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## ABSTRACT

Ultrasonography is the commonly used imaging modality for the examination of several pathologies due to its non-invasiveness, affordability and easiness of use. However, ultrasound images are degraded by an intrinsic artifact called 'speckle', which is the result of the constructive and destructive coherent summation of ultrasound echoes. This paper aims to generate B-mode images out of radiofrequency (RF) data following standard procedures, a series of steps such as envelope detection, log-compression and scan conversion. The best set of parameters of this pipeline will be selected in order to achieve B-mode images with high quality.

## CONCLUSIONS

From the results we can conclude that filtering in RF mode, before the conversion to B-mode, reduce the speckle noise in B-mode image. RF signal processing shows to be equally efficient in noise reduction as the B-mode filtering. This approach needs to be study in order to reduce even more the speckle noise.

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## Introduction

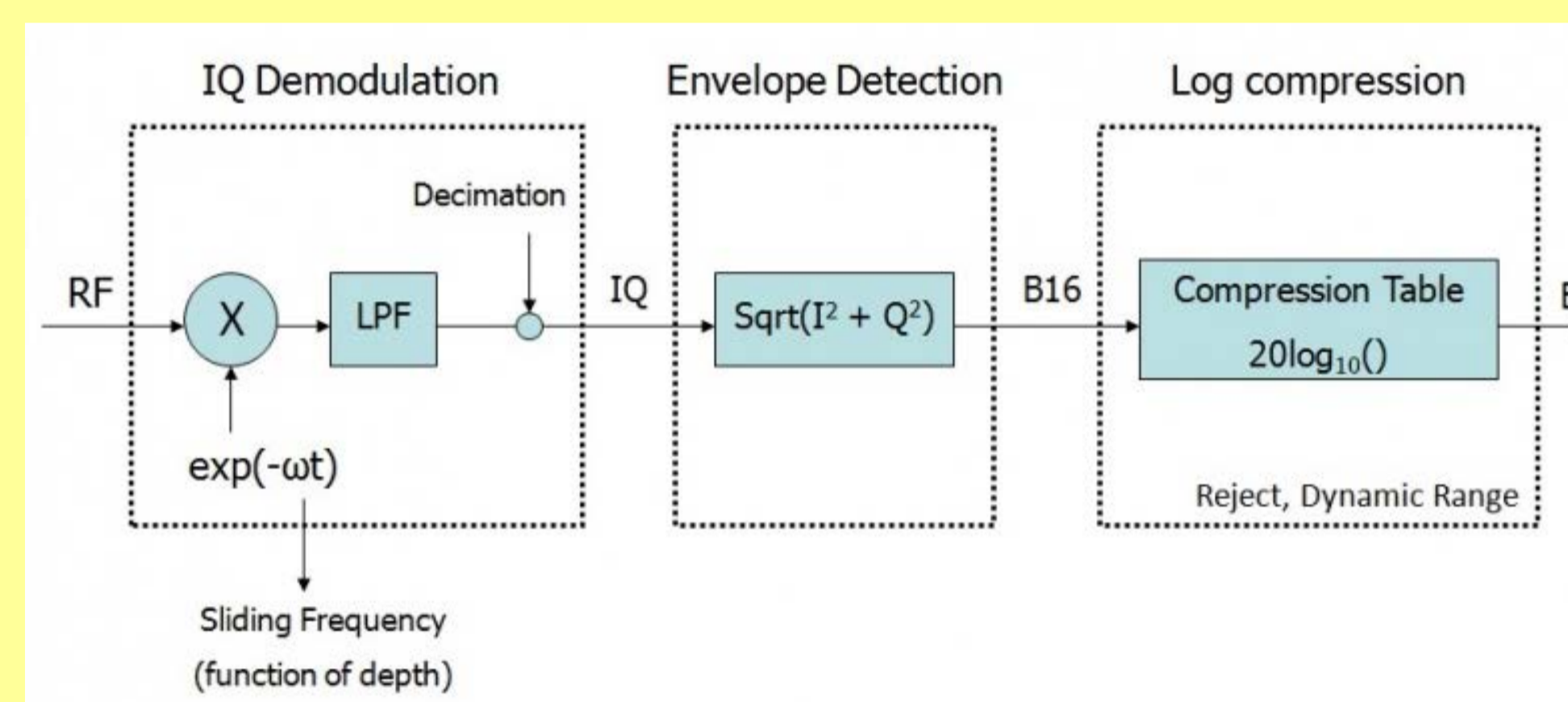
Ultrasound imaging is one of the most important and cheapest instrument used for diagnostic purpose among the clinicians. However, the images obtained through this type of examination presents a characteristic noise type, known as speckle noise, which makes it difficult to analyze and diagnose.

Speckle reduction methods can be classified in two categories: image compounding and image filtering. Image compounding is achieved by averaging a series of ultrasound images acquired from different viewpoints. The main drawback is the need of multiple acquisitions. Image filtering techniques include adaptive filters, anisotropic diffusion and wavelets.

## Materials and Methods

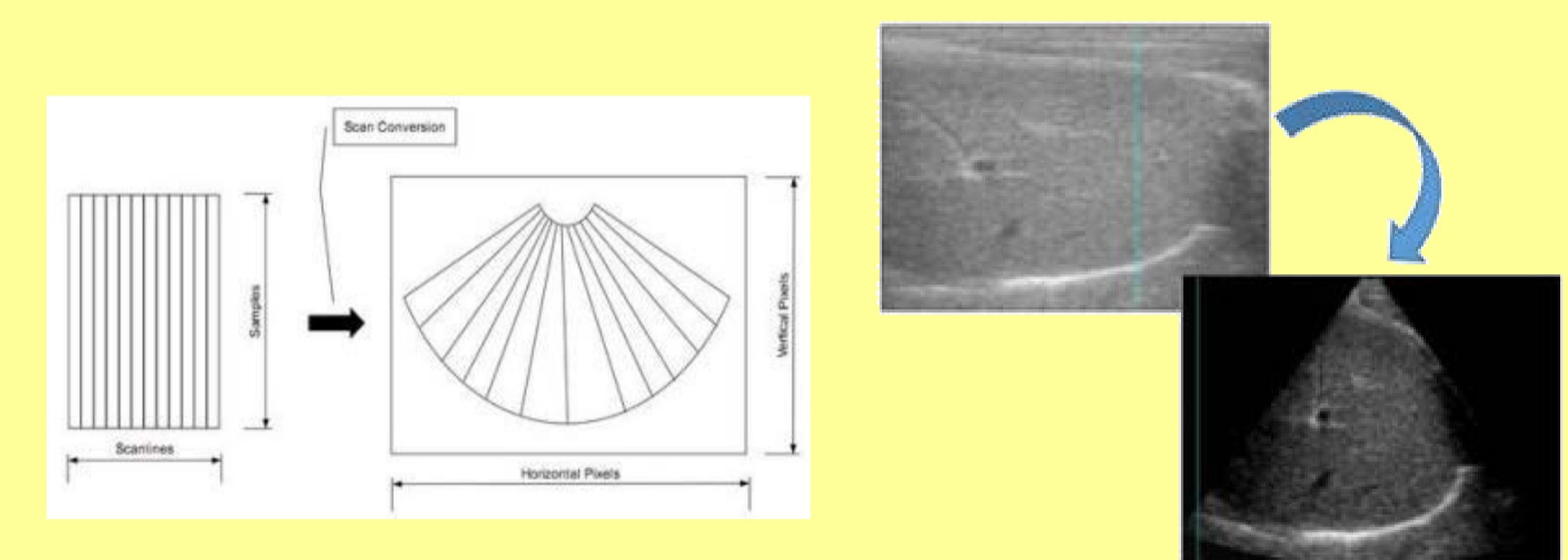
### B-mode Signal Processing

In order to obtain an ultrasound image in B-mode, an RF signal is received which passes essentially through three signal processing phases: IQ Demodulation, Envelope Detection, and Log compression.



### Scan conversion

Helps convert linear B-scan data into geometrically correct images, "fan-shaped" images.



## Experimental Results

The following combination was the one with the best results in the processing of the RF image:

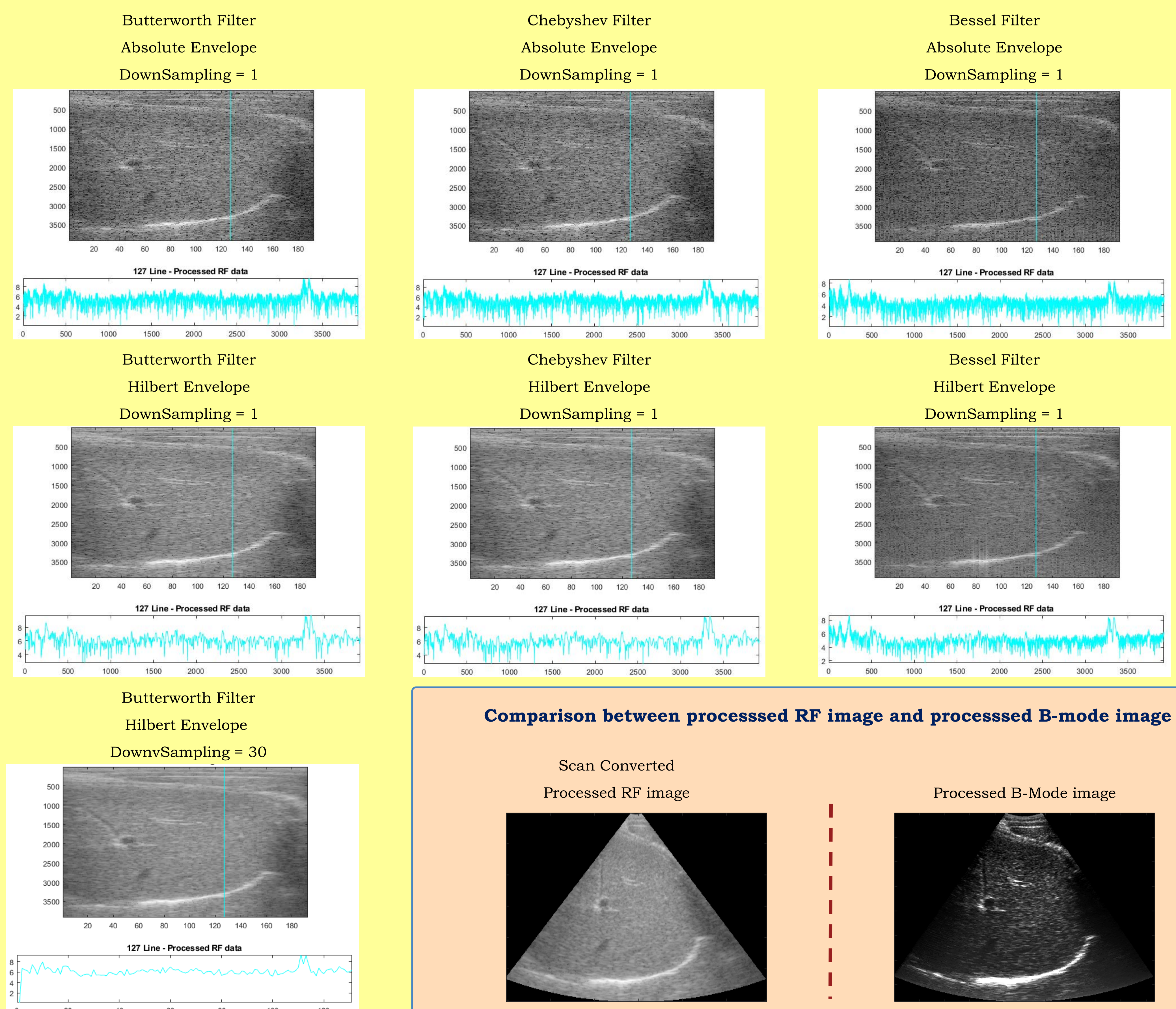
**Butterworth filter + Hilbert envelope + downsampling = 30**

PSNR high means good quality and low means bad quality image. The bigger the downsampling value the better quality. However, visually for downsampling value of 40 the image starts to become affected by the undesirable *blurring effect*.

Table 1 Peak signal-to-noise ratio

Filters	DownSampling	Envelope	PSNR
Butterworth	40	Hilbert	34,5883
	20		32,4544
Chebyshev	1		23,9061
Bessel			23,8879
Butterworth			17,6883
Chebyshev			18,1407
Bessel		17,7704	
		Absolute	14,3964

### Influence of the different filters, envelope detection and downsampling



### Comparison between processed RF image and processed B-mode image

