Metal Artifact Reduction in MRI And CT Scan

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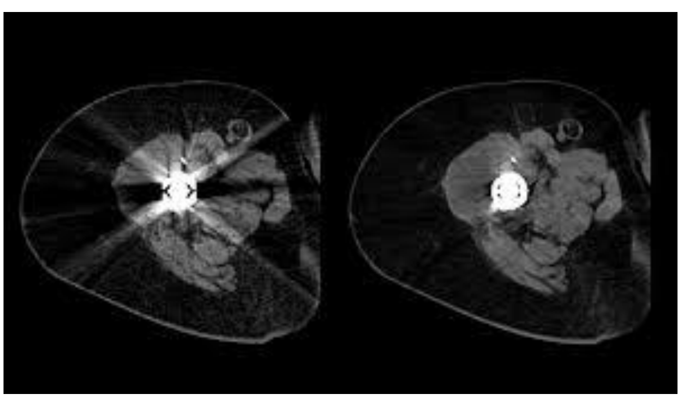
Abstract- *In modern world,looking in to interior of the human body has improved a lot in X-ray computed tomography (CT) scanners, and magnetic resonance imaging (MRI).It can produce excellent images in many cases but there are cases where they fail.They fail because the density of the metal plate or blocks placed in the human body is beyond the normal range that can be handled by the computer, resulting in incomplete attenuation profiles.These artificially inserted metal like substance majorly block or totally block and produce artifacts during reconstructions of the imaging .These metal artifact can limit the diagnostic value of the image produced during the scans .We propose a system where we use both deep learning and machine learning algorithm to produce great and accurate results in CT and MRI scans.Though training the deep learning is so tough challenge at the end we can have a good diagnostic value in the resulting image*

Keywords- Metal artifact , Artifact reduction , MRI scan , CT Scan ,Computed tomography and Magnetic resonance Imaging

I. INTRODUCTION

Nowadays, three-dimensional (3D) imaging is one of the successful clinical applications. In spite of improvements in imaging methods, researchers are faced with various problems. One of the problems is that high-density objects exist in CBCT images such as metal implants and dental fillings and create a lot of artifacts.



The above image shows the striking artifacts in during scans deflecting the rays and producing artifacts

These artifacts considerably reduce the graphical quality of the image and alter the skeletal structure close to metallic substances. Considering independency of this algorithm from data acquisition part, it can be used along with other artifact reduction algorithms which modify scanning algorithm to reduce artifacts. Methods to overcome metal artifacts in Computed Tomography (CT) images have been researched and developed for nearly 40 years.

Metal objects such as a dental filling, artificial hip, spine implant, or surgical clip in the field of view will strongly attenuate x-rays or even completely block their penetration, resulting in corrupt or missing projection data received by the detector known as artifacts. It may result in the improper Diagnosing of the report of the concerned patient. We will discuss some advanced methods to correct artifacts.

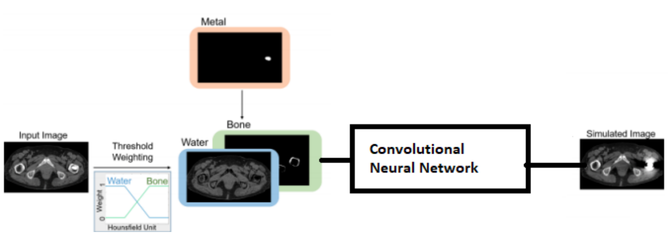
II. RELATED WORKS

To look in to the human body we have various technique and methods for different situation, situational method. They are reached a great height. People usually undergo scans during fracture majorly. Scans during Fracture are common and simple when they are in hand and leg are simple. Its complex when it comes to the spine and brain. Magnetic resonance imaging(MRI) is used for scanning head and computed tomography (CT) for spine. Scan is simple when there is no artificial insertion of plates or blocks but when you under go while you have any artificially inserted plates or some thing to support your system's regular routine it becomes a challenging task. The reason is artificial substance placed inside can partially or totally block or reflect the rays passing in during the scans which damage the value of the resulting image for diagnoses, using some specific algorithms we can reduce the artifacts in the resulting image .

S.NO	Journal details	Technique used	Inference
1.	Ghani, Muhammad Usman and Karl, W Clem, "Fast Accurate CT Metal Artifact Reduction using Data Domain Deep Learning," IEEE Transactions on Computational Imaging, 2019	**Deep Learning**	The standard practical approaches to reducing metal artifacts in CT imagery are either simplistic non-adaptive interpolation-based projection data completion methods or direct image post-processing methods.
2.	Kim, Jiwon and Kwon Lee, Jung and Mu Lee, Kyoung, "Accurate image super-resolution using very deep convolutional networks," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 2016, pp. 1646–1654	**Deep Convolutional Networks**	We find increasing our network depth shows a significant improvement in accuracy
3.	Xia Huang, Jian Wang, Fan Tang, Tao Zhang & Yu Zhang. Metal artifact reduction on cervical CT image by deep residual learning, 2018	RL-ARCNN	Metal artifacts are eliminated efficiently free of sinogram data and complicated Post-processing procedure.
4.	Brian A. Hargreaves[1], Pauline W. Worters[1], Kim Butts Pauly[1], John M. Pauly[2], Kevin M. Koch[3] and Garry E. Gold Metal-Induced Artifacts in MRI,2011	Steps involved with patients motion and using different types of other metals	We find increasing our network depth shows a significant improvement in accuracy
5.	Yakdielrodriguez-gallo,rubenorozcomarlenperez-diaz Metal artifact reduction by morphological image filtering for computed tomography,(2019)	Morphological Image Filtering Approach for Metal Artifact Reduction (MIFMAR) algorithm.	Linear Interpolation technique is used so this method cannot be fully satisfied for all types of CT or in other words the morphed image cannot be fully effective in certain scenario.
6.	Department of Radiology, Yonsei University College of Medicine, Yonsei-ro, Seodaemun-gu, Korea Northwestern University Feinberg School of Medicine, UNITED STATES Metal implants influence CT scan parameters leading to increased local radiation exposure.(2019)	A proposal for correction techniques.	organ dose modulation (ODM) metal artifact reduction (MAR) protocols on dose reduction Gemstone spectral imaging, (GE)
7.	YAN XI, YANNAN JIN High-kVp Assisted Metal Artifact Reduction for X-Ray Computed Tomography(2016)	Iterative methods handle photon starvation by discarding or underweighting corrupted data.	Computed tomography, metal artifact reduction, kVp switching, iterative reconstruction

III. PROPOSED SYSTEM

The proposed algorithm corrects reconstructed CT images. The projected data which is affected by metal fillings is detected and the missing projections are replaced with data obtained from a corresponding MR image.A simulation study was conducted in order to compare the reconstructed images with images reconstructed through linear interpolation, which is a common metal-artifact reduction technique along with the different thresholding techniques and correction algorithms accordingly. The results show that the proposed method is successful in reducing severe metal artifacts without introducing significant amount of secondary artifacts.



IV. CONCLUSION

Hence with the help of datasets of scans we are able to make the machine understand the situation and reduce the effect of Metal Artifact by using customised ADN(Artifact Disentanglement Network) Algorithm. Henceforth, the machine can produce the results from the datasets samples stored using Realtime Machine Learning proces

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