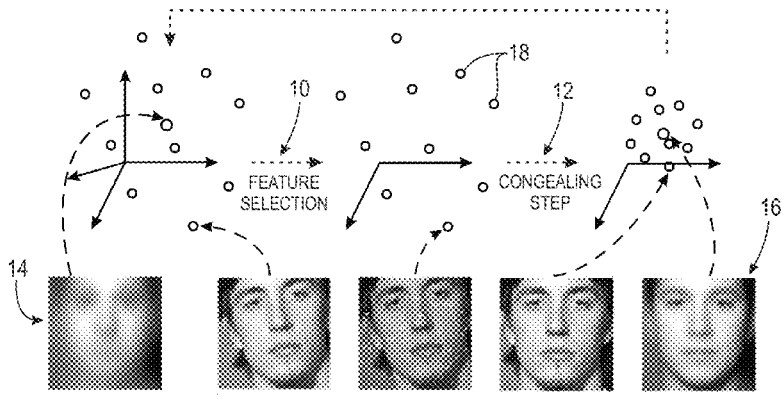
Antoniak, Charles, Mixtures of Dirichlet Processes with Applications to Bayesian Nonparametric Problems, Annals of Statistics, 2:1152-1174, 1974, California.

(Continued)

Primary Examiner — Abolfazl Tabatabai

(74) *Attorney, Agent, or Firm* — Jean K. Testa; Fletcher Yoder, P.C.

(57) **ABSTRACT**

A novel technique for unsupervised feature selection is disclosed. The disclosed methods include automatically selecting a subset of a feature of an image. Additionally, the selection of the subset of features may be incorporated with a congealing algorithm, such as a least-square-based congealing algorithm. By selecting a subset of the feature representation of an image, redundant and/or irrelevant features may be reduced or removed, and the efficiency and accuracy of least-square-based congealing may be improved.

20 Claims, 10 Drawing Sheets