

## Title (en)

AI ENCODING APPARATUS AND OPERATION METHOD OF THE SAME, AND AI DECODING APPARATUS AND OPERATION METHOD OF THE SAME

## Title (de)

KI-CODIERVORRICHTUNG UND BETRIEBSVERFAHREN DAFÜR, KI-DECODIERVORRICHTUNG UND BETRIEBSVERFAHREN DAFÜR

## Title (fr)

APPAREIL DE CODAGE D'IA ET SON PROCÉDÉ DE FONCTIONNEMENT, ET APPAREIL DE DÉCODAGE D'IA ET SON PROCÉDÉ DE FONCTIONNEMENT

## Publication

**EP 3811619 A4 20210818 (EN)**

## Application

**EP 19874036 A 20191016**

## Priority

- KR 20180125406 A 20181019
- KR 20180148905 A 20181127
- KR 20190041100 A 20190408
- KR 20190078344 A 20190628
- KR 2019013595 W 20191016

## Abstract (en)

[origin: KR20200044668A] Various embodiments may provide an AI encoding device and a method for operating the same capable of minimizing conversion error in performing low-precision expression of intermediate result values generated in a first DNN included in the AI encoding device. Disclosed is an image decoding device including a memory storing one or more instructions and a processor executing the one or more instructions stored in the memory. In the processor, the AI encoding device uses the first DNN to acquire image data corresponding to a first image AI-downscaled from an original image, restores a second image corresponding to the first image based on the image data, acquires first result values based on a result of calculation with a first filter kernel and the second image from a first layer including the first filter kernel and a second filter kernel among a plurality of layers when the second image is input to a second DNN including the plurality of layers, acquires second result values based on a result of calculation with the second filter kernel and the second image, normalizes the first result values by conversion into first values based on a first scale factor, normalizes the second result values by conversion into second values based on a second scale factor, converts the normalized values into integer values included in a preset range, acquires third result values from a second layer by inputting the converted integer values to the second layer as the layer next to the first layer among the plurality of layers, and acquires a third image AI-upscaled from the second image based on the third result values. The second DNN corresponds to the first DNN and the first and second scale factors are determined as values related to the scale factors included in the first DNN.

## IPC 8 full level

**H04N 19/132** (2014.01); **G06N 3/08** (2006.01); **G06T 1/20** (2006.01); **G06T 1/60** (2006.01); **H04N 19/184** (2014.01); **H04N 19/50** (2014.01); **H04N 19/85** (2014.01)

## CPC (source: EP KR US)

**G06N 3/045** (2023.01 - EP); **G06N 3/048** (2023.01 - EP); **G06N 3/063** (2013.01 - EP); **G06N 3/08** (2013.01 - KR); **G06N 3/084** (2013.01 - EP); **G06T 1/20** (2013.01 - KR); **G06T 1/60** (2013.01 - KR); **G06T 3/4046** (2013.01 - EP US); **G06T 9/002** (2013.01 - EP); **G06V 10/82** (2022.01 - EP US); **H04N 19/132** (2014.11 - KR); **H04N 19/184** (2014.11 - KR); **H04N 19/426** (2014.11 - EP); **H04N 19/50** (2014.11 - KR); **H04N 19/59** (2014.11 - EP); **H04N 19/85** (2014.11 - EP KR); **G06N 3/044** (2023.01 - EP); **G06T 2207/20084** (2013.01 - KR)

## Citation (search report)

- [Y] WO 2018140294 A1 20180802 - MICROSOFT TECHNOLOGY LICENSING LLC [US]
- [Y] LUCAS THEIS ET AL: "Lossy Image Compression with Compressive Autoencoders", ARXIV.ORG, CORNELL UNIVERSITY LIBRARY, 201 OLIN LIBRARY CORNELL UNIVERSITY ITHACA, NY 14853, 1 March 2017 (2017-03-01), XP080753545
- [Y] LI YUE ET AL: "Learning a Convolutional Neural Network for Image Compact-Resolution", IEEE TRANSACTIONS ON IMAGE PROCESSING, IEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 28, no. 3, 28 September 2018 (2018-09-28), pages 1092 - 1107, XP011703593, ISSN: 1057-7149, [retrieved on 20181025], DOI: 10.1109/TIP.2018.2872876
- [Y] TAO WEN ET AL: "An End-to-End Compression Framework Based on Convolutional Neural Networks", 2017 DATA COMPRESSION CONFERENCE (DCC), IEEE, 4 April 2017 (2017-04-04), pages 463, XP033095376, DOI: 10.1109/DCC.2017.54
- [Y] ANONYMOUS ET AL: "Machine learning: Why do we need floats for using neural networks? -Artificial Intelligence Stack Exchange", AI.STACKEXCHANGE.COM, 16 August 2018 (2018-08-16), pages 1 - 8, XP055822829, Retrieved from the Internet <URL:https://ai.stackexchange.com/questions/7247/why-do-we-need-floats-for-using-neural-networks> [retrieved on 20210709]
- [Y] SUYOG GUPTA ET AL: "Deep Learning with Limited Numerical Precision", ARXIV.ORG, CORNELL UNIVERSITY LIBRARY, 201 OLIN LIBRARY CORNELL UNIVERSITY ITHACA, NY 14853, 9 February 2015 (2015-02-09), XP080677454
- See also references of WO 2020080827A1

## Designated contracting state (EPC)

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

## Designated extension state (EPC)

BA ME

## DOCDB simple family (publication)

CN 112715029 A 20210427; EP 3811619 A1 20210428; EP 3811619 A4 20210818; KR 102312338 B1 20211014; KR 20200044668 A 20200429

## DOCDB simple family (application)

CN 201980060231 A 20191016; EP 19874036 A 20191016; KR 20190078344 A 20190628