REPUBLIC OF SOUTH AFRICA

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PATENTS ACT, 1978

CERTIFICATE

In accordance with section 44 (1) of the Patents Act, No. 57 of 1978, it is hereby certified that:

MANIPAL UNIVERSITY JAIPUR

Has been granted a patent in respect of an invention described and claimed in complete specification deposited at the Patent Office under the number

2021/10309

A copy of the complete specification is annexed, together with the relevant Form P2.

In testimony thereof, the seal of the Patent Office has been affixed at Pretoria with effect from the **30th** day of **March 2022**

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FORM P2

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54	Title of invention
SIGN LANGUAGE TRANSLATOR	

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COMPLETE SPECIFICATION

[Section 30(1) – Regulation 28]

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TITLE OF INVENTION

54	SIGN LANGUAGE TRANSLATOR

SIGN LANGUAGE TRANSLATOR

FIELD OF INVENTION

The present invention relates to a sign language translation field, and more particularly to a system for sign language translator.

BACKGROUND OF THE INVENTION

Over 5% of the world's population – or 430 million people – require rehabilitation to deal with their 'disabling' hearing loss. Being deaf can be a tiresome thing in society. People who are not deaf don’t try to learn sign language to interact with deaf people. Since only a minority of people are deaf, sign language is not taught as a subject in normal schooling. This leads to the isolation of deaf people. In more recent times, researchers have debated that sign is no different from the spoken language with all the same linguistic construction. Sign language recognition is one of the foremost growing fields of the research area. The sign language is mainly used for communication by deaf-dumb people. There are various hand gestures methods recognized by the different researchers like data glove-based approaches for sign language recognition.

The above-mentioned conventional methods and systems are complex and difficult to use. The disadvantage of the above-mentioned conventional methods and systems is that the signer must wear the sensor hardware alongside the glove during the operation of the system, so it requires tons of setup costs.

Therefore, there remains a need in the art for a system for the sign language translator that does not suffer from the above-mentioned deficiencies or at least provides a viable and effective solution.

OBJECTS OF THE INVENTION

Some of the objects of the present disclosure, which at least one embodiment herein

satisfies, are as follows.

It is an object of the present disclosure to ameliorate one or more problems of the prior art or to at least provide a useful alternative.

An object of the present disclosure is to provide a system for a sign language translator.

An object of the present disclosure is to provide a cost-effective system for sign language translators.

An object of the present disclosure is to provide a system to build a machine learning model able to classify which letter of the American Sign Language is being signed, given an image of a signing hand.

An object of the present disclosure is to provide a system that lets deaf-dumb people to communicate with their physically abled counterparts.

Another object of the present disclosure is to provide a system for sign language translators that require less hardware.

An object of the present disclosure is to provide a system using AI-based sign language translators in real-time.

SUMMARY OF THE INVENTION

The following presents a simplified summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not an extensive overview of the present invention. It is not intended to identify the key/critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some concept of the invention in a simplified form as a prelude to a more detailed description of the invention presented later.

An embodiment of the present invention provides a system for a sign language translator. The system comprises a camera unit, a data storage unit, a translating unit, and a display unit. The camera unit is configured to capture gesture images or

text. The data storage unit is configured to store standards sign language images and standard sign language image word information. The translating unit is configured to translate captured gesture images into text or audio language or captured text into sign language images. The translating unit is operationally connected with the camera unit and data storage unit. The translating unit comprises a memory unit and a processor. The memory unit is configured to store machine-readable instruction. The processor is operably connected with the memory unit. The processor obtaining the machine-readable instructions from the memory unit, and is configured by the machine instruction to receive the captured gesture image or text by the users; compare the captured gesture image or text with the predefined sign language images and standard sign language image word information stored in the data storage unit; analyze the compared gesture image or text; convert the analyzed image to text or audio language or convert text to image. The display unit is configured to provide user inference and display to the user in real-time.

In accordance with an embodiment of the present invention, the camera units may be IP camera, box camera, dome camera, PTZ camera, bullet camera, or thermal camera.

In accordance with an embodiment of the present invention, the display unit may be a laptop, desktop, smartphone, and tablet.

In accordance with an embodiment of the present invention, the translating unit comprises TensorFlow Lite models and Delegates.

In accordance with an embodiment of the present invention, the TensorFlow Lite models and Delegates are configured to improve the speed, accuracy, and power consumption.

BRIEF DESCRIPTION OF THE DRAWINGS

So that the manner in which the above recited features of the present invention can be understood in detail, a more particular description of the invention, briefly summarized above, may have been referred to by embodiments, some of which are illustrated in the appended drawings. It is to be noted, however, that the appended

drawings illustrate only typical embodiments of this invention and are therefore not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments.

These and other features, benefits, and advantages of the present invention will become apparent by reference to the following text figure, with like reference numbers referring to like structures across the views, wherein

Fig.1: Illustrates a system for a sign language translator, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The following description is of exemplary embodiments only and is not intended to limit the scope, applicability or configuration of the invention in any way. Rather, the following description provides a convenient illustration for implementing exemplary embodiments of the invention. Various changes to the described embodiments may be made in the function and arrangement of the elements described without departing from the scope of the invention.

While the present invention is described herein by way of example using embodiments and illustrative drawings, those skilled in the art will recognize that the invention is not limited to the embodiments of drawing or drawings described, and are not intended to represent the scale of the various components. Further, some components that may form a part of the invention may not be illustrated in certain figures, for ease of illustration, and such omissions do not limit the embodiments outlined in any way. It should be understood that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the scope of the present invention as defined by the appended claim. As used throughout this description, the word "may" is used in a permissive sense (i.e. meaning having the potential to), rather than the mandatory sense, (i.e. meaning must). Further, the words "a" or "an" mean "at least

one” and the word “plurality” means “one or more” unless otherwise mentioned. Furthermore, the terminology and phraseology used herein is solely used for descriptive purposes and should not be construed 25 as limiting in scope. Language such as "including," "comprising," "having," "containing," or "involving," and variations thereof, is intended to be broad and encompass the subject matter listed thereafter, equivalents, and additional subject matter not recited, and is not intended to exclude other additives, components, integers or steps. Likewise, the term "comprising" is considered synonymous with the terms "including" or "containing" for applicable legal purposes.

Fig.1: Illustrates a system (100) for a sign language translator, in accordance with an embodiment of the present invention. The system (100) comprises a camera unit (102), a data storage unit (104), a translating unit, and a display unit (106). The system (100) is envisaged to include computing capabilities. The camera unit (102) is configured to capture gesture images or text. The camera unit (102) maybe, but is not limited to IP camera, box camera, dome camera, PTZ camera, bullet camera, or thermal camera. The data storage unit (104) is configured to store standards sign language images and standard sign language image word information. The data storage unit (104) may be cloud-based storage or local storage. In any manner, the data storage unit (104) is envisaged to be capable of providing the data to any of the computing devices connected with the communication network, when the data is queried appropriately using applicable security and other data transfer protocols.

In accordance with an embodiment of the present invention, the translating unit (108) is operationally connected with the camera unit (102) and data storage unit (104). The translating unit (108) is configured to translate captured gesture images into text or audio language or captured text into sign language images. The translating unit (108) comprises a memory unit (110) and a processor (112). The translating unit (108) is envisaged to include computing capabilities such as a memory unit (110) is configured to store machine-readable instructions. The machine-readable instructions may be loaded into the memory unit (110) from a non-transitory machine-readable medium such as, but not limited to, CD-ROMs,

DVD-ROMs, and Flash Drives. Alternately, the machine-readable instructions may be loaded in a form of a computer software program into the memory unit (110). The memory unit (110) in that manner may be selected from a group comprising EPROM, EEPROM, and Flash memory. The processor (112) is operably connected with the memory unit (110). The processor (112) obtains the machine-readable instructions from the memory unit (110), and is configured by the machine instruction to receive the captured gesture image or text by the users; compare the captured gesture image or text with the predefined sign language images and standard sign language image word information stored in the data storage unit (104); analyze the compared gesture image or text; convert the analyzed image to text or audio language or convert text to image. In various embodiments, the processor (112) is one of, but not limited to, a general-purpose processor (112), an application-specific integrated circuit (ASIC), and a field-programmable gate array (FPGA).

In accordance with an embodiment of the present invention, the system (100) comprises the display unit (106). The display unit (106) is operationally connected with a camera unit (102), a data storage unit (104), and a translating unit. The display unit (106) is configured to provide user inference and display to the user in real-time. The display unit (106) may be but is not limited to laptop, desktop, smartphone, and tablet.

In accordance with another embodiment of the present invention, a camera unit (102), a data storage unit (104), and a translating unit, display unit (106) are connected with each other with the help of a communication network. The communication network may be a short-range communication network or a long-range communication network. The communication network may be implemented using a number of protocols, such as but not limited to, TCP/IP, 3GPP, 3GPP2, LTE, IEEE 802.x, HTTP, HTTPS, UDP, RTMP etc. Preferably the communication network is internet and/or a GSM network.

In accordance with an embodiment of the present invention, the translating unit

(108) comprises a CNN model. Our mobile phones have limited memory and computational power, this may affect the predictions accuracy and speed of a basic CNN model. To apply the deep convolutional neural network model to real-time applications and low-memory portable devices, a practical solution is to compress and speed up the model to reduce parameters, computation cost, and power consumption. It is proven that the parameters of deep CNN have a lot of redundancy, and these redundant parameters have little influence on the classification accuracy.

In accordance with an embodiment of the present invention, the present invention provides the system (100) which is the bridge to the gap between people with hearing and speech disabilities, and the rest of the society who do not know sign language. The system (100) helps in enhancing harmony in society and provides better communication for all.

In accordance with another embodiment of the present invention, the system (100) translates sign language to normal language. The system (100) comprises a TensorFlow Lite and Delegates. The TensorFlow Lite models are light-weighted models that can be deployed for low latency. The TF lite delegate can be used further. The delegates enable hardware acceleration of TensorFlow Lite models by leveraging on-device accelerators such as the GPU, to improve the speed, accuracy, and power consumption when used.

While considerable emphasis has been placed herein on the specific features of the preferred embodiment, it will be appreciated that many additional features can be added and that many changes can be made in the preferred embodiment without departing from the principles of the disclosure. These and other changes in the preferred embodiment of the disclosure will be apparent to those skilled in the art from the disclosure herein, whereby it is to be distinctly understood that the foregoing descriptive matter is to be interpreted merely as illustrative of the disclosure and not as a limitation.

CLAIMS

1. A system (100) for sign language translator comprising:

a camera unit (102) configured to capture gesture image or text;

a data storage unit (104) configured to store standards sign language images and standard sign language image word information;

a translating unit (108) operationally connected with the camera unit (102) and data storage unit (104), comprising:

a memory unit (110) configured to store machine-readable instruction;

a processor (112) operably connected with the memory unit (110), the processor (112) obtaining the machine-readable instructions from the memory unit (110), and being configured by the machine instruction to:

receive the captured gesture image or text by the users;

compare the captured gesture image or text with the predefined sign language images and standard sign language image word information stored in the data storage unit (104);

analyze the compared gesture image or text;

convert the analyzed image to text or audio language or convert text to image;

a display unit (106) configured to provide user inference and display to the user in real-time.

2. The system (100) as claimed in claim 1, wherein the camera unit (102)s are selected from a group comprising IP camera, box camera, dome camera, PTZ camera, bullet camera, , or thermal camera.
3. The system (100) as claimed in claim 1, wherein the display unit (106) is selected from a group comprising laptop, desktop, smartphone, tablet.
4. The system (100) as claimed in claim 1, wherein the translating unit (108) comprises a TensorFlow Lite models and Delegates.

5. The system (100) as claimed in claim 1, wherein the TensorFlow Lite models and Delegates configured to improve the speed, accuracy and power consumption.

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DRAWINGS

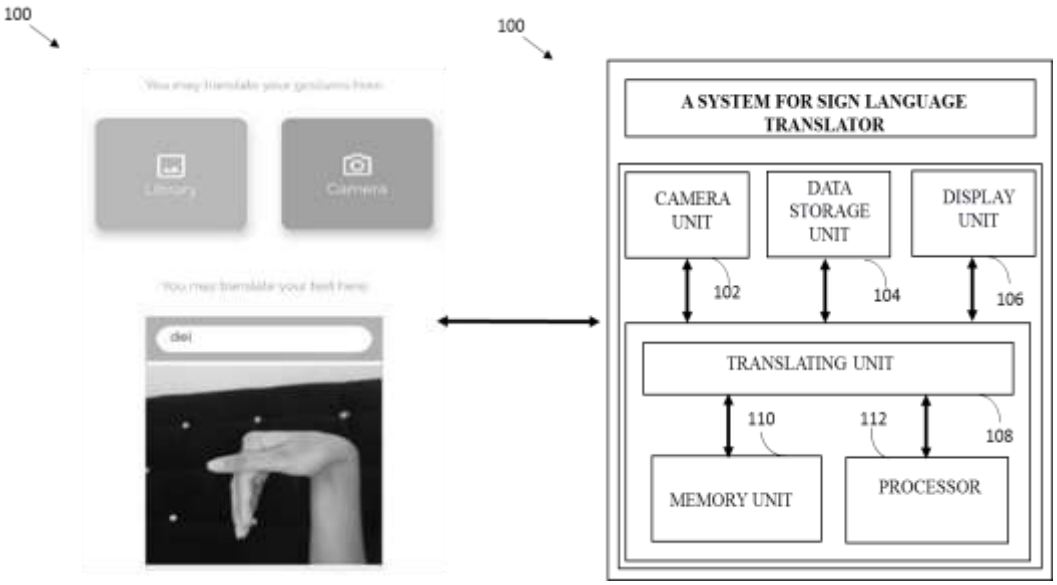

FIGURE 1

ABSTRACT

The present invention relates to a system (100) for a sign language translator. The system (100) comprises a camera unit (102), a data storage unit (104), a translating unit, and a display unit. The camera unit (102) is configured to capture gesture images or text. The data storage unit (104) is configured to store standards sign language images and standard sign language image word information. The translating unit (108) is configured to translate captured gesture images into text or audio language or captured text into sign language images. The translating unit (108) is operationally connected with the camera unit (102) and data storage unit (104). The translating unit (108) comprises a memory unit (110) and a processor (112). The display unit (106) is configured to provide user inference and display to the user in real-time. The present invention provides a system (100) to build a machine learning model able to classify which letter of the American Sign Language is being signed, given an image of a signing hand.

[Figure 1]