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An Experiment of Stroke Recognition using 3D Point Cloud and Deep Neural Networks

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ABSTRACT

A stroke is a medical condition in which poor blood flowto the brain results in cell death. It is now a day a leading cause ofdeath all over the world. There are many causes of stroke, the most common of which are; high blood pressure, lack of mobility, unhealthy diet, obesity, smoking, diabetes, heart disease, and drinking too much alcohol. Furthermore, genetic factors also increase the risk of stroke. If one of your family members suffered from a stroke in the past, it is best to do a stroke screening for prevention and early treatment. With the rapid development of deep learning techniques, the stroke could be early detected by 3D camera. This paper presents an experiment of stroke recognition using 3D point cloud that is received from 3D camera. Our experiments are based on new data format of 3D point cloud and deep neural networks. Experiments results show that the proposed solution is work well and could be applied to private places.

Keywords: Deep Learning; 3D Point Cloud; Stroke Detection; Rehabilitation System; and 3D Camera.

I. Introduction

A large number of people lose their life due to stroke and itis increasing in developing countries [1]. As stroke treatment is complicated, costly, and its sequels have long-term effects, people are advised to do early stroke screening and, once diagnosed with stroke, patients should check regularly for possible recurrence. There are several stroke risk factors that regulate different types of stroke.Predictive algorithms help to understand the relation betweenthese risk factors to types of strokes. The machine learningalgorithm can improve patients' health through early detectionand treatment [2, 3].

Recently, a new technology of 3D sensor helps to generate new format of 3D point cloud as shown in Fig. 1. It is developed by Magik-eye [4]. Magik Eye's technology is based on Invertible Light™ which is our new theory for depth sensing. Invertible Light™ is a breakthrough of optics and mathematics that generates a 3D point cloud, using only a regular dot projector and an image sensor. By projecting a regular dot pattern on an object, the Invertible Light™ method, composed of a small set of data and a direct algorithm, computes 3D depth data in an ultra-high speed manner. The result is the smallest, fastest & most power-efficient 3D sensing.

This technology allows us to install 3D cameras in private places such as toilets, offices, hospitals and return 3D point could while still ensuring privacy (see Fig. 2).This allows us to track and early detect stroke in private place. Therefore, in this paper, we would to present an experiment of stroke recognition based on deep learning and 3D point cloud. First of all, 3D point cloud is collected from 3D Magik Eye's camera to perform the data processing step before recognizing people. Here, we used deep

neural networks to recognize people from 3D point cloud [5, 6]. After people detection, the detected objects will be tracked by the Hungarian algorithm [7] to recognize stroke based on motion and fall detection [8].

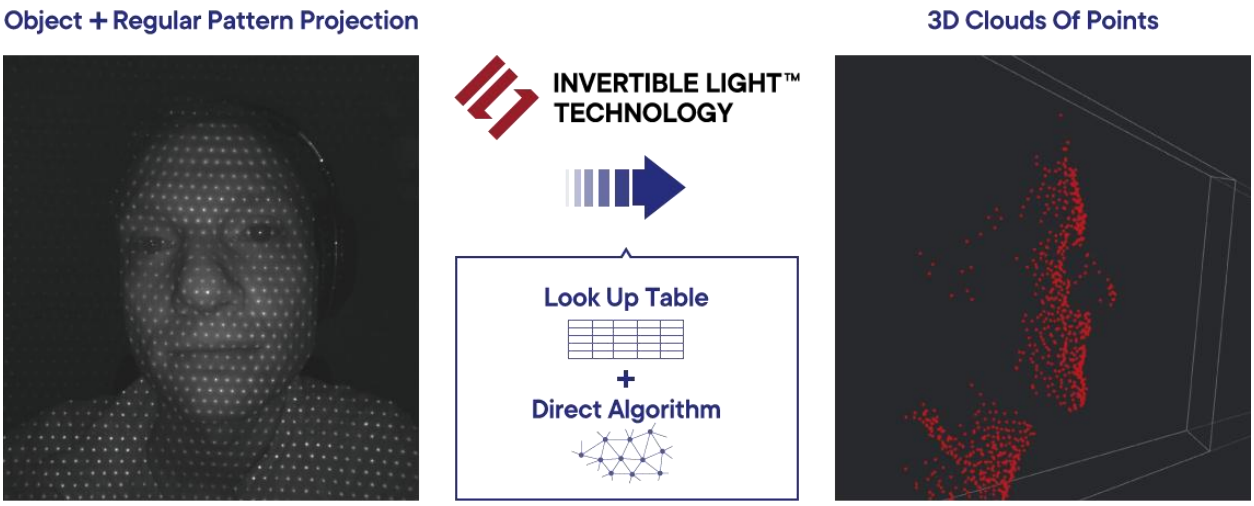

Fig. 1. 3D point cloud is generated by Magik-eye technology [4].

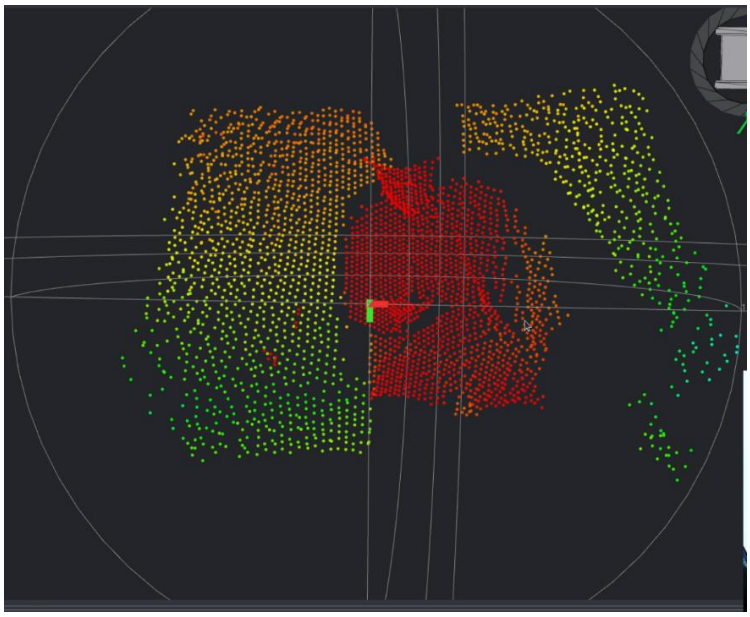

Fig. 2: 3D point cloud from new 3D camera.

II. The Proposed Solution

The proposed solution is shown in Fig. 3. A 3D camera is setup in private place to monitor and return 3D point cloud. The 3D point cloud will be used to detect people from the trained AI model [5]. The detected people will be tracked in private places to detect/recognize stroke based on motion of fall [6]. If a stroke is existed, the system will perform to save the stroke image to database and generate warning to hospital/urgent center, family mobile and alarm bell as described in Fig. 3. The process to train an AI model for people detection is shown in Fig. 4.

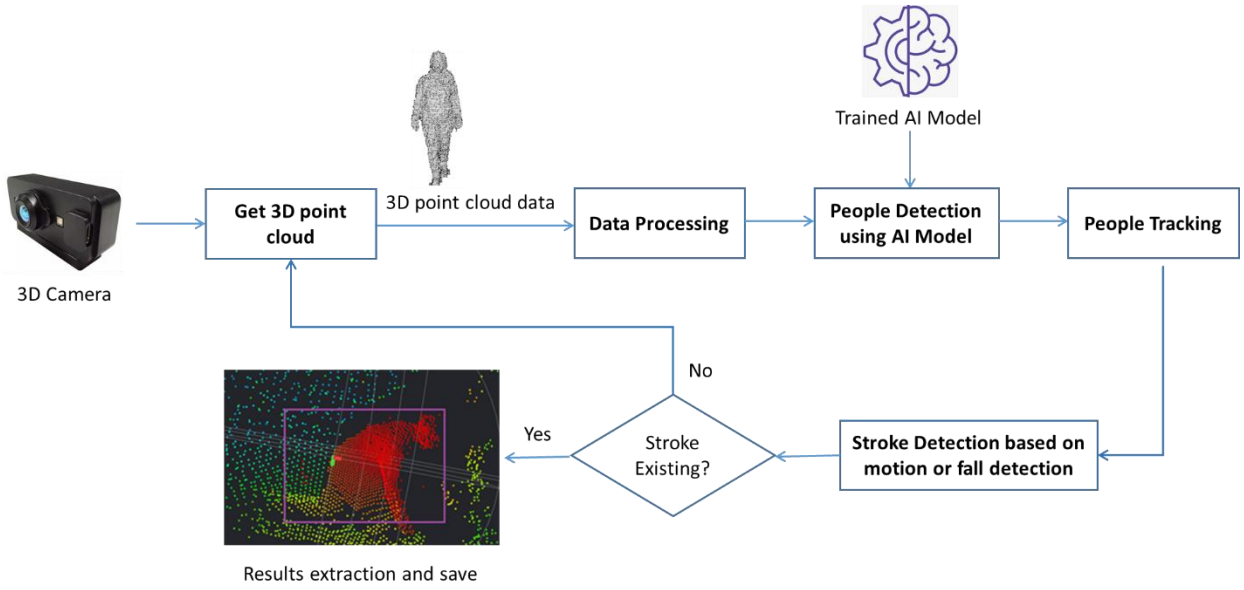

Fig. 3. The Proposed Solution.

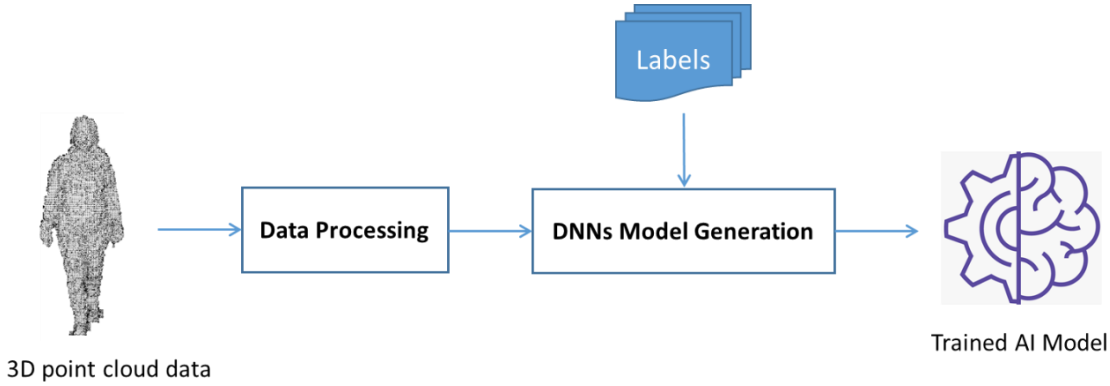

Fig. 4. AI Model Generation for People Detection

IV. Experimental Results

To perform experiments, we used 3D point cloud data that is received from 3D camera. 3D camera is setup and configured to capture all scene in a room. Fig. 5 shows an example of synthesized indoor scene with affordance heatmap. The joint sampling of ascene is achieved by alternative sampling of humans andobjects according to the joint probability distribution.

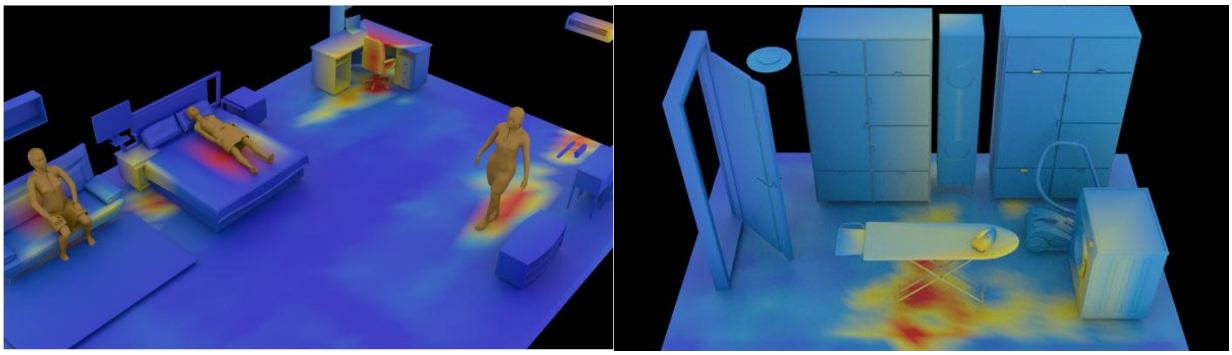

Fig. 5. Example scene.

3D camera is setup to view and capture all private room as shown in Fig. 6 but on screen it will not show other objects. It only shows 3D point cloud of people and noise (see Fig. 7).

Fig. 6. Private room is used to setup 3D camera.

Fig. 7 shows 3D point cloud data that is captured by 3D camera. We could see that the captured data did not describe private objects and face or other things. It only shows people and noise by 3D points. When people fall or have abnormal activities, these activities will be recognized by the proposed solution as shown in Fig. 7. Experimental results in Fig, 7 show that the proposed solution worked well with 3D point cloud that is captured in private room.

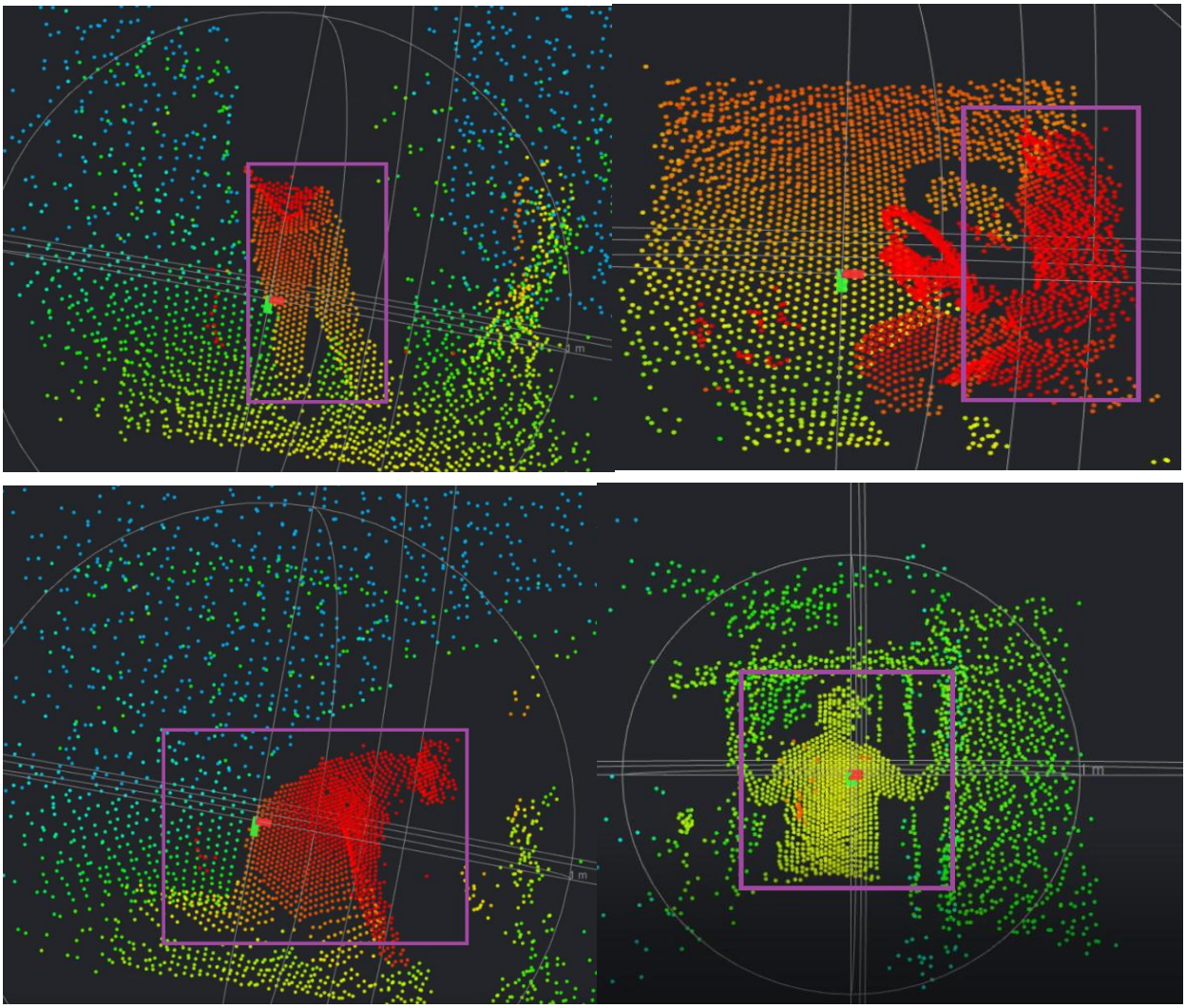

Fig. 7. Experimental Results.

IV. Conclusion

In this paper, we presented a solution for stroke recognition based on the 3D camera of Magik-eye and deep neural networks. The experimental results show that the proposed solution is effectiveto private room. In the future, to synthesize physically plausible scenes, a physics engine should be integrated. We will improve the synthesized data can contribute to thebroad AI community. Next time, we will develop an application to get alarms via sms message, images when stroke occurred in private room.

Acknowledgments

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