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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ERKKI TAPANI VAHALA[1]

Appeal 2017-001113
Application 14/391,183
Technology Center 3700

Before JOHN G. NEW, ELIZABETH A. LAVIER,
and TAWEN CHANG, *Administrative Patent Judges*.

CHANG, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134(a) involving claims to a medical instrument comprising a magnetic resonance imaging system and an ultrasound system with an adjustable focus, which have been rejected as directed to a patent-ineligible abstract idea and as obvious. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

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[1] Appellant identifies the Real Party in Interest as Koninklijke Philips, N.V. (Appeal Br. 4.)

STATEMENT OF THE CASE

According to the Specification, "[i]n High Intensity Focused Ultrasound (HIFU), a volume of interest is detected during [treatment] planning stages and may be marked on medical images, such as magnetic resonance images." (Spec. 1:6–8.) The Specification states, however, that subjects may move during treatment. (*Id.* at 1:18–19.) Further according to the Specification, "[t]he present invention is based on the insight that . . . graphical objects [delineated in a first magnetic resonance image during the original generation of a therapy plan] can be employed to detect movement and accordingly correct the treatment plan." (*Id.* at 5:17–19.) In particular, the Specification explains that,

> [b]y registering the corresponding graphical objects in the first magnetic resonance image to those in the second magnetic resonance image a coordinate transformation is found that represents the motion that occurred between the first magnetic resonance image that forms the basis of the treatment plan and the subsequent second magnetic resonance image. This coordinate transformation is then employed to modify or update the treatment plan to account for the motion that has occurred. The high [intensity] focused ultrasound system is continued to be controlled on the basis of the modified treatment plan.

(*Id.* at 19–26.)

Claims 1–8 and 11–17 are on appeal. Claim 11 is illustrative and reproduced below:

> 1. A medical instrument comprising:
>
> a magnetic resonance imaging system and;
>
> an ultrasound system with an adjustable focus,
>
> a processor for controlling the medical instrument; and

a memory containing machine readable instructions for execution by the processor; wherein execution of the instructions causes the processor to

acquire first magnetic resonance data with the magnetic resonance imaging system,

reconstruct a first magnetic resonance image using the first magnetic resonance data,

wherein a treatment plan is formed from the first magnetic resonance image, the treatment plan controlling the ultrasound system

wherein the formation of the treatment plan includes identification of one or more graphical objects in the first magnetic resonance image,

wherein execution of the instructions further causes the processor to

receive a registration of the one or more graphical objects to the first magnetic resonance image, wherein the registration defines spatial positions of the one or more graphical objects with respect to the first magnetic resonance image, and

wherein execution of the instructions further causes the processor to repeatedly:

acquire second magnetic resonance data using the magnetic resonance imaging system;

reconstruct a second magnetic resonance image using the second magnetic resonance data;

receive repositioning coordinates in the second magnetic resonance image for a first group of graphical objects selected from the one or more graphical objects, wherein the repositioning coordinates describe a repositioning of the first group of graphical objects in the second magnetic resonance image with respect to the first magnetic resonance image; and

determine a coordinate transformation of a second group of graphical objects selected from the one or more

graphical objects by applying a coordinate transformation model to the repositioning coordinates and

wherein execution of the instructions further causes the processor to repeatedly modify the treatment plan using the repositioning coordinates and the coordinate transformation, and

control the ultrasound system in accordance with the modified treatment plan.

(Appeal Br. 28–29 (Claims App.).)

The Examiner rejects claims 1–8 and 11–17 under 35 U.S.C. § 101 as being directed to a patent-ineligible abstract idea. (Ans. 2.)

The Examiner rejects claims 1–3, 5–8, and 11–17 under pre-AIA 35 U.S.C. § 103(a) as unpatentable over Pekar[2] and Shanbhag.[3] (Ans. 5.)

The Examiner rejects claim 4 under pre-AIA 35 U.S.C. § 103(a) as unpatentable over Pekar, Shanbhag, and Brown.[4] (Ans. 5.)

I.

Issue

The Examiner has rejected claims 1–8 and 11–17 under 35 U.S.C. § 101 as being directed to a patent-ineligible abstract idea. The Examiner finds that the claims are directed to "registering images to plan and guide ultrasound treatment" and that "the claimed invention relies upon algorithms to perform registration (reposition coordinates and coordinate transformation), which is considered an abstract idea . . . as it involves measuring, calculating and matching mathematically relating data." (*Id.* at

[2] Pekar et al., WO 2010/113050 A2, published Oct. 7, 2010.

[3] Shanbhag et al., US 2011/0152666 A1, published Jun. 23, 2011.

[4] Brown, US 2005/0190955 A1, published Sep. 1, 2005.

2–3.) The Examiner finds that the remaining elements in the claims are no more than "insignificant post-solution activity and/or data gathering (e.g. adjust ultrasound focus); routine and conventional data processing steps (e.g. segmentation and matching); conventional elements (e.g. ultrasound device, imaging device and processor,); and/or applying the abstract idea in a computer environment according to well-known, routine, and conventional techniques (e.g. controlling therapeutic device)." (*Id.* at 3.)

Appellant contends that, like the invention in *Diamond v. Diehr*, 450 U.S. 175 (1981), the subject matter of claim 1 "provides '[i]mprovements to another technology or technical field,'" specifically "operat[ing] a medical instrument such that 'hyperthermia is accurately applied to the [patient's] tissue in the target region even if motion [of the patient] occurs.'" (Appeal Br. 11–12.)

Appellant also contends that the claim 1 is patent eligible because, to the extent it recites an abstract idea, claim 1 "applies such putative abstract idea . . . with, or by use of, a particular machine (i.e., a medical instrument) having a magnetic resonance imaging system and an ultrasound system" and thus "'recite[s] additional elements that amount to significantly more than the judicial exception.'" (Appeal Br. 13.)

Appellant further contends that claim 1 is patent eligible because the subject matter of claim 1 involves "'transformation or reduction of a particular article to a different state or thing,'" specifically the transformation of "'magnetic resonance data' to a 'treatment plan controlling the ultrasound system.'" (Appeal Br. 13–14.)

Finally, Appellant contends that claims 1, 4, 11, 12, and 14 contain limitations other than what are well-understood, routine, or conventional in

the field, for the reasons discussed in its briefs with respect to the obviousness rejections.

The issue with respect to this rejection is whether the claims are directed to an abstract idea without significantly more.

Analysis

In determining whether a claim is directed to patent ineligible subject matter, we apply the analytical framework set out in *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66 (2012) and elaborated by *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 134 S.Ct. 2347 (2014):

> First, we determine whether the claims at issue are directed to [laws of nature, natural phenomena, or abstract ideas]. If so, we then ask, "[w]hat else is there in the claims before us?" To answer that question, we consider the elements of each claim both individually and "as an ordered combination" to determine whether the additional elements "transform the nature of the claim" into a patent-eligible application. [The Supreme Court has] described step two of this analysis as a search for an "inventive concept"—i.e., an element or combination of elements that is "sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself."

Alice, 134 S.Ct. at 2355 (second and fourth alternations original) (citations omitted). "The second step of the *Alice* test is satisfied when the claim limitations involve more than performance of well-understood, routine, [and] conventional activities previously known to the industry." *Berkheimer v. HP Inc.*, 881 F.3d 1360, 1367 (Fed. Cir. 2018) (internal quotation marks omitted).)

In *Berkheimer*, the Federal Circuit explained that "[t]he question of whether a claim element or combination of elements is well-understood,

routine and conventional to a skilled artisan in the relevant field is a question of fact." *Id.* at 1368. The Federal Circuit further held that "[w]hether a particular technology is well-understood, routine, and conventional goes beyond what was simply known in the prior art" and that "[t]he mere fact that something is disclosed in a piece of prior art . . . does not mean it was well-understood, routine, and conventional." *Id.*

In the present case, Appellant persuades us that the preponderance of the evidence does not support the Examiner's conclusion that the rejected claims recite subject matter ineligible for patenting. In particular, even if we were to agree with the Examiner that the rejected claims are directed to an abstract idea, i.e., algorithms for registering images for planning and guiding ultrasound treatment, we still find that the Examiner has not shown sufficiently that the additional features recited in the claims constitute well-understood, routine, and conventional activity already engaged in by skilled artisans in the relevant art.

The Examiner acknowledges that the claims contain limitations in addition to abstract ideas, including, e.g., using a processor to control a therapeutic device.[5] (Ans. 3.) Although the Examiner states that these

[5] We note that the claims on appeal include three independent claims. Claim 1 recites a medical instrument, while claims 11 and 12 recite, respectively, a non-transitory computer-readable medium storing instructions that may be executed by a processor and a method, executed by the processor, of controlling a medical instrument. (Appeal Br. 28–29, 30–32 (Claims App.).) The Examiner does not provide any separate analysis with respect to these claims. Moreover, each of these claims contain limitations in addition to the alleged abstract idea, such as, e.g., controlling an ultrasound system in accordance with a modified treatment plan. Accordingly, the rejection under 35 U.S.C. § 101 is deficient as to each of these claims, and claims depending from them, for the reasons discussed herein.

additional limitations are no more than "insignificant post-solution activity and/or data gathering (e.g. adjust ultrasound focus); routine and conventional data processing steps (e.g. segmentation and matching); conventional elements (e.g. ultrasound device, imaging device and processor,); and/or applying the abstract idea in a computer environment according to well-known, routine, and conventional techniques (e.g. controlling therapeutic device)," the Examiner cites to no evidence supporting these statements. (*Id.*; *see also id.* at 9–10.)

The Examiner finds that "the steps involved with image registration and medical procedure planning are . . . widely known and can be found in many references including those disclosed in the rejection section by the prior art." (*Id.* at 9.) However, the Examiner fails to point to any particular section of the prior art relied upon as rendering any particular claim limitation well-known, routine, and/or conventional. This lack of specificity is problematic because the Federal Circuit has held that "[t]he mere fact that something is disclosed in a piece of prior art . . . does not mean it was well-understood, routine, and conventional." *Berkheimer*, 881 F.3d 1369. Indeed, as noted below in our discussion of the obviousness rejections, we also find that the Examiner has not established a prima face case of obviousness because the rejections fail to show, with sufficient specificity, that each claim limitation is suggested by the prior art.

Accordingly, we reverse the Examiner's rejection of claims 1–8 and 11–17 as directed to patent ineligible subject matter.

II.

Issue

The Examiner has rejected claims 1–3, 5–8, and 11–17 as obvious over Pekar and Shanbhag. The Examiner has rejected claim 4 as obvious over Pekar, Shanbhag, and Brown. The same issues are dispositive for both rejections; we therefore discuss them together.

The Examiner finds that Pekar discloses a medical instrument comprising a magnetic resonance imaging system, an ultrasound system, a processor for controlling the medical instrument, and memory containing machine readable instructions for execution by the processor. (Ans. 5.) The Examiner finds that Pekar discloses instructions that when executed causes the processor to acquire magnetic resonance data, reconstruct a magnetic resonance image using the data, and receive a registration of one or more graphical objects to the magnetic resonance image, "wherein the registration defines spatial positions of the one or more graphical objects with respect to the magnetic resonance image." (*Id.*) The Examiner finds that Pekar discloses that execution of the instructions further causes the processor to repeatedly acquire second magnetic resonance data and reconstruct a second magnetic resonance image using such data. (*Id.*)

The Examiner finds that Pekar does not disclose (1) forming a treatment plan from the first magnetic resonance image, (2) receiving repositioning coordinates that describe a repositioning of a graphical object in a second magnetic resonance image with respect to the first image, (3) determining a coordinate transformation of other graphical objects by applying a coordinate transformation model to the repositioning coordinates, (4) repeatedly modifying the treatment plan using the repositioning

coordinates and the coordinate transformation, or (5) controlling the ultrasound system with the treatment plans. (*Id.* at 5–6.)

The Examiner finds, however, that Shanbhag discloses "register[ing] MRI images to track target features (tumors) to guide . . . ultrasound device." (*Id.* at 6.) The Examiner concludes that it would have been obvious to a skilled artisan to modify Pekar to "track target features by register[ing] MRI images to guide . . . ultrasound device as taught by Shanbhag because this help[s] ablate tissue while the healthy surrounding tissue is not adversely affect[ed]." (*Id.*)

Appellant contends, among other things, that the cited prior art does not disclose transforming "repositioning coordinates" or "operating upon a second MRI image based upon graphical objects identified in a first MRI image." (Appeal Br. 23, 24.)

The issue with respect to this rejection is whether the cited prior art suggests (1) "repositioning coordinates in [a] second magnetic resonance image" that "describe a repositioning of the . . . objects in the second magnetic resonance image with respect to [a] first magnetic resonance image" and (2) "determin[ing] a coordinate transformation of . . . graphical objects . . . by applying a coordinate transformation model to the repositioning coordinates."

Analysis

On the record before us, we agree with Appellant that the Examiner has not established a prima facie case that the claims are obvious under 35 U.S.C. § 103(a).

The Examiner relies on Pekar for disclosure of a medical instrument comprising an MRI system, an ultrasound system, a processor for

controlling the medical instrument, memory containing machine readable instructions for execution by the processor, and instructions that when executed causes the processor to (1) acquire magnetic resonance data, (2) reconstruct an image, (3) receive a registration that defines the spatial positions of one or more graphical object with respect to the image, and (4) repeatedly acquire second magnetic resonance data to reconstruct a second image. (Ans. 5.) The Examiner relies on Shanbhag for disclosure of "registering MRI images to track target features (tumors) to guide . . . ultrasound device" and concludes that it would have been obvious to a skilled artisan to modify Pekar to "track target features by register[ing] MRI images to guide . . . ultrasound device as taught by Shanbhag because this help[s] ablate tissue while the healthy surrounding tissue is not adversely affect[ed]." (*Id.* at 6.) In response to Appellant's contention that neither Pekar nor Shanbhag teaches the claimed repositioning coordinates or coordinate transformation, the Examiner contends that Shanbhag discloses image registration, that repositioning and transformation are both part of such image registration, and that the claims "basically registers the first image with the second image and tracks the moving target," which is disclosed by Shanbhag. (*Id.* at 12.)

As further discussed below, while we understand the Examiner's position, we find that the Examiner has not sufficiently established a prima facie case that the combination of prior art teaches or suggests each element of the claims.

Shanbhag teaches "using an [Autoregressive Moving Average (ARMA)] treatment of MRI tracking data of salient features of the tissue of interest to predict the spa[t]ial position of the portion of tissue to be treated

and using this prediction to guide the application of the thermal energy," particularly where "high energy focused ultrasound (HIFU) is used to ablate diseased tissue such as a cancerous tumor." (Shanbhag Abstract.) Shanbhag teaches that ARMA is created by "tracking the spatial position of salient features . . . with MRI over multiple respiratory cycles for a number of subjects and subjecting the data so collected to deformable/elastic registration and ARMA treatment," in order to "create predictive relationships between a respiratory cycle and the location of the portions of the tissue of interest." (*Id.* ¶ 4.) Shanbhag then teaches fitting the ARMA model to a given subject by "tracking the spatial position of salient features representative of different portions of the tissue of interest with MRI over multiple respiratory cycles for that subject," and using the individualized model to "guide the application of thermal energy to a particular portion of the tissue of interest without the need to continuously track the movement of said portion during the application of the thermal energy." (*Id.* ¶¶ 5–6.)

Claim 1 requires a processor that controls a medical instrument to (1) receive a registration defining the spatial positions of one or more graphical objects with respect to a first magnetic resonance image, (2) receive repositioning coordinates for a first group of graphical objects that describes a repositioning of the objects in a second magnetic resonance image as compared to the first image, (3) determine a coordinate transformation of a second group of graphical objects by applying a coordinate transformation model to the repositioning coordinates, (4) use the repositioning coordinates and coordinate transformation to repeatedly modify a treatment plan, and (5) control an ultrasound system in accordance with the modified treatment plan.

While Shanbhag does teach using MRI to track spatial positions of salient features for a number of subjects, subjecting the collected data to deformable/elastic registration and ARMA treatment, and then fitting the model to a given subject by tracking the spatial position of the salient features with MRI for that subject, it is unclear to us based on the rejection whether the deformable/elastic registration—which is described as carried out on data collected from multiple subjects—would be performed by the same processor that repeatedly modifies a treatment plan and controls the ultrasound system in accordance with the modified treatment plan. Shanbhag teaches, for example, that its method can be used to "guide the application of thermal energy to a particular portion of the tissue of interest ***without*** the need to continuously track the movement of said portion during the application of the thermal energy." (Shanbhag ¶ 6 (emphasis added).)

To the extent the Examiner's rejection is based on how an individualized model is created for a particular subject (i.e., via "tracking the spatial position of salient features representative of different portions of the tissue of interest with MRI over multiple respiratory cycles for that subject) or the validation of the model discussed in Shanbhag (Shanbhag ¶¶ 7–9, 20–23), the Examiner also has not explained why the creation of such individualized model and/or validation of the model necessarily suggests the relevant claim limitations relating to registration, repositioning coordinates, and coordinate transformation.[6]

[6] Claims 11 and 12, which are the other two independent claims, relate respectively to a "non-transitory computer-readable medium storing instructions that when executed by a processor cause the processor to execute a method of controlling a medical instrument," and "a method, executed by a processor, of controlling a medical instrument." (Appeal Br.

In short, while it does appear that Shanbhag and the claimed invention both generally relate to tracking a moving target using MRI, the rejection does not sufficiently identify how the combination of prior art suggests each element of the claims.

Accordingly, we reverse the Examiner's rejection of claims 1–3, 5–8 and 11–17 as obvious over Pekar and Shanbhag. *In re Fine*, 837 F.2d 1071, 1076 (Fed. Cir. 1988) ("Dependent claims are nonobvious under section 103 if the independent claims from which they depend are nonobvious."). We also reverse the Examiner's rejection of claim 4 as obvious over Pekar, Shanbhag, and Brown for the same reasons.

SUMMARY

For the reasons above, we reverse the Examiner's decision rejecting claims 1–8 and 11–17.

REVERSED

31–32 (Claims App.).) The Examiner's rejections as to these independent claims suffer from the same deficiencies discussed with respect to claim 1.