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<th>Methods and technologies for high quality medical ultrasound imaging</th>
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**Methods & Technologies for High Quality Medical Ultrasound Imaging**

**Introduction**

Using **Pulse-echo Technique**, ultrasound imaging is considered to be **Noninvasive, Portable, Real-time**, and **Cost Effective**, which makes it a most popular diagnostic imaging modality in the world.

Based on **Sonix RP**, an advanced experimental ultrasound scanner, the project **Objective** is to develop and implement new methods and technologies for high quality medical ultrasound imaging, especially in the area of **Speckle Reduction**.

**Imaging Process**

- **RF Data**
- **LPF**
- **Envelope Detection**
- **Log Compression**
- **Adaptive Filter**

**Statistical Modeling for Ultrasonic Echo Signal**

The backscattered ultrasonic echo from tissue follows some statistical distributions. **Nakagami Distribution** is used as a model for envelope-detected ultrasound signal in this project.

**Histograms** of ultrasonic echo signal are used to verify the Model. Results showed the **Simplicity and Versatility** of the model. **Chi-square Tests** are also conducted to test the hypothesis. The results are **Acceptable** within error limits.

**Adaptive Speckle Reduction Filter**

An **Adaptive Filter** based on Nakagami Distribution is proposed and the **Windowing technique** is used to remove the speckles.

\[
p(r, \mu, \omega) = \frac{2\mu^\omega}{\Gamma(\omega)} r^{2\omega-1} \exp\left(-\frac{\mu r^2}{\omega}\right)
\]

\[
\mu = \frac{E[X^2]}{\text{Var}[X^2]} \quad \omega = E[X^2]
\]

**Image Comparison**

Before                      After

**Sonix RP**

- **Clinical Mode**
- **Research Mode**

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