

## *Dedication*

*This project is dedicated to my  
beloved parents,*

*Who educated me and enabled me  
to reach at this level.*

## *Acknowledgment*

*Thanks to Allah at first , and would like to express gratitude to supervisor Dr. Banazier Ahmed Abraham for all her help guidance, her patience valuable encouragement during this study . Also would like to express thanks to the staff members in the department of biomedical engineer- Al- Sudan University. Also, heartily thankful our teachers and friends whose support us in this project.*

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## Abbreviation

US	Ultrasound
US B-mode	Ultrasound Brightness mode
US A-mode	Ultrasound Amplitude mode
US M-mode	Ultrasound Motion mode
SND	Scatter Number Density
FFS	Fully Formed Speckle pattern
NRLR	Non Randomly distributed with Long-Range order
NRSR	Non Randomly distributed with Short-Range order
PDF	Probability Density Function
DsFgf4d	Geometric Filter
DsFls	Linear scaling gray level filter
SRAD	Speckle reduction anisotropic diffusion
PDE	Partial Differential Equation
TVD	Total Variation Denoising Filters
MSE	Mean Square Error
RMSE	Root Mean Square Error
SNR	Signal to Noise Ratio
PSNR	Peak Signal to Noise Ratio
SSIM	Structural Similarity Index
DWT	Discreet Wavelet Transform
IDWT	Inverse Discreet Wavelet Transform
MHMF	Modified Hybrid Median Filter

## Abstract

Ultrasound imaging is a widely used medical tool that can help physician evaluate ,diagnose and treat medical conditions and, due to its noninvasive nature, low cost and capability of forming real time imaging it is widely used technique and considered very safe due to non ionizing radiation properties unlike X-ray .the ultrasound image shows granular appearance called speckle ,this noise decrease the human ability to identify pathological from normal tissue because it depends on the structure of the image tissue and various imaging parameters. The main purpose for speckle reduction in medical ultrasound imaging to improve the human into keep in mind that certain speckle contains diagnostic information and should be retained.

The objective of this thesis is to give an overview about types of speckle reduction techniques in ultrasound imaging and to present tow new techniques of speckle reduction. And to carry out comparative evaluation of despeckle filtering based on image quality evaluation metrics.

A new speckle suppression methods and coherence enhancement of medical ultrasound images where proposed: The first one is modified of hybrid median filter, the second one is combining of SRAD with hybrid median filter.

It has been found that quality evaluation metrics the proposed methods performed better than all other methods while the structural details and results preserved edges and features in a better way than other despeckling filters.

## المستخلص

جهاز الموجات الصوتية هو أداة طبية مستخدمة بصورة واسعة في المجال الطبي , حتى تساعد الأخصائي على تقييم ,تشخيص وعلاج الحالات الطبية , لأن جهاز الموجات الصوتية غير مؤثر على الانسجة , وقليل التكلفة ويمكنه اعطاء صورة حية في الزمن , هذه الاسباب جعلته شائع الاستخدام ويعتبر جهاز آمن لأنه لا يحتوي على أشعة مؤينة مثل جهاز الأشعة السينية.

صورة الموجات الصوتية تظهر فيها حبيبات تسمى الرقطة , هذه الحبيبات تعتبر ضوضاء , وتؤثر بدورها في مقدرة الأخصائي على تحديد وتميز الأنسجة السليمة من الأنسجة المصابة , لأنها ترتبط بتفاصيل الصورة وعوامل تصويرية أخرى .

السبب الأساسي لضرورة التخلص من ضوضاء الرقطة هو تحسين مقدرة الأخصائي على تفسير الصورة.

الهدف من هذه الأطروحة هو إعطاء فكرة عامة عن أنواع تقنيات الحد من ضوضاء الرقطة في جهاز الموجات الصوتية وأيضا اقتراح تقنيتين في الحد من ضوضاء الرقطة , وأيضا إجراء مقارنة تقييمية بين مرشحات الحد من ضوضاء الرقطة بناء على مقاييس تقييم جودة الصورة.

تم اقتراح بعض الطرق الجديدة للحد من ضوضاء الرقطة و تعزيز صور الموجات الصوتية في المجال الطبي ، و هي على النحو التالي.

أولا :تعديل مرشح الهجين المتوسط , ثانيا: دمج مرشح الحد من ضوضاء الرقطة متباينة الخواص مع مرشح الهجين المتوسط.

وقد توصلنا في هذا البحث أن الطريقتين المقترحتين هي الأفضل من حيث مقاييس تقييم جودة الصورة , لأنها تحافظ على تفاصيل الصورة والنتائج الهيكلية الحواف والملاح بشكل أفضل مقارنة بالطرق الأخرى لمرشحات ازالة ضوضاء الرقطة.