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Federated Deep Learning for Automated Detection of Diabetic Retinopathy
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Abstract
Diabetic retinopathy (DR) is a primary cause of impaired vision that can lead to permanent blindness if not detected and treated early. Unfortunately, DR frequently has no early warning signs and may not generate any symptoms. According to recent figures, over 382 million people worldwide suffer from DR, with the number expected to climb to 592 million by 2030. Patients with DR may not be treated in time given the apparent large number of DR patients and inadequate medical resources in specific places, resulting in missed treatment possibilities and eventually irreversible vision loss. Color fundus diagnosis requires highly experienced experts to recognize the existence of tiny features and the relevance of DR. Unfortunately, manually diagnosing DR is time-consuming, tedious and error-prone. At the same time, the effect of manual interpretation is highly dependent on the medical expert experiences. Deep learning is a machine learning algorithm with potential for detecting the significance of DR. However, deep learning still suffers from high computational cost, requires tons of training data, over fitting, and non-trivial hyper parameter tuning. Thus, in order to build a model that can compete with medical experts, deep learning algorithms must feed a huge number of instances or pool data from other institutions. Federated learning allows deep learning algorithms to learn from a diverse set of data stored in multiple databases. Federated learning is a novel method for training deep learning models on local DR patient data, with just model parameters exchanged between medical facilities. The objectives of this research is to avoid the requirement sharing DR patient data, since such approaches expedite the development of deep learning models through the use of federated learning. Primarily, we propose a federated learning which decentralizes deep learning by eliminating the need to pool data in a single location. In this research, we present a practical method for the federated learning of deep network based on retinal image of diabetic retinopathy. © 2022 IEEE.

Author Keywords
automated detection; deep learning; diabetic retinopathy; federated learning

Index Keywords
Deep learning, Diagnosis, Eye protection, Hospital data processing, Learning systems, Patient treatment; Automated detection, Deep learning, Diabetic retinopathy, Early warning signs, Federated learning, Impaired vision, Learning models, Medical experts, Patient data, Permanent blindness; Learning algorithms

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