Short solution proposal for stroke detection based on deep learning and 3D point cloud

Giao N Pham
Department of Computing Fundamentals, FPT University, Hanoi, Vietnam

Corresponding Author: **Giao N Pham**

Abstract
A stroke is a medical condition in which poor blood flow to the brain results in cell death. It is now a day a leading cause of death 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 camera. In this short paper, I would like to propose a short solution for stroke detection based on deep learning and 3D point cloud that is generated from the new technology of 3D sensor. The proposed system could warn to urgent center/hospital; family mobile and generate alarm bell when a stroke occurs.

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

1. Introduction
A large number of people lose their life due to stroke and it is 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 between these risk factors to types of strokes. The machine learning algorithm can improve patients' health through early detection and 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 short paper, I would like to propose a short solution to early detect stroke for new format 3D point cloud from 3D camera. For detail, the short solution will be described in Sec. 2.
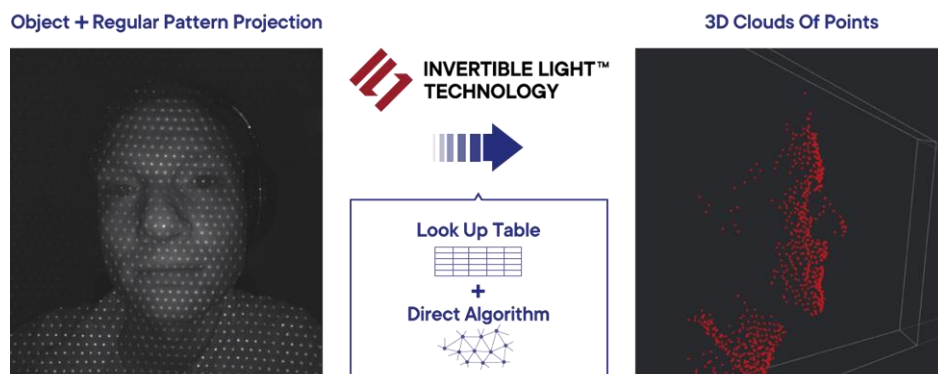

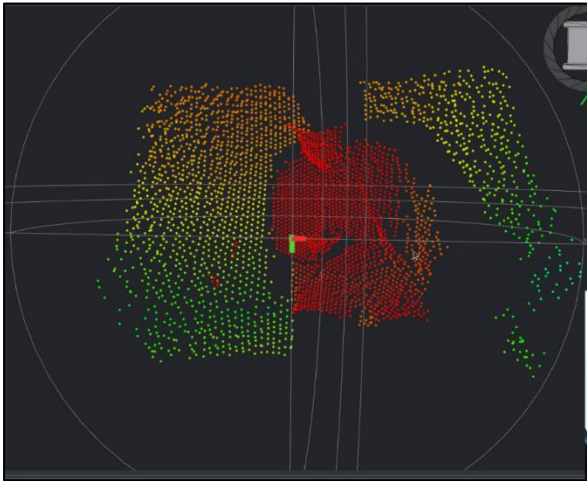**Fig 1:** 3D point cloud is generated by Magik-eye technology [4].

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

2. Short Solution Proposal

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.

Currently, I am experimenting this solution on the 3D camera of Magik-eye. Experimental results are not bad but not good because the 3D point cloud is new format. It is different with traditional 3D point cloud. I will present and discuss new experimental results next time.
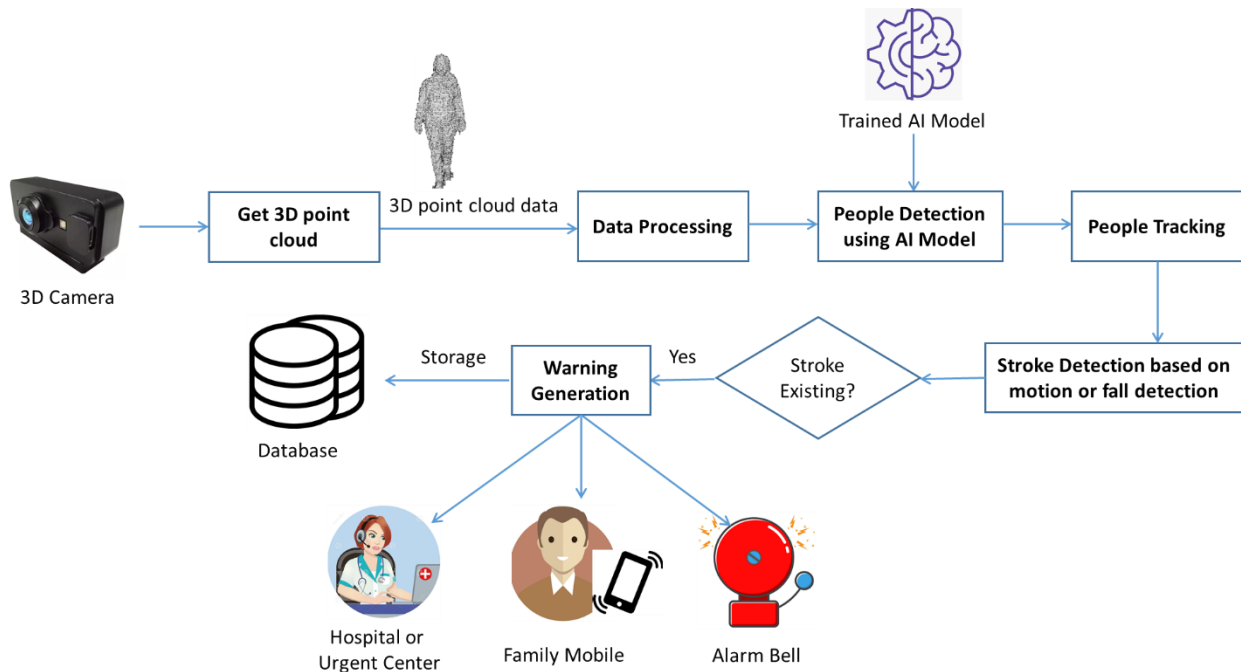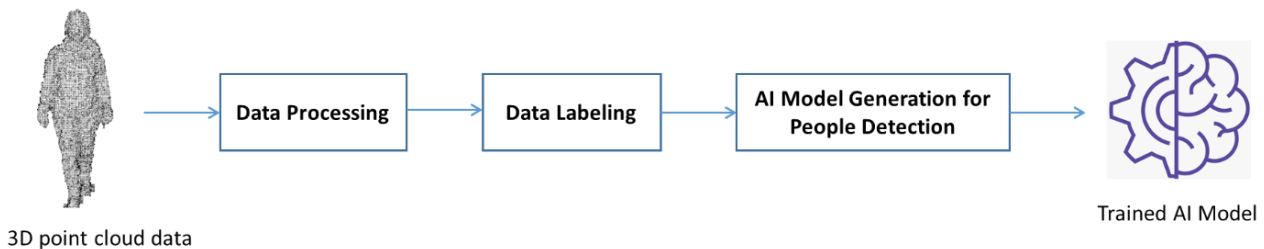

Fig 3: The Proposed Solution.

Fig 4: AI Model Generation for People Detection

3. Conclusion

In this paper, I presented a solution for stroke detection based on the 3D camera of Magik-eye and deep learning. Currently, I am experimenting this solution for smart factories and some building. Next time, I will improve my solution and expand experiments to some cases to evaluate the proposed solution.

4. Acknowledgments

5. Disclosure of conflict of interest

On behalf of all authors, corresponding author declares that there is no conflict of interest to publish this research.

6. References

1. LT Kohn, J Corrigan, MS Donaldson, *et al*. To err is human: building a safer health system. National academy press Washington, DC, 2000, 6.
2. BR Gaidhani, RR Rajamenakshi, S Sonavane, Brain Stroke Detection Using Convolutional Neural Network

and Deep Learning Models, The 2nd International Conference on Intelligent Communication and Computational Techniques, 2019, 28-29.

3. R Karthik, R Menaka, A Johnson, S Anand, Neuroimaging and deep learning for brain stroke detection - A review of recent advancements and future prospects, Computer Methods and Programs in Biomedicine, 2020, 197.

4. Magik-eye technology. Available online: https://www.magik-eye.com/, accessed on 18 Sep. 2021.

5. People Detection from 3D Point Cloud, available online: https://github.com/zhulf0804/3D-PointCloud, accessed on 19, Sep. 2021

6. Choi YA, Park SJ, Jun JA, Pyo CS, Cho KH, Lee HS, *et al*. Deep Learning-Based Stroke Disease Prediction System Using Real-Time Bio Signals. Sensors. 2021; 21:4269. https://doi.org/10.3390/s21134269