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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte LI ZHANG, JIANLE CHEN, MARTA KARCZEWICZ, JOEL
SOLE ROJALS, and WOO-SHIK KIM

Appeal 2019-003695
Application 14/656,526
Technology Center 2400

Before MICHAEL J. STRAUSS, IRVIN E. BRANCH, and
PHILLIP A. BENNETT, *Administrative Patent Judges*.

STRAUSS, *Administrative Patent Judge*.

DECISION ON APPEAL¹

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant² appeals from the
Examiner's decision to reject claims 1–10, 12–21, 23–25, 27–29, 31–40, 42–

¹ We refer to the Specification, filed March 12, 2015 as amended January 19, 2018 (“Spec.”); Final Office Action, mailed May 16, 2018 (“Final Act.”); Appeal Brief, filed October 19, 2018 (“Appeal Br.”); Examiner’s Answer, mailed February 7, 2019 (“Ans.”); and the Reply Brief, filed April 8, 2019 (“Reply Br.”).

² We use the word Appellant to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as Qualcomm Incorporated. Appeal Br. 3.

51, 53, and 54. *See* Final Act. 3-20.³ Claims 11, 22, 26, 30, 41, and 52 are canceled. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

CLAIMED SUBJECT MATTER

The claims are directed to modifying bit depths in color-space transform coding. Spec., Title. In video encoded by a combination of (i) a brightness or luminance (i.e., “luma”, represented by the letter “ Y ”) component and (ii) color or chrominance (i.e., “chroma”) components (e.g., a blue-difference chroma component C_b and a red-difference chroma component C_r), the bit depths (i.e., the number of bits) of data representing the respective luma and chroma components (i.e., Y , C_b and C_r) are made equal by a bitwise shift operation prior to applying a color-space transformation (e.g., converting from YC_bC_r to RGB color-space). *See, e.g.*, Claim 1, Spec. ¶ 50. Claim 1, reproduced below, is illustrative of the claimed subject matter:

1. A method of encoding video data, the method comprising:
 - determining a bit-depth of a luma component of the video data and a bit-depth of a chroma component of the video data;
 - in response to the bit-depth of the luma component being different than the bit depth of the chroma component, modifying one or both of the bit depth of the luma component and the bit depth of the chroma component such that the bit depths are equal comprising performing a bitwise shift operation on the video data of one or both of the luma component and the chroma component before applying a color-space transform process; and

³ The listing of claims rejected on page 1 of the Final Action erroneously includes canceled claim 41 and omits rejected independent claim 42. We consider the misstatement to constitute harmless error.

applying the color-space transform process to the modified video data.

REFERENCES

The prior art relied upon by the Examiner is:

Name	Reference	Date
Sato	US 2013/0315493 A1	Nov. 28, 2013
Ohgose	US 2014/0003515 A1	Jan. 2, 2014
Saxena	US 2015/0110181 A1	Apr. 23, 2015
Rabbani et al., “An overview of the JPEG 2000 still image compression standard”, 17 SIGNAL PROCESSING: IMAGE COMMUNICATION 3–48, (2002) (“Rabbani”)		
Kim et al., “Adaptive Residue Transform and Sampling”, Document JVT-K018, JOINT VIDEO TEAM (JVT) OF ISO/IEC MPEG & ITU-T VCEG(ISO/IEC JTC1/SC29/WG11 AND ITU-T SG16 Q6), 15 March 2004, pages 1–16 (“Kim”)		

REJECTION

Claims 1–3, 6, 8, 9, 10, 12–14, 17, 19–21, 23–25, 27–29, 31–33, 36, 38–40, 42–44, 47, 49–51, 53 and 54 stand rejected under 35 U.S.C. § 103 as being unpatentable over Rabbani, Kim, and Sato. Final Act. 11–22.⁴

Claims 4, 5, 15, 16, 34, 35, 45, and 46 stand rejected under 35 U.S.C. § 103 as being unpatentable over Rabbani, Kim, Sato, and Ohgose. Final Act. 22–25.

Claims 7, 18, 37, and 48 stand rejected under 35 U.S.C. 103 as being unpatentable over Rabbani, Kim, Sato, and Saxena. Final Act. 25–27.

⁴ The listing of claims rejected under 35 U.S.C. § 103 over Rabbani, Kim, and Sato appearing at page 11 of the Final Action erroneously omits claims 53 and 54 although these claims are included in the rejection narrative at pages 19–20. We consider the omissions to constitute harmless error.

STANDARD OF REVIEW

We review the appealed rejections for error based upon the issues identified by Appellant, and in light of the arguments and evidence produced thereon. *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential).

OPINION

Examiner's Findings

The Examiner finds Rabbani's description of a JPEG 2000 digital image encoder teaches the recited steps of claim 1 except (i) Rabbani processes individual digital images rather than the claimed video data, and (ii) Rabbani does not disclose performing "a bitwise shift operation on the video data of one or both of the luma component [e.g., "Y"] and the chroma component [e.g., "C_b", "C_r"] before applying a color-space transform process" as claimed. Final Act. 12–14, (emphasis omitted). In particular, the Examiner finds Rabbani's explanation that "a typical color image would have three components (e.g., RGB and YC_bC_r)" and that "sample values for each component can be . . . integers with a bit-depth in the range of 1–38 bits" teaches "determining a bit-depth of a luma component of the [image] data and a bit-depth of a chroma component of the [image] data." *Id.* at 12, (emphasis omitted) (citing Rabbani p. 6, § 2). The Examiner finds Rabbani's disclosure of a restriction on applying a forward point-wise intercomponent transformation such that "the components must have identical bit-depths and dimensions" teaches modifying the luma [e.g., Y] and chroma components [e.g., C_b, C_r] to have equal bit depths. *Id.* at 12–13 (citing Rabbani pp. 6–7, § 2.1).

The Examiner applies Kim for teaching processing video data instead of Rabbani's single image data. *Id.* at 13 (citing Kim p. 1, § 1). According to the Examiner, "[o]ne would be motivated as one of ordinary skilled in the art would have recognized that applying color transformation for saving bits in Rabbani would be equally applicable to video data since video data comprises of multiple still pictures that are subject to the same benefits disclosed in Rabbani." *Id.* at 14. The Examiner relies on Sato's shift-to-right unit for teaching performing a bitwise shift operation on the video data before applying a color-space transform process. *Id.* at 14 (citing Sato ¶ 174). The Examiner reasons it would have been obvious "to utilize the teachings of Sato to bit shift the color components so as to make the bit depths equal between the components to be transformed when performing color space transformation in Rabbani-Kim." *Id.* at 15.

Appellant's Contentions and Examiner's Answer

Appellant contends Rabbani fails to teach modifying the bit depth of the luma or chroma component of video data to have equal bit depths.

Appeal Br. 9. Appellant argues

Rabbani merely discloses performing a "DC level shift" on the red, green, and blue color components *after* the Y, C_[b], and C_r components (or the Y, U, and V components) have been transformed back into the RGB color space. Rabbani fails to disclose or suggest "***performing a bitwise shift operation on the video data*** of one or both of the luma component and the chroma component ***before applying a color-space transform process***" (emphasis added), as recited in Appellant's claim 1.

Id. Appellant argues Rabbani's restriction requiring components have identical bit-depths is in connection with a forward point-wise

intercomponent transform of red, green and blue image components of an image in RGB color space to YC_bC_r color space, not the luma (i.e., Y) and chroma (i.e., C_b, C_r) components in YC_bC_r color space. *Id.* According to Appellant, Rabbini's removal of a DC shift level after an inverse color transform evidences that bit depths are only of concern after a transformation back into RGB components, not prior to the transform while an image is encoded using luma and chroma components. *Id.* at 10. In further support of the argument that Rabbani is concerned only with the bit depth of RGB components, Appellant directs attention to Rabbani's disclosure that "as the result[] of the RCT transform, '[t]he Y component has the same bit-depth as the RGB components while the U and V components have one extra bit of precision.'" *Id.* at 11, (emphasis omitted).

The Examiner responds as follows:

The statement in the section 2.1 of Rabbani that the components in the intercomponent transformation must have identical bit depth is understood to be a general statement on the color transformation of images having color components (such as the RGB or luma chroma components, the most well-known color components immediately apparent to one of ordinary skilled in the art), especially since Rabbani's statement says "One restriction on applying the intercomponent transformation is that the components must have identical bit-depth . . ." and does not refer to "RGB" components. Just because Rabbani goes on to describe a specific example of transforming RGB components does not take away from the general statement as described above.

Ans. 23.

Appellant replies, further arguing Sato's shift operation does not teach modifying the bit-depth in such a way as to cure the argued deficiency of Kim. . Reply Br. 4. According to Appellant "Sato does not describe a color-

space transform process at all. Therefore, Sato does not disclose or suggest, ‘performing a bitwise shift operation on the video data of one or both of the luma component and the chroma component **before applying a color-space transform process,**’ per Appellant’s claim 1.” *Id.* (citing Final Act. 14).

Analysis

Appellant’s arguments are persuasive of reversible Examiner error. We disagree with the Examiner’s finding that Rabbani’s statement “that the components in the intercomponent transformation must have identical bit depth is understood to be a general statement on the color transformation of images having color components” (Ans. 23) as conclusory and not supported by the evidence. Instead, based on evidence and reasoning proffered by Appellant, we are persuaded Rabbani’s requirement that video components have equal bit-depths is disclosed only in connection with RGB, i.e., not in connection with video coded using luma and chroma components as claimed. Furthermore, we agree with Appellant that Sato’s shift-to-right unit that decreases data bit depth, although performing a bitwise shift operation, does not teach or suggest performing the shift operation before applying a color-space transformation of luma and chroma video components. Reply Br. 4.

For the reasons discussed above, we do not sustain the rejection of independent claim 1 under 35 U.S.C. § 103 over Rabbani, Kim, and Sato or the rejection of independent claims 12, 23, 27, 31, and 42 which include corresponding limitations. Furthermore, we do not sustain the rejections of dependent claims 2–10 and 53 that depend from claim 1, claims 13–21 and 54 that depend from claim 12, claims 24 and 25 that depend from claim 23,

claims 28 and 29 that depend from claim 27, claims 32–40 that dependent from claim 31, and claims 43–51 that depend from claim 42, these dependent claims standing with their respective base claim.

CONCLUSION

We reverse the Examiner’s rejections of claims 1–10, 12–21, 23–25, 27–29, 31–40, 42–51, 53 and 54 under 35 U.S.C. § 103.

DECISION SUMMARY

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1–3, 6, 8, 9, 10, 12–14, 17, 19–21, 23–25, 27–29, 31–33, 36, 38–40, 42–44, 47, 49–51, 53, 54	103	Rabbani, Kim, Sato		1–3, 6, 8, 9, 10, 12–14, 17, 19–21, 23–25, 27–29, 31–33, 36, 38–40, 42–44, 47, 49–51, 53, 54
4, 5, 15, 16, 34, 35, 45, 46	103	Rabbani, Kim, Sato, Ohgose		4, 5, 15, 16, 34, 35, 45, 46
7, 18, 37, 48	103	Rabbani, Kim, Sato, Saxena		7, 18, 37, 48
Overall Outcome				1–10, 12–21, 23–25, 27–29, 31–40, 42–51, 53, 54

REVERSED