UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TOYOTA MOTOR CORPORATION

Petitioner

v.

AMERICAN VEHICULAR SCIENCES,

Patent Owner

Patent No. 6,772,057
Issue Date: Aug. 3, 2004
Title: VEHICULAR MONITORING SYSTEMS

REPLY DECLARATION OF NIKOLAOS PAPANIKOLOPOULOS, PH.D.

Case No. IPR2013-00419

I, Nikolaos Papanikolopoulos, Ph.D., hereby further declare and state as follows:

I. BACKGROUND

1. My employment and compensation information have not changed since I submitted my original declaration in support of Toyota's Petition for Inter Partes Review of U.S. Patent No. 6,772,057 ("the '057 patent").

2. A copy of my updated curriculum vitae is included herewith.

II. ASSIGNMENT AND COMPENSATION

3. I submit this declaration in support of Toyota's Reply to Patent Owner's Response (Paper 33, hereinafter "Response") and in response to the Declaration (Exhibit 2001) and Deposition Testimony (Exhibit 1022) of Cris Koutsougeras.

4. Specifically, I have been asked to respond to Dr. Koutsougeras's opinions regarding the disclosure in U.S. Patent No. 6,553,130 ("Lemelson") relating to neural network training.

5. The opinions expressed in this declaration are not exhaustive of my opinions on the patentability of any of the claims in the '057 patent. Therefore, the fact that I do not address a particular point should not be understood to indicate any agreement on my part that any claim otherwise complies with the patentability requirements.

In forming my opinion I have reviewed the following additional sources:

- Declaration of Chris Koutsougeras, PhD in Support of AVS's Response Under 37 CFR §42.120 (Ex. 2001).
- Decision on Institution of Inter Partes Review for U.S. Patent No.

6,772,057 (Paper 19).

- Patent Owner's Response (Paper 33).
- U.S. Patent No. 5,537,327 (Exhibit 2003).
- Pomerleau, "Neural Network Perception for Mobile Robot Guidance" (Exhibit 2004).[1]
- The transcript from the deposition of Dr. Cris Koutsougeras in connection with this case (Exhibit 1022).

6. The opinions expressed in this declaration are my personal opinions and do not reflect the views of University of Minnesota.

III. ANALYSIS

A. Preliminary Understanding of Dr. Koutsougeras' Positions

7. As a preliminary matter, I understand from Dr. Koutsougeras's declaration and deposition that he divided the data that could have been used for pattern recognition algorithm training (in 1995) into three areas: training with data and waves from actual objects ("real data"), training with simulated data and waves ("simulated data"), and training with "data and waves not representing exterior objects to be detected" ("partial data"). Ex. 1022 at 86:25-87:14, 132:24-138:5, 163:18-164:7. As I understand

1 I was previously familiar with this paper in the context of my work on IPR2013-00424 and from my interaction with Dean Pomerleau and the NavLab vehicle.

it, Dr. Koutsougeras opined that only training with real data would meet the claim limitation "pattern recognition algorithm generated from data of possible exterior objects and patterns of received waves."

8. As I understand it, Dr. Koutsougeras further opined that Lemelson's disclosure of training with "known inputs" does not necessarily mean training with "real data" because it could have been referring instead to "simulated data" or "partial data."

9. For the reasons I discuss below, I disagree with Dr. Koutsougeras's interpretation of Lemelson. In my opinion, one of ordinary skill in the art would have understood the phrase "known inputs" in Lemelson to refer to "real data" because Lemelson's neural network was trained to identify exterior objects, and one of ordinary skill in 1995 would have known that training with "real data" would have yielded the best results for this purpose. One of ordinary skill in the art would not have understood that "known inputs" referred to simulated data or partial data in the context of Lemelson's disclosure, since one of ordinary skill would not have had any reason to believe that those categories of data would have been effective for the purpose of object identification (e.g., for the purpose of identification of a pedestrian).

B. One of Ordinary Skill Would Have Understood that Training of the Lemelson Neural Network Would Have Used Real Data

10. Lemelson discloses a collision avoidance system, wherein a neural network is used to identify many different types of objects that could present themselves as hazards on a roadway, including, for example, road barriers, trucks, automobiles,

pedestrians, signs and symbols, etc. Ex. 1002 at 5:41-43; 8:1-6. Lemelson explains:

> Neural networks used in the vehicle . . . warning system are trained to recognize roadway hazards which the vehicle is approaching including automobiles, trucks, and pedestrians. Training involves providing known inputs to the network resulting in desired output responses. The weights are automatically adjusted based on error signal measurements until the desired outputs are generated. Various learning algorithms may be applied. Adaptive operation is also possible with on-line adjustment of network weights to meet imaging requirements.

Ex. 1002 at 8:1-6.

11. One of ordinary skill in the art would have understood the phrase "known inputs," and would have understood that it referred to the use of real sensor data in the context of Lemelson. For example, one of ordinary skill would have understood that training a neural network could involve putting actual examples of real-world objects in front of a camera, imaging them, and providing feedback to the neural network as to the desired output responses corresponding to those images.

12. As set forth below, it is my opinion that one of ordinary skill would not have understood the phrase "known inputs" in the context of Lemelson to refer to "partial data" or "simulated data" because one of ordinary skill would have recognized that neither of these categories would have been effective for the intended purpose of training a neural network to identify various types of exterior objects. I often refer to

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