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# Editorial: Data science and digital service delivery in healthcare

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Editorial on the Research Topic
Data science and digital service delivery in healthcare

The applications of machine learning and AI technologies in the medical and healthcare fields have advanced with deep learning technologies like other AI fields. Most real-world applications of medical AI technologies have remained diagnostic systems based on medical images obtained from computer technology (CT) and magnetic resonance imaging (MRI). On the other hand, the use of biological signals currently has been left behind.

Various biological signals have been used for testing in hospitals, for example, Electrocardiograms (ECG) for cardiovascular tastings, Electroencephalograms (EEG) for epilepsy diagnosis and sleep testing, Electromyography (EMG), Electrooculography (EOG), a saturation of percutaneous oxygen ($SpO_2$) and respiratory signals for sleep testing. In addition, acceleration signals have been used for monitoring daily activities. However, these biological signals have not been fully utilized for medical AI development.

This may be because: (1) the Spatio-temporal patterns of the biological signals are usually complex non-stationary, and high-dimensional. In EEG, around 20 electrodes are used for measurement according to the 10–20 International system. Thus, it is difficult to specify the expression of the target physiological phenomena in the biological signals. (2) The amount of obtained biological signals in hospitals is limited because the biological signal measurement is usually burdensome. In many studies, we need to perform additional tests to collect enough biological signals for AI development. (3) Even when a large number of biological signals is obtained, the occurrence frequency of the target phenomenon is still low, which results in highly imbalanced data. For example, when we focus on epileptic seizures and collect EEG data from epileptic patients, obtaining sufficient EEG data around seizure occurrences is difficult because most patients have seizures once or twice a day or week. (4) Various artifacts are easily contaminated in biological signals, such as motion artifacts or electrical noise from power supplies. We have to remove such artifacts before analysis appropriately. (5) Even when such artifacts can be removed appropriately, the signal-to-noise ratio (SNR) of the biological signal is

not always high, and (6) Individuality among people is considerable, and generalization among them is difficult. Therefore, medical AI based on biological signals contains all of the difficulties in machine learning.

In our Research Topic, the published articles presented various AI and machine learning applications for healthcare services, which may suggest ideas on solutions to these problems. We hope that many researchers in machine learning will enter this area soon.

## Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

## Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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