Slide 1

Goodmorning —------------------

Slide 2

According to WHO's Blindness and vision impairment statistics in 2019, around 2.2 billion people suffer from blindness or vision impairment, out of which 80% of disability can be avoided if detected at an early stage.
All these people will be at risk of developing diabetic macular edema.

With such massive numbers, detecting retinal disorders manually by an ophthalmologist is a strenuous task. The identification of retinal disorders can be made by spotting the existence of deformation associated with the disease. Although clinicians may be able to diagnose the disease through vascular abnormalities, its resource demands are high.

The OCT is a non-invasive imaging modality mainly used in ophthalmology to visualize retinal layers. Information about all the retina layers can be inferred from OCT images, useful in Early detection and diagnosis of retinal disorders. Even a minimal change in retinal layers can be accurately seen in the OCT images.

OCT can provide means for early detection for various types of diseases because morphological changes often occur before the physical symptoms of these diseases.

In this work we aim to develop a CNN architecture for detection of retinal disorders using OCT images

Slide 3

Now I'll take up the flow of our project -
We divided the proj in 5 parts starting with the literature review of both denoising of oct images and dev a automated system for erection of retinal diseases
Then we move on to finding the region of interest which will help us to find out the region where deformities in the retina are present thus helping us to detect the disease. Further the deep learning model will be trained particularly on the region of interest.
Moving ahead with the denoising of oct images which will be discussed further in the ppt, followed by segmentation of retinal layers and then finally developing a deep learning model for automated detection of retinal diseases.

Slide 4 & 5

Here are some of the many papers we reviewed for better understanding of the two topics namely denoising of oct images and dev a deep learning model for retinal diseases detection.
The first paper "Diagnosis of retinal disorders from Optical Coherence Tomography images using CNN", the author develops a CNN architecture consisting of convolution and fully connected layers along with batch normalization. As far as the second paper namely "Deep learning-based automated detection of retinal diseases using optical coherence tomography images" which used an approach of four classification model instances each of which was based on an improved ResNet50. Hence used transfer learning approach. The first paper used the same open source dataset called as Mendeley database consisting of around 84,000 OCT images categorized

into four types namely Diabetic Macular Edema, Drusen Macular Degeneration, Choroidal Neovascularization and Normal. Whereas the second paper collected a total of 21,357 retinal OCT images from different local hospitals. The first paper achieves a testing accuracy of 97.01%. While the second paper achieved a better classification accuracy of 97.3%.

Slide 6 & 7 & 8

Transitioning to the literature review on OCT denoising, Our literature study indicates that the major cause of noise in OCT images is Speckle noise and Salt & pepper noise. Speckle noise is the noise that arises due to the effect of environmental conditions on the imaging sensor during image acquisition. Speckle noise is mostly detected in case of medical images. An image having salt-and-pepper noise will have a few dark pixels in bright regions and a few bright pixels in dark regions. Salt-and-pepper noise is also called impulse noise.

We have included 3 major types of OCT denoising
Firstly : Statistical model for OCT image denoising which is founded on a numerical optimization framework. It combines a novel speckle noise model, derived from local statistics of empirical spectral domain OCT data.

Second is the Denoising using CGAN Networks. The conditional generative adversarial network is a type of GAN that involves the conditional generation of images. Image generation can be conditional on a class label allowing the targeted generation of images of a given type.

All the three use robust datasets namely Duke, Topcon and retinal OCT database.

Slide 9

We have used an openly available dataset from Kaggle which consists of a total of 4 classes namely Normal, Drusen, Choroidal Neovascularization (CNV). We also did manual inspection of the following images from our dataset.

Slide 10

In the lower retinal layer you can see some disc-like structures. Disc drusen are composed of small proteinaceous material that become calcified with advancing age. These deposits can be considered small tumors. They also may lead to a loss of visual field or, in rare cases, optic neuropathy

Slide 11

Choroidal Neovascularization (CNV) is a major cause of vision loss and is the creation of new blood vessels in the choroid layer of the eye. In these images you can notice a red arrow showing disruption of the ellipsoid zone along with yellow and white arrows which show choroidal back-shadowing and retinal fuzziness respectively..

Slide 12

Diabetic macular edema (DME) is the accumulation of excess fluid in the extracellular space within the retina in the macular area, typically in the subretinal space. In the OCT image we can see the Microaneurysms or damaged capillaries resulting from the breakdown of the blood-retina barrier leak fluid to the extracellular space, resulting in a swollen retina which may leave behind lipoprotein residues resulting in eventual vision loss.

Slide 13

This is the normal retina OCT image, we have used this as a baseline OCT image for basing all other OCT disease manual inspection.

Slide 14

As we have discussed in the previous slides, We have done extensive literature review of papers related to Retinal OCT disease detection and OCT denoising.
We have done manual inspection of OCT images to find morphological deformations in the OCT images and as we would discuss in the upcoming slide, we have made our retinal OCT denoiser using Denoising Autoencoders.

Slide 15

An autoencoder is a type of neural network that tries to learn an approximation to identity function using back-propagation, i.e. given a set of unlabeled training inputs An autoencoder first takes an input and maps(encode) it to a hidden representation using deterministic mapping.
We are using a convolutional Autoencoder for denoising as when Compared to classic autoencoders, convolutional autoencoders are better suited for image processing as they utilize the full capability of convolutional neural networks to exploit image structure.

Here you can see the input noisy image and denoised output image.

Slide 16

We have visualized our timeline into a very intuitive Gantt chart. We dedicated our first month to mainly literature review which helped us to base all our future work on.
We dedicated month 1 to developing our OCT denoiser. We have allocated a total of 1.5 months for developing our Unet based retinal OCT segmentation network. This gantt chart is till the month of december, we plan to map the whole month of january for writing the report.