Report 2

Different Types of Noises in different imaging modalities:

CT Scans:

CT (computed Tomography) is an imaging technology which is an improvisation to the X-Ray. Compared to X-Ray the subject contrast is greatly enhance in CT scans and instead of being limited to axial imaging it is able to generate a versatile 3-D image models.

Common types of noises:

- Gaussian noise: due to electrical signals appear caused by high energy thermal fluctuations
- Quantum Noise: are also common in CT scans.

MRI Scans:

This technique forms images utilizing the fact that when the human body is subjected to strong magnetic field the protons of water molecules in the body align according to that field. This gradual change in the inclination of rotational axis is captured and converted into images. Some kinds of MRI imaging are: T1 weighted MRI, T2 weighted MRI, Diffusion Weighted MRI etc.

Common types of noises: These noises results from the electronic interferences in the circuit and also contributed by the radiofrequency emitted due to the thermal motion of ions in the patient's body.

- Gaussian Noise
- Rician Noise
- Rayleigh Noise

Interestingly, the Rician noise distribution transforms into Gaussian distribution when Signal to Noise ratio is greater than 2, and transforms into Rayleigh distribution if SNR approaches to 0.

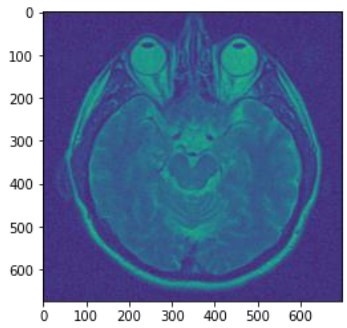

Fig:1 Addition of Rician Noise

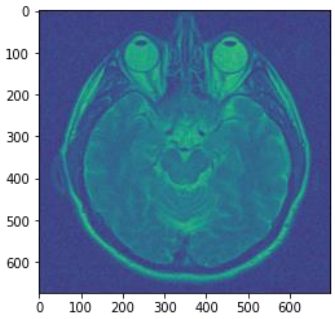

Fig:2 Addition of Rayleigh Noise

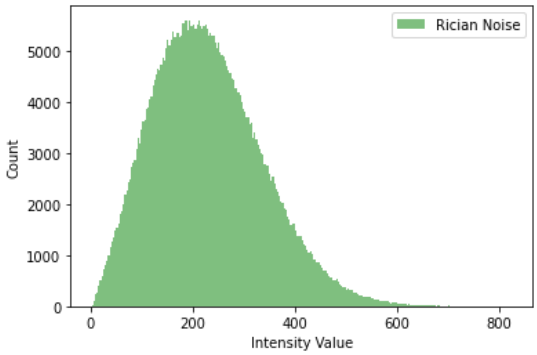

Fig:3 Rician Noise Distribution Converges to Gaussian Distribution at (SNR = 2)

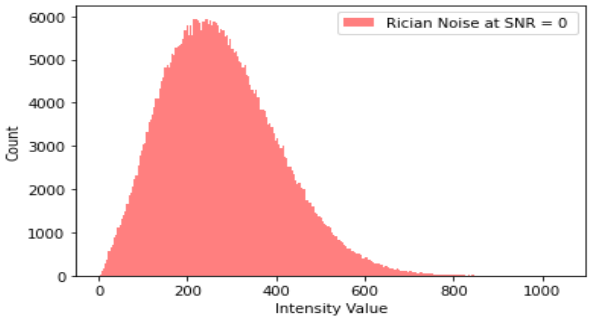

Fig:4 Rician Noise Distribution at SNR = 0

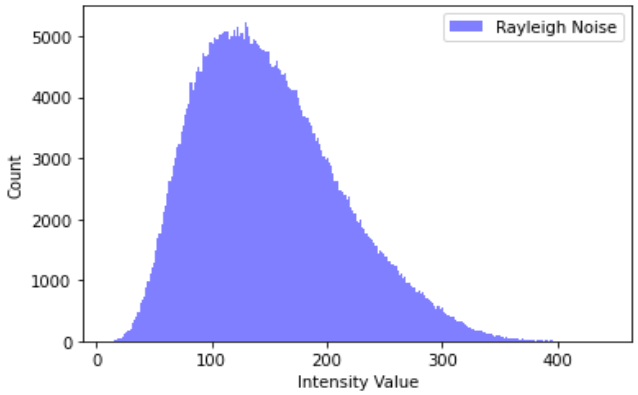

Fig:5 Rayleigh Noise Distribution

Ultrasounds:

This imaging technique renders real time images of live tissues using a probe pulse signal ranging from 20KHz to several gigahertz. These sound waves are dispersed through the body and when reflected cast the image. Being live images, they are of low quality.

Common types of noises:

- Speckle: It's a kind of a granular noise arise due to the constructive and destructive interference of the temporal coherent sound waves in the system.
- Gaussian: this arises due to numerous thermal and electronic fluctuations in the circuit.

X-Ray Scans:

Probably the earliest imaging technique discovered. In X-Ray, patient is subjected to X-ray radiations and the reflection produced is used to render the 2D images on the photographic plates. As, the calcium in bones absorb this X-Ray, so in the image this region looks white while tissues absorb less of X-Ray so they appear to be black.

Common types of noises:

- Gaussian: thermal activity produces this noise.

- Poisson Noise
- Quantum Noise: produced due to the random distribution of photons in the X-Ray imaging.

As, it is fairly visible, Additive White Gaussian Noise (ADWG) is present in almost all the imaging modalities, because it is cause by the thermal agitation of electrons in the analogy circuitry which is the part of all systems.