**DIABETIC RETINOPATHY DETECTION**

Diabetic Retinopathy is the leading cause of blindness in the working age population of the developed world, estimated to affect over 93 million people. Diabetic Retinopathy (DR) is an eye disease caused by long-standing diabetes. It causes progressive damage to the retina, the light-sensitive lining at the back of the eye. Diabetic retinopathy is a serious sight-threatening complication of diabetes. Diabetes interferes with the body's ability to use and store sugar (glucose). The disease is characterized by too much sugar in the blood, which can cause damage throughout the body, including the eyes. Over time, diabetes damages the blood vessels in the retina. Diabetic retinopathy occurs when these tiny blood vessels leak blood and other fluids. This causes the retinal tissue to swell, resulting in cloudy or blurred vision. The condition usually affects both eyes. The longer a person has diabetes, the more likely they will develop diabetic retinopathy. If left untreated, diabetic retinopathy can cause blindness. Early detection and treatment can limit the potential for significant vision loss from diabetic retinopathy. Often the early stages of diabetic retinopathy have no visual symptoms.

**Symptoms of diabetic retinopathy include:**

* Seeing spots or floaters
* Eye pain
* Double vision
* Blurred vision/ Sudden changes in vision
* Having a dark or empty spot in the center of your vision
* Difficulty seeing well at night

**Diabetic retinopathy is classified into two types:**

1. Non-proliferative diabetic retinopathy (NPDR) is the early stage of the disease in which symptoms will be mild or non-existent. In NPDR, the blood vessels in the retina are weakened. Tiny bulges in the blood vessels, called microaneurysms, may leak fluid into the retina. This leakage may lead to swelling of the macula.
2. Proliferative diabetic retinopathy (PDR) is the more advanced form of the disease. At this stage, circulation problems deprive the retina of oxygen. As a result new, fragile blood vessels can begin to grow in the retina and into the vitreous, the gel-like fluid that fills the back of the eye. The new blood vessels may leak blood into the vitreous, clouding vision.

**Risk factors for diabetic retinopathy include:**

* Diabetes: People with type 1 or type 2 diabetes are at risk for developing diabetic retinopathy. The longer a person has diabetes, the more likely he or she is to develop diabetic retinopathy, particularly if the diabetes is poorly controlled.
* Race: Hispanics and African Americans are at greater risk for developing diabetic retinopathy.
* Medical conditions: People with other medical conditions, such as high blood pressure and high cholesterol, are at greater risk.
* Pregnancy: Pregnant women face a higher risk for developing diabetes and diabetic retinopathy. If a woman develops gestational diabetes, she has a higher risk of developing diabetes as she ages.

**How is diabetic retinopathy diagnosed:**

Diabetic retinopathy can be diagnosed through a [comprehensive eye examination](https://www.aoa.org/patients-and-public/caring-for-your-vision/comprehensive-eye-and-vision-examination). Testing, with emphasis on evaluating the retina and macula, may include:

* Patient history to determine vision difficulties, presence of diabetes, and other general health concerns that may be affecting vision
* Visual acuity measurements to determine how much central vision has been affected
* Refraction to determine if a new eyeglass prescription is needed
* Evaluation of the ocular structures, including the evaluation of the retina through a dilated pupil
* Measurement of the pressure within the eye

**Supplemental testing may include:**

* Retinalphotography or tomography to document current status of the retina
* Fluorescein angiography to evaluate abnormal blood vessel growth

**The risk of developing diabetic retinopathy can be lessened through taking the following precautions:**

* Taking a dilated eye examination once a year
* [Managing diabetes](http://www.diabetes.co.uk/managing-diabetes.html) strictly through medicine, insulin, diet and exercise
* [Test blood sugar levels](http://www.diabetes.co.uk/blood-glucose/blood-glucose-testing.html) regularly
* Test urine for [ketone levels](http://www.diabetes.co.uk/diabetes-and-ketones.html) regularly

Loss of vision can be stopped if DR is detected in time, however this is difficult as the disease shows little symptoms until it is too late. Currently, detecting DR is a time-consuming and manual process that requires a trained clinician to examine and evaluate digital color fundus photographs of the retina. By the time human readers submit their reviews, often a day or two later, the delayed results lead to lost follow up, miscommunication, and delayed treatment.

The need for a comprehensive and automated method of DR screening has long been recognized, and we’ll be creating a system which takes a “color fundus” photograph as input and producing a numerical output on a scale of 0-4 where 0 represents No DR and 4 is Proliferative DR. Our aim is to improve upon the previous efforts which applied image classification, machine learning and pattern recognition.

**References:**

* Casanova, Ramon, Santiago Saldana, Emily Y. Chew, Ronald P. Danis, Craig M. Greven, and Walter T. Ambrosius. "Application of Random Forests Methods to Diabetic Retinopathy Classification Analyses." PLOS ONE 9, no. 6 (2014): 1-7. Accessed December 26, 2014. www.plosone.org.
* Sinthanayothin, C., J.F. Boyce, T.H. Williamson, H.L. Cook, E. Mensah, S. Lal, and D. Usher. "Automated Detection of Diabetic Retinopathy on Digital Fundus Images." Diabetic Medicine 19 (2002): 105-12.
* Usher, D., M. Dumskyjs, M. Himaga, T.H. Williamson, S. Nussey, and J. Boyce. "Automated Detection of Diabetic Retinopathy in Digital Retinal Images: A Tool for Diabetic Retinopathy Screening." Diabetic Medicine 21 (2003): 84-90.
* https://en.wikipedia.org/wiki/Diabetic\_retinopathy