

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DIGITAL GLOBAL SYSTEMS, INC.,
Petitioner,

v.

DEEPSIG INC.,
Patent Owner.

Case IPR2024-01358
U.S. Patent No. 11,018,704

PATENT OWNER'S SUR-REPLY

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Petitioner's Reply ("Reply") newly argues that claim 4 of the '704 patent does not require a signal to be received at a receiver, despite element [4A] explicitly reciting "obtaining a received radio signal ... received at the one or more radio receivers." Reply, 18. Instead, Petitioner muddies the water with an untenable interpretation that the "received radio signal" is a "*received...representation*' signal." Reply, 18. But this is not what the claim recites. The claim recites that the "received radio signal" corresponds to a "representation of the transmit output radio signal received at the one or more radio receivers." This language serves to clarify the relationship between the claimed "received radio signal" and the "transmit output radio signal." Rather than allowing the "received radio signal" to be a modeled signal only, the claim specifies that it is a received version of the "transmit output radio signal." This claim language in no way suggests that the "received" radio is never received. To the contrary, the claim explicitly recites a "received" radio signal that it is "received" at "one or more radio receivers." Petitioner's new efforts to advance its unsupported and illogical interpretation should be rejected as untimely and wrong.

While Patent Owner stands on the arguments from the Patent Owner Response ("POR") for independent claims 1, 9, and 17, Patent Owner submits this Sur-Reply specifically to address dependent claims 4-6, 12-14, and 20-22, which are plainly patentable over Petitioner's challenge based on Jüscke in view of Holt.

The Reply's arguments to the contrary (*see* Reply, 16-30) are newly advanced in the Reply, are not persuasive, and cannot prevail.

I. ARGUMENT

A. Unlike the Prior Art, Challenged Dependent Claims 4-6, 12-14, and 20-22 Apply Pre-Distortion at the Transmitter Based on a Distance Metric Computed Between a Transmitted Radio Signal and a Received Radio Signal

Dependent claims 4-6, 12-14, and 20-22 use a distance metric computed between a transmitted radio signal and a received radio signal to update values of the nonlinear pre-distortion machine learning model to correct for distortion in the system. Jüschke does not use a *received radio signal* to correct for system distortion *at the transmitter*. Instead, Jüschke uses an output of the transmitter in the feedback loop, so there is no distance metric computed between a transmitted radio signal and a received radio signal in Jüschke.

Holt primarily uses encoder models, decoder models, and channel models to emulate a transmitter device or component, a communication channel, and a receiver device or component respectively. Holt, 4:33-39. Holt's "channel coding model can be retrained in order to adapt the channel coding model and corresponding encoding scheme to changing conditions of a communication channel over time" Holt, 4:41-44. Then, the encoder model and decoder model portions of the channel coding model can be retrained, "thereby causing the encoder model and decoder model portions of the channel coding model to learn an

updated encoding scheme that is appropriate for the new communication channel conditions.” Holt, 4:49-54. Holt’s “encoder model and the decoder model of the channel coding model can automatically devise an appropriate encoding scheme for the communication channel.” Holt, 4:27-30. Holt makes no mention of distortions in a radio signal processing system, or training pre-distortion machine learning models to correct for such distortions.

Further, while Holt does disclose an actual communication channel in limited circumstances, Holt is abundantly clear in its disclosure that the use of an actual communication channel, as appearing in Figures 6 and 11 and described in corresponding portions of the specification, are for used training a *decoder* model only, *not an encoder model*. Thus, Holt does not use received signals from a radio receiver, received via an actual communication channel, to process transmit signals for transmission. Like Jüschke, Holt also fails to disclose using a signal received via an actual communication channel to train an encoder model or to update parameters for a pre-distortion machine learning model to process a transmit signal.

Whether Jüschke and Holt are considered alone or in combination, there is no disclosure or suggestion in Petitioner’s asserted art to compute a distance metric between a transmit radio signal and a received radio signal that is then used to update model parameters for the pre-distortion machine learning model used for

processing a transmit radio signal, and generating a pre-distorted radio signal.

These features of dependent claims 4-6, 12-14, and 20-22 are neither disclosed by nor obvious in view of the asserted art in the Petition.

B. The Reply Incorrectly Treats a Modeled Signal and a Received Radio Signal as Identical for the Purposes of Claim 4

Exemplary dependent claim 4 includes the following method steps: [4A] “obtaining a received radio signal that corresponds to a representation of the transmit output radio signal received at the one or more radio receivers;” [4B] “determining a distance metric between the transmit radio signal and the received radio signal;” and [4C] “updating the values of the model parameters for the particular deployment scenario based at least on the distance metric.”

In continuing to advance its faulty arguments against dependent claim 4, Petitioner asserts that the claimed “received radio signal” can be a modeled signal that is not received. Petitioner specifically argues that “claim 4 does not require the ‘*received radio signal*’ from which the ‘*distance metric*’ is determined to be the same signal as the signal received at a radio receiver because ‘*received*’ in [4A] modifies the ‘*radio signal that corresponds to a representation.*’” Reply, 19. This argument, frankly, makes no sense. In effect, Petitioner is saying that there can be a “received radio signal” and then another modeled signal that corresponds to, but is not the same, as the “received radio signal,” and the distance metric of claim 4 is computed based on the modeled signal rather than the “received radio signal.”

This argument does not match the claim language, and does not match Petitioner's own theory in the Petition.

Element [4B] plainly states the step of “determining a distance metric between the transmit radio signal and the received radio signal.” The antecedence for “the received radio signal” in [4B] corresponds to “a received radio signal” in [4A]. This is clear.

If the “received radio signal” can be a modeled signal, as Petitioner now argues, Petitioner fails to explain what is meant in claim 4 by “received.” Petitioner argues that a “received radio signal” “need not be a signal received at a receiver as Patent Owner contends.” Reply, 20. But this argument is based on a tortured and nonsensical reading of the '704 patent specification. *Id.*, 20-22.

Properly understood, the '704 patent delineates when a “modeled received radio signal” is used and when it is not. In the disclosures in the '704 patent corresponding to Petitioner's citations, the specification and accompanying illustrations specifically describe a modeled signal as “modeled,” and not as a received signal “received at the one or more radio receivers.” *See* '704 patent, FIG. 5A (“Modeled Received Radio Signal 505”); 9:46-47 (“compute a distance metric between the candidate transmit radio signal 501 and the modeled received radio signal 505.”). Indeed, there is no radio receiver in FIG. 5A, nor any disclosure of a signal received at a radio receiver. And FIG. 5A is specifically

directed to a system “for model training.” ’704 patent, 4:55-56. Thus, when the ’704 patent intended to disclose or describe a modeled signal, it did so expressly, using the words “model” or “modeled.”

In contrast to the model training system of FIG. 5A, FIG. 1 of the ’704 patent plainly illustrates a Received signal 111 received at Receiver 109, and Received signal 111 is fed back to the Nonlinear Pre-distortion System 103. And FIG. 5B illustrates a Received signal 111 from a Receiver 109 that is fed back to the Distance Computation Block 508. Additionally, the ’704 patent discloses that in “the online tuning configuration, the receiver 109 sends the received signal 111 to the nonlinear pre-distortion system in order for the system to compute the distance metric between the transmit signal 104 and the received signal 111.” ’704 patent, 10:14-18. Again, this embodiment specifically discloses no “modeled” signals and instead discloses using “actual transmit signals 104.” *Id.*, 10:6.

Thus, the specification does not support reading the claimed “received radio signal” as a modeled signal that is not received.

Finally, Petitioner argues that “the ’704 patent itself clarifies that a ‘*radio signal received at the one or more radio receivers*’ is distinct from a ‘*received radio signal*.’” Reply, 23. This argument goes nowhere. Petitioner wants the Board to believe that element [4A] could be rewritten as “obtaining a [modeled signal] that corresponds to a representation of the transmit output radio signal

received at the one or more radio receivers.” But this substitution also makes no sense because it converts a “received radio signal” into a modeled signal and eliminates the claimed “one or more radio receivers” and their function, once again in contradiction of the plain language of claim 4.

C. The Reply's Theory Relying on a Modeled Signal, Rather Than a Received Radio Signal, is New

Aside from its lack of merit, another reason to disregard Petitioner's modeled signal theory is that it is new and was never developed in the Petition. Immediately following its new argument that Holt's modeled signal and the first loss function satisfy claim 4, Petitioner includes a preemptive “this is not new argument” footnote filled with case law on page 25. That footnote alleges that Petitioner is just responding to “positions Patent Owner took in its POPR and Response, and this is the first opportunity Petitioner has had to respond.” Pet., 25 n.7. But there's a clear difference between responding to Patent Owner's arguments on one hand, and attempting to dodge those arguments with a new theory on the other. Petitioner falls on the wrong side of that line. Petitioner never alleged in the Petition that the “received radio signal” of claim 4 is satisfied solely by a modeled signal, and no amount of case law can change the claim 4 theories that were advanced over and over in the Petition.

The Petition's discussion of claim 4 spans pp. 67-76 of the Petition. There, Petitioner alleges that “Holt teaches communication data (*transmit output radio*

signal) received by a receiver.” Pet., 69 (emphasis in original). Petitioner also discusses Holt’s Figure 2, noting that “a client computing device 150 with transmitter 159 transmits a signal over network 142. This signal can be received and processed at computing system 160 with ML models 172, 174, and 176 and model trainer 178.” Pet., 69. Thus, Petitioner’s focus in looking to Holt for claim 4 in the Petition was to rely on an actual received signal at Holt’s receiver.

The Petition specifically relied upon a signal received at a receiver when addressing element [4A], alleging that “Holt’s disclosure of transmitted and received communication data received by a decoder model implemented in a receiver device teaches a *received radio signal that corresponds to a representation of the transmit output radio signal received at the one or more radio receivers.*” Pet., 70 (emphasis in original). Petitioner even specifically addressed received signals as its basis for combining Holt with Jüschke, arguing that “using transmit signals ***actually received and recovered at a receiver*** as taught in Holt would have provided a known improvement to Jüschke’s training techniques” Pet., 70 (emphasis added). Continuing on, Petitioner argued in favor of adding “Holt’s ***received and recovered transmission data*** into Jüschke’s feedback loop would have introduced more accurate training data into Jüschke’s neural network training techniques” *Id.* (emphasis added).

Looking to Holt for element [4B], Petitioner confirms its reliance on Holt's received signals rather than modeled signals, noting that "Holt's loss functions also use difference metrics between signals sent and ***received over a communication channel.***" Pet., 72 (emphasis added). Once again, the Petition reiterates its reliance on received signals in its motivation section related to element [4B], arguing that a "POSITA also would have understood that implementing Holt's loss function into Jüschke's feedback sampling would have been an exchange of one form of output data sampling for training neural networks (Jüschke's) for ***another more accurate version (Holt's) of sampling output data actually received and recovered at a receiver.***" Pet., 73 (emphasis added).

And in its analysis of [4C], the Petition identified Holt's "fourth loss function 318" for training and updating model parameters without understanding, as explained above, that Holt's fourth loss function 318 is used to train a decoder model, not an encoder model. Pet., 75. Notably, this argument does not rely on Holt's first loss function, contrary to the assertion in the Reply. And the Petition's reliance on received signals rather than modeled signals was addressed once again in an additional motivation section, noting that "POSITA would have understood that updating parameters using Holt's loss functions based on ***actually received transmissions*** would have provided a known accuracy improvement to Jüschke's training techniques by ***accounting for the actual effects of transmission and***

reception into Jüschke's output data sampling for neural network training." Pet., 75-76 (emphasis added).

The Petition is abundantly clear that Petitioner was relying on actual received signals from Holt, and not modeled signals. But the actual received signals used in Holt's loss functions exist in the fourth loss function, which does not train an encoder model. The Petition misunderstood Holt, and therefore fails to establish that the alleged combination of Jüschke in view of Holt discloses or suggests every claimed feature for the reasons set forth here and in Patent Owner's Response.

D. Even if Combined, Jüschke and Holt Fail as to Claims 4, 12, 20, and their Dependent Claims

For the reasons discussed above, even if combined, Jüschke in view of Holt fails to disclose or suggest every feature of the challenged dependent claims 4-6, 12-14, and 20-22. This is because whether considered alone or in combination, there is no distance metric computed between a transmit radio signal and a received radio signal that is used to update values of the model parameters for the pre-distortion machine learning model, which is used for processing the transmit radio signal and generating a pre-distorted radio signal. Jüschke uses a feedback loop at the transmitter only to process a transmission signal, while Holt uses its fourth loss function to train a decoder model only, not an encoder model. Thus,

even if combined, the combination of these references therefore fails to disclose these claimed features of dependent claims 4-6, 12-14, and 20-22.

II. CONCLUSION

While Patent Owner contends that each Ground is deficient for the reasons set forth here and in the Patent Owner Response, Patent Owner specifically notes that at least dependent claims 4-6, 12-14, and 20-22, as challenged based on Jüsckhe in view of Holt in the Petition, must survive Petitioner's challenges.

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CERTIFICATE OF WORD COUNT

The undersigned certifies that the foregoing PATENT OWNER'S RESPONSE complies with the type-volume limitation in 37 C.F.R. § 42.24(c)(4). According to the word-processing system's word count, the brief contains 2,459 words, excluding the parts of the brief exempted by 37 C.F.R. § 42.24(a).

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CERTIFICATE OF SERVICE

Petitioner has consented to e-mail service in this proceeding. Pursuant to 37 C.F.R. §42.6, the undersigned certifies that on this date, a copy of the foregoing document was served by email upon the following counsel at the below email addresses:

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