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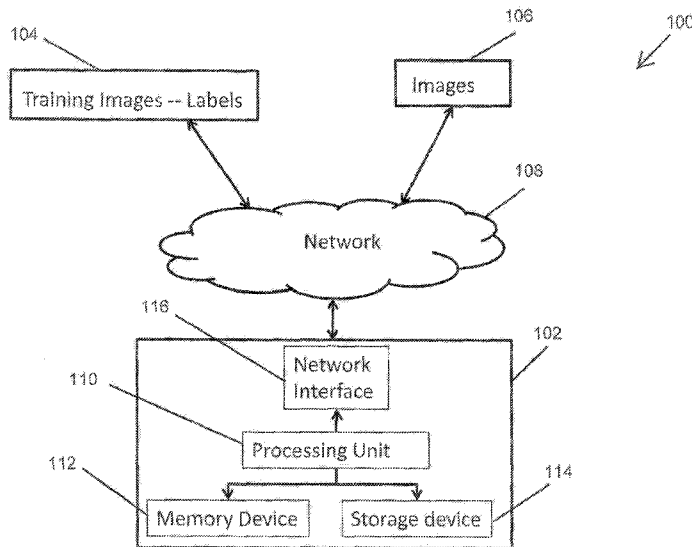


FIG. 1

(57) Abstract: A method of training an image classification model includes obtaining training images associated with labels, where two or more labels of the labels are associated with each of the training images and where each label of the two or more labels corresponds to an image classification class. The method further includes classifying training images into one or more classes using a deep convolutional neural network, and comparing the classification of the training images against labels associated with the training images. The method also includes updating parameters of the deep convolutional neural network based on the comparison of the classification of the training images against the labels associated with the training images.

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AMENDED CLAIMS

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1. A computer implemented method of classifying images using one or more image classification models, the method comprising:
 - obtaining training images associated with labels, wherein one or more training images of the training images are each associated with two or more labels of the labels and wherein one or more labels of the labels each correspond to an image classification class;
 - training a deep convolutional neural network using the training images and the labels associated with the training images; and
 - classifying an input image into one or more classes based on the trained deep convolutional neural network.
2. The method of Claim 1, wherein a classification layer of the deep convolutional neural network is based on soft-sigmoid activation.
3. The method of Claim 1, wherein the training images and the input images include graphically designed images.
4. The method of Claim 1, wherein the labels have a hierarchical structure and wherein the labels are non-mutually exclusive labels.
5. The method of Claim 4, wherein a separate deep convolutional neural network is trained for each hierarchy level of the labels.
6. The method of Claim 1, wherein the labels are codes used by a trademark registration organization.
7. The method of Claim 1, wherein the labels are codes used to classify design patent images or industrial design images.

8. The method of Claim 1, wherein the labels are available as metadata of the training images associated with the labels.

9. The method of Claim 1, wherein classifying the input image into two or more classes based on the trained deep convolutional neural network includes tagging or labelling the input image with two or more labels corresponding to the two or more classes.

10. The method of Claim 1, further comprising pre-processing the training images, wherein training the deep convolutional neural network using the training images and the labels associated with the training images comprises training the deep convolutional neural network using the pre-processed training images and the labels associated with the training images.

11. A computer implemented method of training an image classification model, the method comprising:

obtaining training images associated with labels, wherein one or more training images of the training images are each associated with two or more labels of the labels and wherein one or more labels of the labels each correspond to an image classification class;

classifying training images into one or more classes using a deep convolutional neural network;

comparing the classification of the training images against labels associated with the training images; and

updating parameters of the deep convolutional neural network based on the comparison of the classification of the training images against the labels associated with the training images.

12. The method of Claim 11, wherein the training images include graphically designed images.

13. The method of Claim 11, wherein the labels have a hierarchical structure.

14. The method of Claim 13, wherein a separate deep convolutional neural network is trained for each hierarchy level of the labels.

15. The method of Claim 11, wherein the labels are codes used by a trademark registration organization.

16. The method of Claim 11, further comprising pre-processing the training images before classifying the training images comprises classifying the pre-processed training images.

17. The method of Claim 11, wherein a classification layer of the deep convolutional neural network is based on soft-sigmoid activation.

18. A system for classifying images using one or more image classification models, the system comprising:

a training image source comprising training images associated with labels, wherein the labels include codes used by a trademark registration organization or an industrial design registration organization;

an image processing device communicably coupled to the training image source, wherein the image processing device is configured to obtain the training images from the training image source and to train a deep convolutional neural network using the training images and the labels associated with the training images; and

an input image source comprising input images to be classified into image classification classes, wherein classifying an input image into one or more image classification classes associates the input image with one or more labels corresponding to the one or more image classification classes.

19. The system of Claim 18, wherein a classification layer of the deep convolutional neural network is based on soft-sigmoid activation.

20. The system of Claim 18, wherein the labels include one or more of U.S. design codes used by U.S. Patent and Trademark Office, Vienna codes, keywords image constituents, or codes used in Locarno classification.