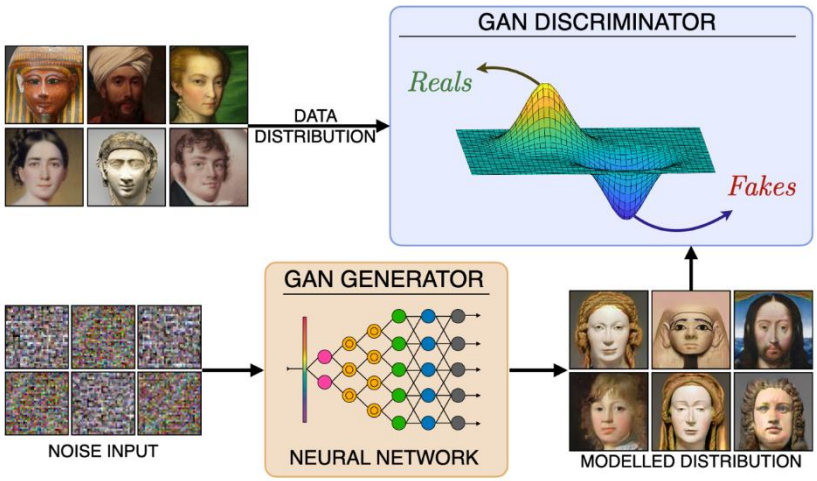
SPECTRUM LAB AT OPEN DAY

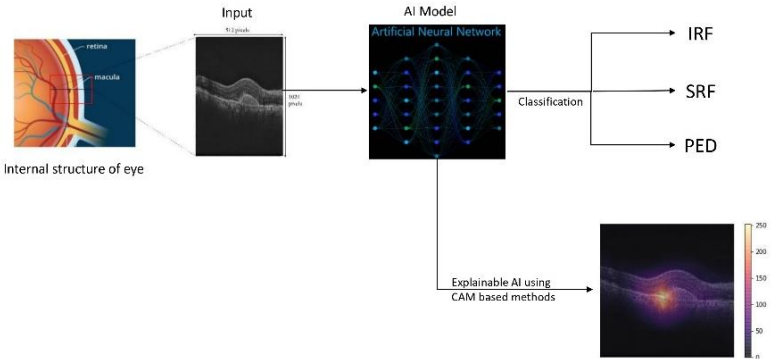
1. Generative Models

Generative adversarial networks (GANs) are a machine learning framework to transform noise into realistic images. At Spectrum Lab, we explore the intersection of Signal processing and Generative modelling, deriving equivalences between neural network optimization, differential equation theory, and Fourier analysis. We use GANs to generate high-dimensional images with applications such as modelling face data, lunar surfaces, etc.



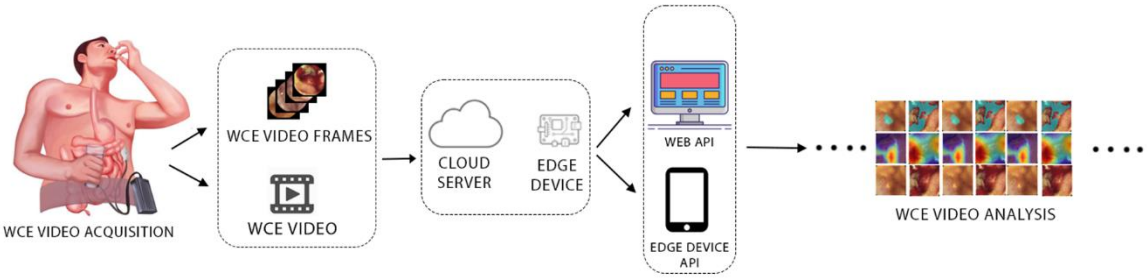
2. XAI for Optical Coherence Tomography

Optical Coherence Tomography is a non-invasive procedure used to measure the thickness of the retina and optic nerve and analyse the diseases associated with them. At Spectrum Lab, we develop tools for OCT image classification using AI models to aid automatic screening, using visual explanation techniques that provide insight into the reasoning behind model prediction.



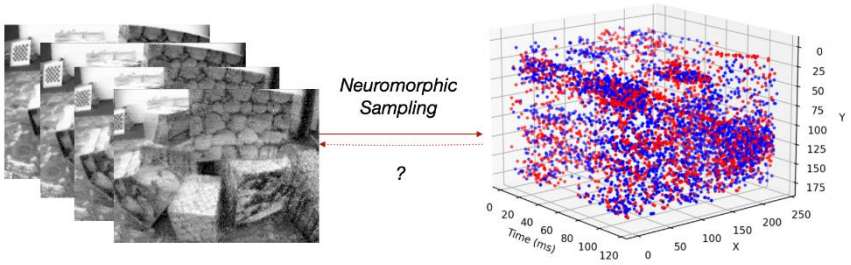
3. AI Assited Wireless-Capsule Endoscopy Analysis

A wireless capsule endoscope generates a vast number of images, typically tens of thousands of images, which makes it impractical to screen them manually. Having an automated system developed for identifying abnormalities in WCE images will reduce the screening time from ~45 mins to ~5-10 mins. With the help of a computer-aided diagnostic (CAD) system, an endoscopist would not miss polyps or cancerous abnormalities and reduce inter-observer variability among endoscopists.



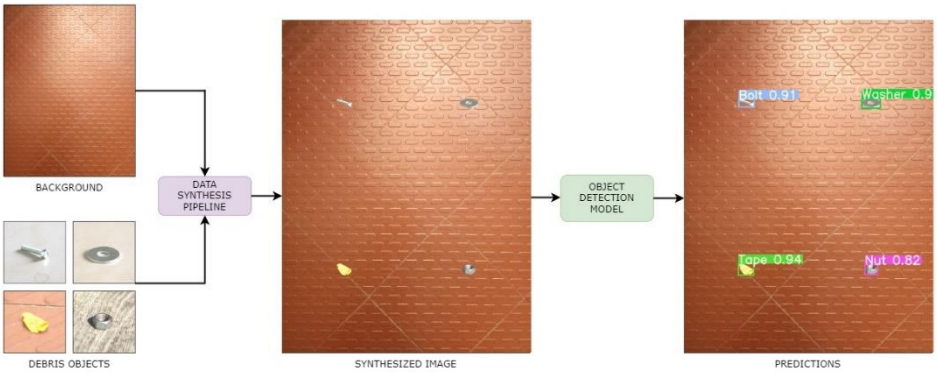
3. Neuromorphic Cameras

Neuromorphic cameras or event cameras are novel, asynchronous video devices that record sparse measurements. In particular, they are recorded with very high temporal resolution. At Spectrum Lab, we link event cameras with sampling-theoretic ideas and develop methods to reconstruct videos from events.



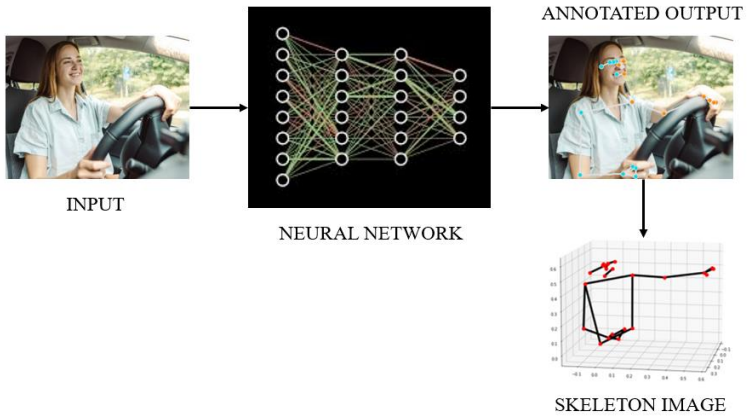
4. Foreign Object Debris (FOD) Detection

- Object detection algorithms can be used to automatically detect and classify foreign object debris (FOD) in airport environments, which can improve safety and reduce the cost of manual inspections.
- At Spectrum Lab, we specialize in generating extensive synthetic datasets by leveraging limited real-world data. Our focus is on utilizing these datasets to train cutting-edge object detection models such as YOLO, thereby enhancing their accuracy and efficacy when applied to real-world data.



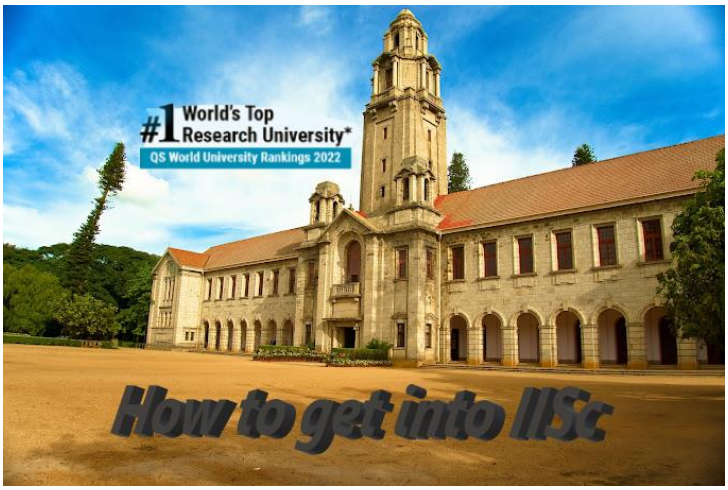
5. Real Time Human Pose Detection

- Pose estimation is a challenging task that involves inferring the 2D or 3D locations of key body joints and limbs from input images or videos.
- At spectrum lab, we aim to detect real time pose of a driver by detecting body joints to accurately identify the position and orientation of the body for the purpose of monitoring and analysing their behaviour to avoid accidents.
- This can also be used in the fields of sports, healthcare, security and more.



6. How to get into IISc?

- Learn how to enter India's premier science and technology institute - IISc, learn about various entrance exams you need to qualify before taking admission into IISc.
- Explore the benefits of studying at IISc - world-class faculty, cutting-edge research, and a vibrant campus life.
- Learn more about the admission process for IISc's competitive programs and take the first step towards your dream career in science and technology at one of India's most prestigious institutions.



7. AI-assisted echocardiography

An echocardiogram is a graphic outline of your heart's movement. During an echo test, doctor uses ultrasound from a hand-held wand placed on your chest to take short videos of your heart's valves and chambers. At Spectrum Lab, we are using these echocardiogram videos accorded by Apollo to predict cardiac abnormality with interpretability using classification and regression techniques.