

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today
(1) was not written for publication in a law journal and
(2) is not binding precedent of the Board.

Paper No. 12

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KASHIPATI G. RAO

Appeal No. 1996-4030
Application 08/104,462¹

ON BRIEF

Before JERRY SMITH, FLEMING and HECKER, ***Administrative Patent Judges.***

FLEMING, ***Administrative Patent Judge.***

DECISION ON APPEAL

¹ Application for patent filed August 9, 1993.

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This is a decision on appeal from the final rejection of claims 1 through 4, and 10 through 14. Claims 5 through 9 are objected to. On page 2 of the answer, the Examiner withdraws the

35 U.S.C. § 103 rejection of claims 10 through 12 and 14, thereby claims 1 through 4 and 13 have been finally rejected and claims 5 through 12 and 14 are objected to.

Appellant's invention relates to digital image processing. In particular, Appellant's invention relates to a system for recognition of three-dimensional objects in a two-dimensional image. Independent claim 1 is reproduced as follows:

1. A method of model-based image recognition, comprising the steps of:

(a) extracting image points from an input two-dimensional image;

(b) selecting a set of n of said image points extracted in step (a) and a set of n model points of a three-dimensional model in a class of K models, where n is a positive integer greater than or equal to 4 and K is a positive integer;

(c) computing a transformation of three dimensions to two dimensions based on said set of n model points and said

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set of n image points, said transformation consisting of rotation, translation, and scaling;

(d) repeating steps (b)-(c) for all sets of n of said image points and all sets of n model points of a model of said class of models;

(e) selecting a hypothesized transformation from said transformations created by steps (b)-(d) wherein said hypothesized transformation is characterized by an error of transforming its n model points to its n image points of less than a predetermined threshold, but when none of said transformations has an error less than said predetermined threshold, selecting no transformation; and

(f) indicating recognition of an object in said image and corresponding to the model including the n model points of said hypothesized transformation when a hypothesized transformation is selected in step (e), else indicating no model objects recognized in said image when no transformation is selected in step (e).

The references relied on by the Examiner are as follows:

Huttenlocher et al. (Huttenlocher), "Recognizing Solid Objects by Alignment with an Image," ***International Journal of Computer Vision***, 5:2, 195-212 (1990)

Horaud et al. (Horaud), "An Analytic Solution for the Perspective 4-Point Problem," ***Computer Vision and Pattern Recognition***, 500-507 (1989).

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Claims 1 through 4 and 13 stand rejected under 35 U.S.C. § 103 as being unpatentable over Huttenlocher and Horaud. Rather than repeat the arguments of Appellant or the Examiner, we make reference to the brief and the answer for details thereof.

OPINION

After a careful review of the evidence before us, we agree with the Examiner that claims 1 through 4 are properly rejected under 35 U.S.C. § 103. However, we do not agree with the Examiner that claim 13 is properly rejected under 35 U.S.C.

§ 103. Thus, we will sustain the rejection of claims 1 through 4 but we will reverse the rejection of claim 13 on appeal for the reasons set forth *infra*.

At the outset, we note that Appellant states on page 4 of the brief that claims 1, 3 and 4 stand or fall together as a group and claims 2 and 13 stand separately. We note that Appellant argues all of the claims consistent with the above

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groupings in the briefs. 37 CFR § 1.192(c)(7) (July 1, 1995)
as amended at 60 Fed. Reg. 14518 (March 17, 1995), which was
controlling at the time of Appellant's filing the brief,
states:

For each ground of rejection which
appellant contests and which applies to a
group of two or more claims, the Board
shall select a single claim from the group
and shall decide the appeal as to the
ground of rejection on the basis of that
claim alone unless a statement is included
that the claims of the group do not stand
or fall together and, in the argument under
paragraph (c)(8) of this section, appellant
explains why the claims of the group are
believed to be separately patentable.
Merely pointing out differences in what the
claims cover is not an argument as to why
the claims are separately patentable.

Appellant has provided a statement that claims 1, 3 and 4 may
be considered together as a group. We will, thereby, consider

Appellant's claims 1, 3 and 4 as standing or falling together
and we will treat claim 1 as a representative claim of the
group.

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It is the burden of the Examiner to establish why one having ordinary skill in the art would have been led to the claimed invention by the express teachings or suggestions found in the prior art, or by implications contained in such teachings or suggestions. *In re Sernaker*, 702 F.2d 989, 995, 217 USPQ 1, 6 (Fed. Cir. 1983). In regard to claims 1 through 4, we find that the Examiner has set forth a *prima facie* case and thereby met this burden, but has failed to meet this burden for claim 13.

On pages 3 and 4 of the brief, Appellant argues that the exact transformation approach of Huttenlocher and Horaud do not teach or suggest the step of generating approximation transformations which need not map the model (object) points onto the image points, that is, the model and image points need not match. Appellant further argues that Huttenlocher's three point alignment transformation does not generate a four point transformation simply because a four point alignment transformation usually does not exist. Appellant argues that given a random set of four points in three space and a random set of four points in an image plane, the probability of an

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alignment transformation existing which maps the four points of three space to the four

points of the image plane has a mathematical probability of zero. Appellant further argues that Horaud expressly states that their problem presumes a given set of object points and their corresponding image points and intrinsic camera parameters, and seeks to find transformations between camera and object frames. Appellant points out that Horaud takes as a given the existence of a transformation matching the object points and the image points. Appellant argues that there would be no suggestion to extend Huttenlocher to a set of four model points and four image points that do not match for which no transformation need exist.

Turning to claim 1, we note on page 3 of the Examiner's answer that the Examiner shows a one-to-one correspondence of how Huttenlocher teaches the method as recited in claim 1 for each of the method steps. We further note that the Appellant does not contradict the Examiner's findings that Huttenlocher teaches these method steps. The

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Examiner further points out that Huttenlocher does not teach that n is equal to 4 as claimed in Appellant's claim 1. However, the Examiner points out that Huttenlocher did suggest on page 209 that n could be equal to 4 and, in addition, points to Horaud which teaches a 4 or greater point embodiment.

We appreciate Appellant's argument that Horaud and Huttenlocher are an exact transformation approach. However, we fail to find that Appellant's claim 1 distinguishes over the exact transformation approach of Huttenlocher and Horaud. In particular, we fail to find that the claim sets forth that the four points in the three space and the four points in the image plane must be a random set.

Appellant further argues on page 3 of the brief that one of ordinary skill in the art would not try Huttenlocher's approach for four points. Appellant argues that the alignment transformation would usually not exist and there would not be

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an analogous calculation which would lead to the alignment transformation.

On page 4 of the answer, the Examiner argues that it would have been obvious to one of ordinary skill in the art to set the variable n in Huttenlocher's method to 4. The Examiner points out that on page 209, Huttenlocher does suggest the use of the four image points. Furthermore, the Examiner points out that Horaud teaches a method of using four or more points.

The Federal Circuit reasons in ***Para-Ordnance Mfg. Inc. v. SGS Importers Int'l Inc.***, 73 F.3d 1085, 1088-89, 37 USPQ2d

1237, 1239-40 (Fed. Cir. 1995), ***cert. denied***, 117 S.Ct. 80 (1996), that for the determination of obviousness, the court must answer whether one of ordinary skill in the art who sets out to solve the problem and who had before him in his workshop the prior art, would have been reasonably expected to use the solution that is claimed by the Appellants.

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Turning to Huttenlocher, we find on page 209 that Huttenlocher does suggest that there are possible transformations that were computed by matching each group of four connected image vertexes to each group of four connected model vertexes. Turning to Horaud, we find that Horaud teaches on page 501, first column, that they have derived an analytic solution or a case of four non-coplanar points, namely, a biquadratic polynomial in one unknown. Horaud further teaches that it is important to find a closed form solution for four non-coplanar points for several reasons. First, they provide fewer solutions than three points. Second, the solutions are more stable when the points are not coplanar, because they do not depend on relative orientation of the image plane with respect to the scene plane containing the points. Third, the computation of such solutions is fast and, therefore, it can be included in a runtime visual process.

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Thus, Horaud gives reasons of why one of ordinary skill in the art would use the Horaud 4-point solution in Huttenlocher's method. Therefore, we find that one of ordinary skill in the art who sets out to solve the problem and has before him in his workshop Huttenlocher's three point solution and Horaud's 4-point solution would have been reasonably expected to use Horaud's 4-point solution in Horaud's method as claimed by Appellant. On page 4 of the brief, Appellant argues that claim 2 requires n to be a number in the range of 5 to 7. Appellant argues that the exact transformation approach of Huttenlocher and Horaud is nonexistent for five points. We agree that this may be true for a random set of five points. However, Horaud teaches that for five points in general position, the strategy of the 4-point solution can as well be equally applied. Therefore, we will sustain the decision of the Examiner rejecting claims 1 through 4 under 35 U.S.C. § 103.

We have addressed all of Appellant's arguments. We are not required to raise and/or consider any further issue not argued by Appellant. As stated by our reviewing court in

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In re Baxter Travenol Labs., 952 F.2d 388, 391, 21 USPQ2d 1281, 1285 (Fed. Cir. 1991), "[i]t is not the function of this court to examine the claims in greater detail than argued by an appellant,

looking for nonobvious distinctions over the prior art." 37 CFR § 1.192(a)(July 1, 1995) **as amended at** 60 Fed. Reg. 14518 (March 17, 1995), which was controlling at the time of Appellant filing the brief, states as follows:

The brief . . . must set forth the authorities and arguments on which appellant will rely to maintain the appeal. Any arguments or authorities not included in the brief will be refused consideration by the Board of Patent Appeals and Interferences, unless good cause is shown.

Also, 37 CFR § 1.192(c)(8)(iv) states:

For each rejection under 37 U.S.C. 103, the argument shall specify the errors in the rejection and, if appropriate, the specific limitations in the rejected claims which are not described in the prior art relied on in the rejection, and shall explain how such limitations render the claimed subject matter unobvious over the prior art. If the rejection is based upon a combination of references, the argument

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shall explain why the references, taken as a whole, do not suggest the claimed subject matter, and shall include, as may be appropriate, an explanation of why features disclosed in one reference may not properly be combined with features disclosed in another reference. A general argument that all the limitations are not described in a single reference does not satisfy the requirements of this paragraph.

Thus, 37 CFR § 1.192 provides that this board is not under any greater burden than the court which is not under any burden to raise and/or consider issues not argued by Appellant.

Appellant argues on page 4 of the brief that neither Huttenlocher nor Horaud teaches a pseudo-inverse approach in finding the hypothesized transformations as required by Appellant's claim 13. The Examiner responds to this argument on page 6 of the answer that it is well known in the art that various matrix inversion techniques are utilized to solve matrix equations for specific variables. We note that the Examiner does not provide any evidence for the Examiner's finding.

We are not inclined to dispense with proof by evidence when the proposition at issue is not supported by a teaching in a prior art reference, common knowledge or

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unquestionable demonstration. Our reviewing court requires this evidence in order to establish a *prima facie* case. *In re Knapp-Monarch Co.*, 296 F.2d 230, 232, 132 USPQ 6, 8 (CCPA 1961); *In re Cofer*, 354 F.2d 664, 668, 148 USPQ 268, 271-72 (CCPA 1966).

In view of the foregoing, the decision of the Examiner rejecting claims 1 through 4 under 35 U.S.C. § 103 is affirmed; however, the decision of the Examiner rejecting claim 13 under 35 U.S.C. § 103 is reversed.

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

AFFIRMED-IN-PART

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	JERRY SMITH)	
	Administrative Patent Judge)	
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)	BOARD OF
PATENT)	
	MICHAEL R. FLEMING)	APPEALS
AND)	
	Administrative Patent Judge)	
INTERFERENCES)	
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