MRI-based Diagnosis of Alzheimer’s Disease Using Deep Learning with CycleGAN for Data Augmentation

Wang, Sunny (School: Camas High School)

Alzheimer’s disease is a progressive disease causing deterioration of neurons in the brain, leading to dementia and eventual death. Diagnosis of Alzheimer’s conventionally consists of a combination of neuropsychological tests and laboratory tests, and clinical diagnosis accuracy lies at around 77%. As Alzheimer’s is associated with a loss in brain mass, which can be discerned from MRI scans, it is a suitable task for deep learning and computer vision. An accurate and efficient machine learning model could be of great assistance to physicians as it could reinforce their diagnosis. However, deep learning typically requires large amounts of data, and medical data is often scarce. A recent breakthrough in machine learning, the generative adversarial network (GAN), allows for the generation of realistic images, providing a potential solution to a lack of data. In this study, we construct ResNet50-based convolutional neural networks to perform Alzheimer’s disease classification using MRI scans, achieving an F-1 score of 89%. Furthermore, by generating samples using CycleGAN, we demonstrate that GANs can significantly improve classification accuracy when used for data augmentation, achieving an F-1 score of 95%.

Awards Won: