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Intellectual Property Office

PATENTS ACT 1977

APPLICANT	Teledyne FLIR Commercial Systems, Inc
ISSUE	Whether patent application GB2020338.6 complies with section 14(3) and/or is excluded under section 1(2)(c)
HEARING OFFICER	H Jones

DECISION

Background

1 A PCT application entitled "Closed Loop Automatic Dataset Creation Systems and Methods" was filed on 9 July 2019 in the name of FLIR Commercial Systems, Inc. The application claims a priority date of 12 July 2018 and has been published as WO2020/014286 A1. The application entered the national phase on 22 December 2020 and was re-published as GB 2589495. The application is now proceeding in the name of Teledyne FLIR Commercial Systems, Inc.

2 The examiner is of the view that there are two reasons that the application should be refused, namely that the invention is not described in sufficient detail to enable the skilled person to put it into effect, and that the invention relates to a program for a computer.

3 The applicant withdrew their initial request to have these matters heard in person, so my decision is based upon the correspondence on file, which I have fully considered. The examiner's reports and the applicant's responses may be viewed on the IPO's file inspection service.

The invention

4 The application relates to using a neural network for image identification and classification. In particular, the claimed invention addresses the problem of how to generate a suitable training dataset of labelled images with which to train the neural network so as to improve its performance in identifying and classifying objects present in images.

5 The most recent set of amended claims includes an independent system claim and an independent method claim. The claims are largely in correspondence and will therefore stand or fall together. The independent claims read as follows:

> 1. A system comprising:
>
> a training dataset comprising a plurality of labeled images, wherein the

plurality of labeled images comprises a plurality of real world images and a plurality of synthetic images and wherein each labeled image includes a label identifying a correct object classification for a corresponding image;

a synthetic image generator operable to update the training dataset by generating a plurality of synthetic images of identified objects in virtual three-dimensional environments and corresponding labels identifying a correct classification for the identified objects in the corresponding synthetic images;

a neural network training system operable to train a convolutional neural network for object detection using the plurality of labeled images from the training dataset and produce a trained convolutional neural network; and

a training dataset analysis engine operable to analyze the trained neural network based at least in part on a validation process to generate parameters for an updated training dataset comprising an identification of a subset of the plurality of images to use in the updated training dataset based at least on part on objects correctly labeled during the validation process and parameters defining new synthetic images to be generated by the synthetic image generator based at least in part on objects with detected errors in classification;

wherein parameters defining new synthetic images to be generated comprise an identification of objects to be detected and classified, imaging sensors to be modeled, and/or three-dimensional virtual environments in which the new synthetic images are to be captured.

14. A method comprising:

providing a training dataset comprising a plurality of labeled images, wherein the plurality of labeled images comprises a plurality of real world images and a plurality of synthetic images and wherein each labeled image includes a label identifying a correct object classification for a corresponding image;

generating, via a synthetic image generator, a plurality of synthetic images of identified objects in virtual three-dimensional environments and corresponding labels identifying a correct classification for the object in the corresponding synthetic images;

training, via a neural network training system, a convolutional neural network for object detection using the plurality of labeled images from the training dataset to produce a trained convolutional neural network; and

generating, based on an analysis of the trained neural network via a training dataset analysis engine, parameters for an updated training dataset comprising an identification of a subset of the plurality of labeled images and parameters defining new synthetic images to be generated by the synthetic image generator based at least in part on objects with detected errors in classification;

wherein parameters defining new synthetic images to be generated comprise an identification of objects to be detected and classified, imaging sensors to

be modeled, and/or three-dimensional virtual environments in which the new synthetic images are to be captured.

The law

6 Section 1(2) of the Act lists certain categories of subject-matter which are excluded from patent protection.

> *1(2). It is hereby declared that the following (among other things) are not inventions for the purposes of this Act, that is to say, anything which consists of –*
>
> *(a) …*
> *(b) …*
> *(c) … a program for a computer;*
> *(d) …*
>
> *but the foregoing provision shall prevent anything from being treated as an invention for the purposes of this Act only to the extent that a patent or application for a patent relates to that thing as such.*

7 The test for establishing whether a patent application relates to one of these excluded categories is set out in the Court of Appeal's judgement in *Aerotel*[1]. The steps of the test are as follows:

> (i) properly construe the claim;
> (ii) identify the actual contribution;
> (iii) ask whether it falls solely within the excluded subject-matter;
> (iv) check whether the actual or alleged contribution is actually technical in nature.

8 In *Symbian*[2] the Court made clear that the question of whether a computer implemented invention is patentable has to be resolved by asking whether it reveals a technical contribution to the state of the art.

9 Lewison J in *AT&T/CVON*[3] set out five signposts that he considered to be helpful when considering whether a computer program makes a technical contribution. In *HTC*[4] the signposts were reformulated slightly in light of the decision in *Gemstar*[5]. The signposts are:

> i) Whether the claimed technical effect has a technical effect on a process which is carried on outside the computer.
>
> ii) Whether the claimed technical effect operates at the level of the architecture of the computer; that is to say whether the effect is produced irrespective of the data being processed or the applications being run.
>
> iii) Whether the claimed technical effect results in the computer being made to operate in a new way.

[1] Aerotel Ltd v Telco Holdings Ltd and Macrossan's Application [2006] EWCA Civ 1371
[2] Symbian Ltd v Comptroller-General of Patents [2008] EWCA Civ 1066
[3] AT&T Knowledge Venture/CVON Innovations v Comptroller General of Patents [2009] EWHC 343 (Pat)
[4] HTC Europe Co Ltd v Apple Inc [2013] RPC 30
[5] Gemstar-TV Guide International Inc v Virgin Media Ltd [2010] RPC 10

iv) Whether the program makes the computer a better computer in the sense of running more efficiently and effectively as a computer.

v) Whether the perceived problem is overcome by the claimed invention as opposed to merely being circumvented.

10 Section 14(3) requires that:

> *The specification of an application shall disclose the invention in a manner which is clear enough and complete enough for the invention to be performed by a person skilled in the art.*

11 In *Eli Lilly v Human Genome Sciences*[6], Kitchin J gave the following summary of the relevant principles to be applied when assessing whether an application satisfies this section of the Act (cf para. 239):

> *The specification must disclose the invention clearly and completely enough for it to be performed by a person skilled in the art. The key elements of this requirement which bear on the present case are these:*
>
> *(i) the first step is to identify the invention and that is to be done by reading and construing the claims;*
> *(ii) in the case of a product claim that means making or otherwise obtaining the product;*
> *(iii) in the case of a process claim, it means working the process;*
> *(iv) sufficiency of the disclosure must be assessed on the basis of the specification as a whole including the description and the claims;*
> *(v) the disclosure is aimed at the skilled person who may use his common general knowledge to supplement the information contained in the specification;*
> *(vi) the specification must be sufficient to allow the invention to be performed over the whole scope of the claim;*
> *(vii) the specification must be sufficient to allow the invention to be so performed without undue burden.*

12 Shortly after this application was referred to me for a decision, the IPO published a set of guidelines for the examination of patents relating to artificial intelligence[7]. This includes a useful overview of statute and caselaw which may be of relevance in such situations. It also contains a set of "scenarios" and an assessment of how the requirements of section 1(2) would likely be applied to those scenarios. One of those scenarios (Scenario 15: Active Training of a Neural Network) bears a remarkable resemblance to the current application.

Arguments and analysis

Construing the claims

13 Having read the application carefully I broadly agree with the examiner's understanding of the invention as set out in his pre-hearing report of 25 August 2002, and I am entirely content to proceed on that basis. Likewise, the applicant does not appear to disagree with this assessment.

14 However, I must say that the clarity of the independent claims leaves more than a little to be desired. The order in which the various portions of the claims are presented is confusing and consequently there is much unhelpful and/or inconsistent

[6] Eli Lilly v Human Genome Sciences [2008] RPC 29
[7] Examining patent applications relating to artificial intelligence (AI) inventions - GOV.UK (www.gov.uk)

repetition of features and claim language. For instance, in both independent claims the reference to the synthetic image generator appears prior to the portions of the claims which define generating the parameters necessary to perform the synthetic image generation. Also, the references to the synthetic image generator mentions only two of the three types of parameters mentioned later in the claims. The reference to a training dataset analysis engine is particularly convoluted due to the repeated “based…on” and the multiple references to “parameters”. These issues are no doubt a consequence of the applicant focussing on amending the scope of the claims to overcome points of disagreement rather than on maintaining clarity. However, any such inconsistencies or difficulties in the claim language do not prevent me from considering the two substantive issues before me.

15 As I understand it, the method of the invention begins with a training dataset which comprises a combination of real and synthetic images, each labelled with a correct object classification. The convolutional neural network is trained with the training dataset and the effectiveness of the trained neural network is analysed. This analysis involves detecting errors in object classification during a validation process. Based on the analysis, two things are determined. First, a subset of the images in the training dataset are identified as suitable for retaining in an updated training dataset, the identification being based on correct labelling of objects in the validation process. Secondly, a set of three types of parameters are determined, the types of parameters being i) objects to be detected and identified, ii) backgrounds in which those objects are to be placed, and iii) imaging sensor types which are to be modelled. The parameters are then used by a synthetic image generator to generate a set of synthetic images which are used, along with the subset of the images retained from the previous training dataset, to generate an updated training dataset with which to retrain the neural network for improved performance.

Sufficiency

16 The examiner’s position on sufficiency is that the steps of analysing the training dataset and generating the parameters are described only vaguely in terms of the results desired to be achieved, and consequently there is a lack of the specific detail which the skilled person would need in order to implement the invention. By way of example, the application does not set out specific performance criteria for the neural network against which the suitability of the training dataset may be judged, and nor does it teach in detail how to select the precise parameters that the synthetic image generator requires in order to ensure that it generates a “better” set of training data which will result in a more effective neural network. Accordingly, the examiner’s view is that the skilled person is placed under an undue burden when trying to work the invention.

17 In response the applicant has done little more than to point to the various portions of the application which they consider provide the necessary level of disclosure, but nevertheless I am in agreement with the applicant on this point. It seems perfectly clear to me that there is enough information here for the skilled person to perform the invention. The analysis of the training dataset involves assessing the performance of the trained neural network with a set of validation images. If there are classification errors for certain objects (clouds are given as one example) then more synthetically generated training data for images containing clouds is required. Of course, the application does not spell out precisely what the synthetically generated images should look like, and nor does it need to. The application clearly explains that the images should comprise relevant objects set in modelled 3D environments, and that

the resolution of the models and/or the accuracy of the modelling of the image sensors may need to be increased to help distinguish between the objects in the images. The results of updating the training dataset would be easily analysed, and further updates could simply be implemented. I am in no doubt that performing such a technique in a practical embodiment of the invention would clearly be within the realms of what the relevant skilled person could achieve without further instruction.

Patentability

18 The examiner's assessment of the contribution is:

> a more efficient computer implemented method of training a neural network by generating a first set of synthetic images, evaluating which data elements contribute to the success or failure of a neural network trained with the first set of images, and in response to that evaluation, generating additional synthetic images that are expected to lead to an improved neural network while retaining images from the first dataset that contributed to the successful training of the neural network.

19 Nowhere in the correspondence does the applicant present any alternative to this contribution.

20 To my mind, the contribution as the examiner has defined it is perfectly reasonable up to a point, but it omits one crucial element. The neural network of the invention has a specific purpose, or to borrow the words of Birss HHJ in *Halliburton*[8], it performs a specific task external to the computer. As the claims make clear it is "for object detection", or as the description puts it "to detect and classify objects of interest within a field of view (e.g. a scene) of an imaging device".

21 My assessment of the contribution is therefore:

> A method of generating a trained neural network for image detection and classification comprising analysing an initial training dataset in a validation process and based on errors in classification during the validation process generating an updated training dataset by retaining some images from the initial training dataset and adding some new synthetically generated images to improve the training of the neural network.

22 Earlier I mentioned the recently issued IPO guidance on assessing the patentability of methods using AI technologies, and the scenario it discusses (Scenario 15) which is similar to the applicant's claimed method and which is thought to be unpatentable. The similarity is that the scenario also relates to a method of augmenting a training dataset based on an analysis of the trained neural network. However, in contrast to the current invention, the neural network in that scenario is not tied to any specific area of technology, as is the case here.

23 The inventive step here may well reside in a new method of training a neural network, but the contribution is more than that. The contribution is in the technical field of image recognition. What the applicant has devised is a more reliable neural

[8] Halliburton Energy Services Inc., [2011] EWHC 2508 (Pat)

network to detect and classify objects of interest, which is made possible by optimising a training dataset in the manner detailed in the claims.

24 Since my assessment of the contribution differs in a significant way to that set out by the examiner, I do not see any value in analysing the various arguments that have been presented regarding the *AT&T/HTC* signposts. However, it seems to me that signposts (i) and (v) both point towards allowability, i.e. the invention provides a technical contribution to the state of the art.

Conclusion

25 I have found that the invention is not excluded from patentability and that the specification is sufficiently clear and complete enough to enable the skilled person to perform the invention.

Further processing

26 The application will be referred back to the examiner to conclude the examination process. At the very least the original search requires updating, but the applicant and examiner may wish to consider whether the independent claims would benefit from amendment to avoid potential issues arising from lack of clarity.

Huw Jones
Deputy Director, acting for the Comptroller