Motivation

Diabetic Retinopathy (DR) is a complication of diabetes caused by damage to the small vessels in the back of the eye (retina) that commonly leads to blindness if left untreated. Diabetic Retinopathy is the leading cause of blindness in the working population of the western world. In patients younger than 30 at time of diagnosis of diabetes the prevalence of diabetic retinopathy was 97% at 15 years post diagnosis.

Diabetic Retinopathy can be successfully treated by laser surgery or ocular injection. Early detection is vital for effective treatment. The presence of diabetic retinopathy can be detected by examining the retina for characteristic features including: microaneurysms, hemorrhages, hard exudates, cotton wool spots, and neovascularizations.

Screening for diabetic retinopathy is important. The American Diabetes Association recommends an eye exam once per year. Despite this, only about 50% of people with diabetes undergo a yearly eye examination.

IDx-DR Performance (N=5000)

IDx-DR 2.0 Improvements

IDx-DR 2.0 improves upon IDx-DR 1.3 by incorporating NVIDIA GPU-based deep convolutional neural networks (CNNs) into the device. The device contains a number of detectors for signs of DR and to detect the location of the normal anatomical landmarks. CNNs were used to enhance the performance of the following detectors:

1) The optic disc position
2) The fovea position
3) The orientation of the images (left or right eye)
4) Large hemorrhage presence
5) Hard exudate presence

IDx-DR 2.0 takes, as input, two retinal images of each eye acquired according to a pre-specified protocol. As output it provides an indication of the severity of diabetic retinopathy in the patient. A healthcare provider, using the device output, then makes the final referral decision.

Objective

Demonstrate the impact of NVIDIA GPU-based deep convolutional neural networks that form the basis for the performance improvement between IDx-DR 1.3 and IDx-DR 2.0.