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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte THOMAS BABY SEBASTIAN, ERIC DANIEL BUEHLER, BENJAMIN THOMAS OCCHIPINTI, and KONRAD ROBERT KUCZYNSKI

Appeal 2015-007042
Application 13/673,052
Technology Center 2600

Before THU A. DANG, NATHAN A. ENGELS, and ALEX S. YAP, *Administrative Patent Judges*.

DANG, *Administrative Patent Judge*.

DECISION ON APPEAL

I. STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134(a) from a non-final rejection of claims 1, 2, and 4–10. Claim 3 has been canceled. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

A. INVENTION

According to Appellants, the invention relates to "a method of removing stationary objects from at least one hyperspectral image" (Spec. ¶ 3).

B. ILLUSTRATIVE CLAIM

Claim 1 is exemplary:

1. A method of compressing hyperspectral imagery, the method comprising:

collecting a series of hyperspectral images of a target scene;

determining and storing a first hyperspectral image to represent a background of the target scene from the series of hyperspectral images of the target scene;

collecting a series of current hyperspectral images of the target scene;

determining a second hyperspectral image having moving or new objects in the target scene from the series of current hyperspectral images of the target scene;

determining a value of each spectral band for each pixel of the first and second hyperspectral images to establish a signature for each pixel;

iterating through each corresponding pair of pixels while comparing one signature to another;

determining a dissimilarity measure value for each comparison;

comparing the dissimilarity measure value to a predetermined threshold, and if the dissimilarity measure value comparison is within the predetermined threshold then setting the value of the pixel in the second hyperspectral image to zero to create a compressed background-subtracted hyperspectral image; and

storing the compressed background-subtracted hyperspectral image wherein the stored compressed background-subtracted hyperspectral image comprises only stored pixels of the moving or new objects in the target scene while preserving the values of all spectral bands in the stored pixels.

C. REJECTIONS

1. Claims 4 and 9 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement.

2. Claims 1, 2, 4, 7, and 10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Auty (US 5,809,161, iss Sept. 15, 1998), Oyaizu (US 2011/0243451 A1, pub. Oct. 6, 2011), and Banerjee (US 2011/0322480, pub. Dec. 23, 2010).[1]

3. Claim 5 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Auty, Oyaizu, Banerjee, and Tsuchikawa (US 5,748,775, iss. May 5, 1998).

4. Claim 6 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Auty, Oyaizu, Banerjee, and Jain (US 5,745,126, iss. Apr. 28, 1998).

5. Claim 8 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Auty, Oyaizu, Banerjee, and Jin (US 5,937,102, iss. Aug. 10, 1999).

6. Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Auty, Oyaizu, Banerjee, and Brill (US 6,937,651, iss. Aug. 30, 2005).

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[1] Page 9 of the the Non-Final Action includes a heading identifying claims 1, 2, and 7 as being rejection over Auty, Oyaizu, and Banerjee, but the heading does not list claims 4 and 10 (Non-Final Act. 9). The Non-Final Action nevertheless includes substantive rejections of claims 4 and 10 with the rejections of claims 1, 2, and 7 and based on the same references (Non-Final Act. 14–15). Accordingly, claims 4 and 10 also stand rejected over Auty, Oyaizu, and Banerjee.

II. ISSUE

The principal issue before us is whether the Examiner erred in finding that the combination of Auty, Oyaizu, and Banerjee teaches or suggests a method of compressing "hyperspectral" imagery, comprising "determining and storing a first hyperspectral image to represent a background of the target scene;" "determining a second hyperspectral image having moving or new objects in the target scene;" "determining a value for each spectral band for each pixel . . . to establish a signature for each pixel;" and "iterating through each corresponding pair of pixels while comparing one signature to another" (claim 1).

III. FINDINGS OF FACT

The following Findings of Fact (FF) are shown by a preponderance of the evidence.

Auty

1. Auty discloses monitoring movement of an object (Abst.), which detects a moving object as different from a still background (col. 4, ll. 58–66), wherein the background image representing a static background is determined and stored (col. 9, ll. 35–37). In particular, a background difference board subtracts a background image from the current or live image to produce a preliminary difference image (col. 9, ll. 24–29).

Oyaizu

2. Oyaizu discloses storing a reference background image, detecting an object from an input image and estimating the rough position and shape of the detected object, generating a background difference image between the input image and the reference background image, and calculating a

relationship equation of pixel values between pixels corresponding to the background difference image and the reference background image (Abstr.).

Banerjee

3. Banerjee discloses tagging and tracking of objects using hyperspectral video sensors to exploit the objects' unique signatures, which includes examining image pixels and computing how closely a pixel's spectrum matches a known object spectral signature (Abstr.). In particular, Banerjee detects and discriminates an object from the surrounding objects and background by examining every image pixel and computing how closely each pixel's spectrum matches a known object spectral signature (¶ 9).

IV. ANALYSIS

35 U.S.C. § 112, first paragraph

The Examiner rejects claims 4 and 9 under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement (Non-Final Act. 7). In particular, the Examiner finds the following newly added limitation of claim 4 lacks supporting description in the Specification: "if the absolute difference between an averaged value of the hyperspectral signatures of the first hyperspectral image and an averaged value of the hyperspectral signatures of the second hyperspectral image is less than a predetermined threshold value, the value of the pixel in the second hyperspectral image is set to zero" (*id.*). According to the Examiner, "there is no disclosure in the specification about multiple signatures at each pixel," or "setting the value of the pixel in the second image to zero" (Non-Final Act. 7–8). The Examiner similarly finds the following newly added limitation of claim 9 lacks supporting description in the Specification:

"determining the second hyperspectral image is done by comparing the first hyperspectral image to the series of current hyperspectral images" (Non-Final Act. 8).

In response, Appellants contend that "Claim 4 finds support in ¶¶ [0024] and [0027]" of the Specification (App. Br. 11), wherein "the processor may average the multiple hyperspectral images . . . to create a single background image" and "the processor may perform the subtraction . . . by setting the resulting pixel value to zero if the absolute difference between the signature of the background image pixel and the signature of the corresponding pixel of the hyperspectral image is less than a predetermined threshold value" (*id.*). According to Appellants, "one of ordinary skill would read ¶¶ [0024] and [0027] with an understanding that Appellants had possession of and were the inventors of the invention" (*id.*). Appellants then contend "Claim 9 finds support ¶ [0025]" of the Specification "which discusses aspects of determining the background image" (*id.*).

We do not find Appellants' contention persuasive. Here, although Appellants point to "support in ¶¶ [0024] and [0027]" of the Specification (App. Br. 11) for claim 4, we agree with the Examiner that the claimed "averaged value of the *hyperspectral signatures*" is not supported in ¶ [0024], which merely describes an "average [of the] *multiple hyperspectral images*" (Ans. 16 (emphasis added)). Similarly, we agree with the Examiner that the claim recites "setting 'the value of the pixel in the *second hyperspectral image'* to zero rather than 'setting the *resulting pixel value* to zero," as stated in ¶ [0027] of the Specification (Ans. 16 (emphasis added)). We also agree with the Examiner that there is no support in ¶ [0025] of the Specification for the amended features of "determining the second

hyperspectral image" of claim 9, since the paragraph merely "refers to the process of selecting the first hyperspectral image" (Ans. 16–17).

For the above reasons, we find that the preponderance of evidence supports the Examiner's determination that the claims are not adequately supported by a written description under 35 U.S.C. § 112, first paragraph.

35 U.S.C. § 103(a)

As for independent claim 1, Appellants contend that "[t]he question here is whether Auty is analogous . . . art" since "processing monochrome images is fundamentally different than processing hyperspectral images" (App. Br. 14). That is, Appellants contend "Auty is not from the same field of endeavor" (*id.* at 15) andis not reasonably pertinent to the problem faced by the inventors" (*id.* at 16). Similarly, although Appellants concede Oyaizu discloses color imagery instead of monochrome as in Auty (*id.* at 20), Appellants also contend "Oyaizu is non analogous art" (*id.* at 19). Although Appellants concede Banerjee discloses "pixel-by-pixel comparison of hyperspectral signatures" (*id.* at 20), Appellants contend there is no support for the Examiner's conclusion "that combining Bannerjee [sic] with Auty will yield predictable results" (*id.* at 21).

We have considered all of Appellants' arguments and evidence presented. However, we disagree with Appellants' contentions regarding the Examiner's rejections of the claims. We agree with the Examiner's findings, and find no error with the Examiner's combination of the references and the conclusion that the claims would have been obvious over the combined teachings.

Although Appellants contend Auty and Oyaizu are nonanalogous, the nonanalogous art test considers the threshold question whether a prior art

reference is "too remote to be treated as prior art." *In re Clay*, 966 F.2d 656, 658 (Fed. Cir. 1992) (quoting *In re Sovish*, 769 F.2d 738, 741 (Fed. Cir. 1985)). A reference is analogous art to the claimed invention if: (1) "the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem)"; or (2) "the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention)" (*In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004)).

We agree with the Examiner that Auty and Oyaizu are both "in the field of applicant's endeavor (image processing)" and also use "the very technique Appellant[s] [are] using, i.e., background subtraction" (Ans. 19–20). In particular, like Appellants' invention, Auty discloses monitoring movement of an object by detecting a moving object as different from the background (FF 1). Similarly, Oyaizu also detects an object from the background (FF 2). Thus, we agree that both Auty and Oyaizu are from the same field of endeavor as the claimed invention (image processing) and are reasonably pertinent to the problem faced by the inventor (detecting a moving object from the background). *See Bigio*, 381 F.3d at 1325.

Thus, we find no error with the Examiner's finding that Auty and Oyaizu as analogous art, as the references are not "too remote to be treated as prior art." *See Clay*, 966 F.2d at 658 (quoting *In re Sovish*, 769 F.2d 738, 741 (Fed. Cir. 1985)).

Auty discloses monitoring movement of an object using background subtraction, which includes detecting a moving object as different from a stored static background, and then subtracting a background image from the current or live image to produce a preliminary difference image (FF 1). We

agree with the Examiner's reliance on Auty to disclose the steps of determining and storing an image to represent a background of the target scene, and then determining an image having moving or new objects in the target scene (Non-Final Act. 9–12).

In the same field of endeavor of image processing using background subtraction, Oyaizu discloses storing a reference background image, detecting an object from an input image, and generating a background difference image (FF 2). That is, similar to Auty, Oyaizu also discloses determining and storing an image to represent a background of the target scene and then determining an image having moving or new objects in the target scene (*id.*).

Furthermore, we agree with the Examiner that Auty discloses pixel-by-pixel subtraction (Ans. 6; FF 1). Similarly, Oyaizu discloses calculating a relationship equation of pixel values between pixels corresponding to the background difference image and the reference background image (FF 2). We agree with the Examiner that such pixel-by-pixel subtraction comprises "comparing" the pixels, wherein the "difference value at each pixel [can be] interpreted as the 'dissimilarity measure value for each comparison'" (Ans. 6, emphasis omitted). Thus, we find no error with the Examiner's reliance on Auty and Oyaizu for disclosing and suggesting determining a value for each pixel and iterating through each corresponding pair of pixels while comparing one to another (Ans. 7–8). Accordingly, we agree with the Examiner that Auty in view of Oyaizu discloses and suggests all of the claimed limitations except that the determined image having the moving/new objects is not a "hyperspectral" image, wherein the value for

each pixel is not a value "for each spectral band" to establish a signature for each pixel (*id.*).

However, Banerjee discloses tracking/monitoring of objects using hyperspectral video sensors to exploit the objects' unique signatures (FF 3). In particular, Banerjee detects and discriminates the object from the surrounding objects and background by examining every image pixel and computing how closely each pixel's spectrum matches a known object spectral signature (*id.*). Accordingly, we find no error with the Examiner's reliance on Banerjee for teaching and suggesting determining a value for each spectral band for each pixel and iterating through each pixel while comparing the signatures (*id.*). That is, we find no error with the Examiner's reliance on Banerjee for at least suggesting a hyperspectral image may be determined as an image having the moving/new objects, wherein the value for each spectral band for each pixel is determined to establish a signature for each pixel. Accordingly, we agree with the Examiner that the combination of Auty, Oyaizu, and Banerjee teaches and suggests the contested limitations of claim 1.

We are guided by the Supreme Court's guidance regarding modification of prior art teachings by a practitioner in the art: an improved product in the art is obvious if that "product [is] not [one] of innovation but of ordinary skill and common sense" (*KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007)). The skilled artisan is "[a] person of ordinary creativity, not an automaton" (*id.*).

Here, we agree with the Examiner that Banerjee "provides a solution (hyperspectral) to the very 'variability' problem that 'compromises the performance of many vision systems, including background subtraction

methods'" (Ans. 22). We conclude that a person of ordinary skill in the art, upon reading Banerjee's teaching that a hyperspectral image may be determined as an image having the moving/new objects, would have found it obvious to modify Auty and Oyaizu's image processing to include "hyperspectral" images, wherein the value for each pixel is a value for each spectral band to establish a signature for each pixel. As the Supreme Court guides, "[w]hen a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one" (*KSR*, 550 U.S. at 417). When considering obviousness of a combination of known elements, the operative question is thus "whether the improvement is more than the predictable use of prior art elements according to their established functions" (*Id.*).

Appellants have not provided any evidence that such modification to apply Auty's and Oyaizu's method with hyperspectral images would have been "uniquely challenging or difficult for one of ordinary skill in the art" (*Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007)), or would have yielded unexpected results. Here, we agree with the Examiner that Appellants' invention is simply a modification of familiar prior art teachings (as taught or suggested by the cited references) that would have realized a predictable result (*KSR*, 550 U.S. at 421).

On this record, we find no error in the Examiner's rejection of claim 1, and claims 2, 7, and 10 depending therefrom over Auty, Oyaizu, and Banerjee. Appellants do not provide substantive arguments for the dependent claims separate from claim 1 from which they depend (App. Br. 21–22). Thus, we also affirm the rejection of claim 5 over Auty, Oyaizu, and Banerjee, in further view of Tsuchikawa; of claim 6 over Auty, Oyaizu,

and Banerjee, in further view of Jain; of claim 8 over Auty, Oyaizu, and Banerjee, in further view of Jin; of claim 9 over Auty, Oyaizu, and Banerjee, in further view of Brill.

V. CONCLUSION AND DECISION

We affirm the Examiner's rejections of claims 1, 2, and 4–10 under 35 U.S.C. § 103(a) and of claims 4 and 9 under 35 U.S.C. § 112, first paragraph.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED