Neural network for elderly care could save millions

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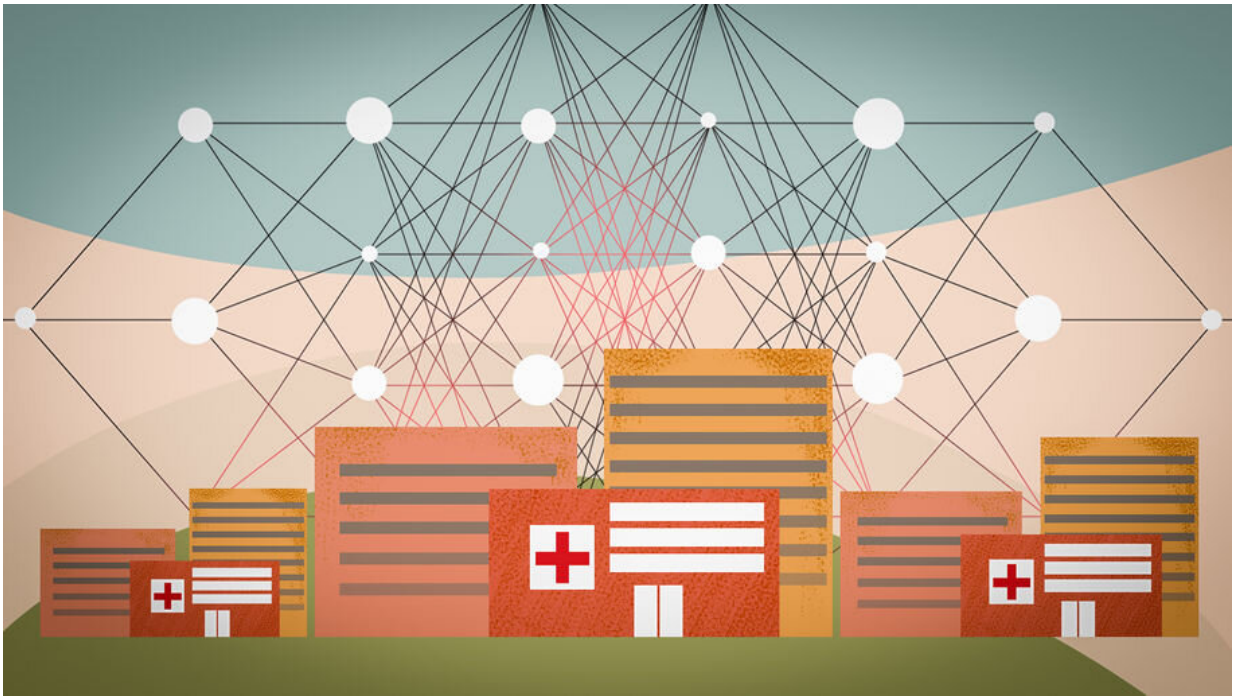

Credit: Matti Ahlgren, Aalto University

If healthcare providers could accurately predict how their services would be used, they could save large sums of money by not having to allocate funds unnecessarily. Deep learning artificial intelligence models can be good at predicting the future given previous behavior, and researchers based in Finland have developed one that can predict when and why elderly people will use healthcare services.

Researchers at the Finnish Centre for Artificial Intelligence (FCAI), Aalto University, the University of Helsinki, and the Finnish Institute for Health and Welfare (THL) developed a so-called risk adjustment model to predict how often elderly people seek treatment in a healthcare center or hospital. The results suggest that the new model is more accurate than traditional regression models commonly used for this task, and can reliably predict how the situation changes over the years.

Risk-adjustment models make use of data from previous years, and are used to allocate healthcare funds in a fair and effective way. These models are already used in countries like Germany, the Netherlands, and the US. However, this is the first proof-of-concept that deep neural networks have the potential to significantly improve the accuracy of such models.

"Without a risk adjustment model, healthcare providers whose patients are ill more often than average people would be treated unfairly," Pekka Marttinen, Assistant Professor at Aalto University and FCAI says. Elderly people are a good example of such a patient group. The goal of the model is to take these differences between patient groups into account when making funding decisions.

According to Yogesh Kumar, the main author of the research article and a doctoral candidate at Aalto University and FCAI, the results show that deep learning may help design more accurate and reliable risk adjustment models. "Having an accurate model has the potential to save several millions of dollars," Kumar points out.

The researchers trained the model by using data from the Register of Primary Health Care Visits of THL. The data consists of out-patient visit information for every Finnish citizen aged 65 or above. The data has been pseudonymized, which means that individual persons can not be identified. This was the first time researchers used this database for

training a deep machine learning model.

The results show that training a deep model does not necessarily require an enormous dataset in order to produce reliable results. Instead, the new model worked better than simpler, count-based models even when it made use of only one tenth of all available data. In other words, it provides accurate predictions even with a relatively small dataset, which is a remarkable finding, as acquiring large amounts of medical data is always difficult.

"Our goal is not to put the model developed in this research into practice as such but to integrate features of deep learning models to existing models, combining the best sides of both. In the future, the goal is to make use of these models to support decision-making and allocate funds in a more reasonable way," explains Marttinen.

The implications of this research are not limited to predicting how often elderly people visit a healthcare center or hospital. Instead, according to Kumar, the researchers' work can easily be extended in many ways, for example, by focusing only on patient groups diagnosed with diseases that require highly expensive treatments or healthcare centers in specific locations across the country.

The research results were published in the scientific publication series of *Proceedings of Machine Learning Research*.

More information: Kumar, Y., Salo, H., Nieminen, T., Vepsäläinen, K., Kulathinal, S., and Marttinen, P. (2019). Predicting utilization of healthcare services from individual disease trajectories using RNNs with multi-headed attention. Proceedings of Machine Learning Research: Machine Learning for Health (ML4H) at NeurIPS 2019. tuhat.helsinki.fi/ws/portalfil … 2645/ML4H_Camera.pdf

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