METHOD FOR IMAGE RECONSTRUCTION USING UNSUPERVISED DEEP LEARNING AND SYSTEM THEREOF

IITM Technology Available for Licensing

PROBLEM STATEMENT

- In the present era, various techniques like nuclear imaging, magnetic resonance imaging, computerized tomography scan which may be used **to obtain images** of **internal structures of objects or patients**.
- However, these techniques subject to **various trade-offs** between **speed, efficiency & quality of reconstruction**.
- Hence, there is a need to address said issues.

INTELLECTUAL PROPERTY

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TECHNOLOGY CATEGORY/ MARKET

Technology: Image reconstruction using unsupervised deep learning techniques;
Industry & Application: Biomedical Engineering, Healthcare Industries, Magnetic Resonance Imaging(MRI) units, Medical Device;
Market: The global 3D reconstruction technology market is projected to grow at a **CAGR** of **11.6%** during **2024-2029.**

TRL (TECHNOLOGY READINESS LEVEL)

TRL-4, Proof of Concept ready, tested in lab.

TECHNOLOGY

- Present Invention explains about a **system & method** for **image reconstruction** using fully **unsupervised deep learning techniques**.
- Further it explains that a system of one or more computers can be configured to perform particular operations or actions by virtue of having **software, firmware, hardware, or a combination of them installed on the system** that in operation causes or cause the system to perform the actions.. like a method for training a neural network for **image reconstruction.**

- The method includes the following steps depicted in the smart chart hereinbelow:

STEP 1 •**Calculating loss function (L(X,X')) & projection data error (X-X') based on actual projection data (X) & reference reconstructed projection data (X');**

STEP 2 •**Updating one or more parameters of the neural network based on the calculated loss function (L(X,X'));**

STEP 3 •**Reconstructing an image (Y') by processing the actual projection data error (X-X') using the one or more updated neural network parameters;**

STEP 4 •**Transforming the reconstructed image (Y') into new reference reconstructed projection data (X');**

STEP 5 •**Iteratively performing steps S1-S4 for a predefined number of cycle for calculating an optimum loss function (L(X,X'));**

STEP 6 •**Generating one or more optimum parameters of the neural network using the optimum loss function (L(X,X'));**

STEP 7 •**Updating the neural network with the one or more optimum parameters, & Transforming the reconstructed image (Y') by processing the projection data (X) using a trained neural network.**

RESEARCH LAB

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KEY FEATURES / VALUE PROPOSITION

❖ *Technical Perspective:*

- Facilitates a software framework for image reconstruction by combing the **Deep Learning** (DL) & the **Iterative Reconstruction** (IR) techniques.
- Provide **fast, fully unsupervised & robust image reconstruction technique.**
- Advantageous to **reconstruct tomographic images without any noise/blur artifacts** & allows **reconstruction from the truncated data** without the need for prior truncation correction.
- The present techniques **do not restrict** the **solution space** by using regularization term in the loss function.

❖ *Industrial Perspective:*

- **Efficient cost-effective solution** and applicable in the medical imaging system to reconstruct the image.
- **Provide speedy solution.**
- Facilitates **high quality of reconstructed image** as shown in fig 2.
- Easily **installed on the system** that in operation causes the system to perform the action of reconstruction of image.

IMAGE

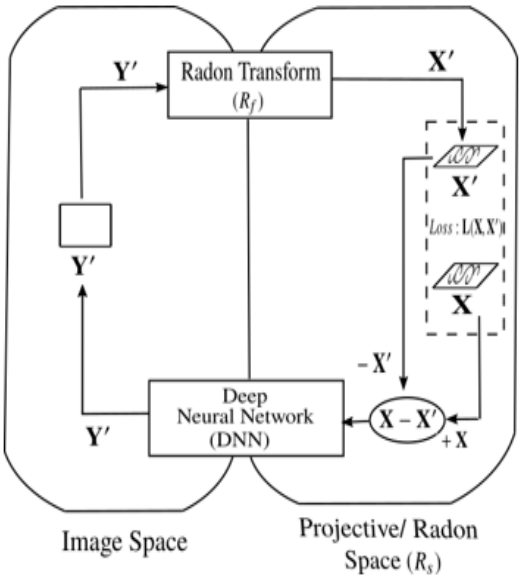

Fig.1 (Above): Illustrates Architecture of the UIRF for image reconstruction;

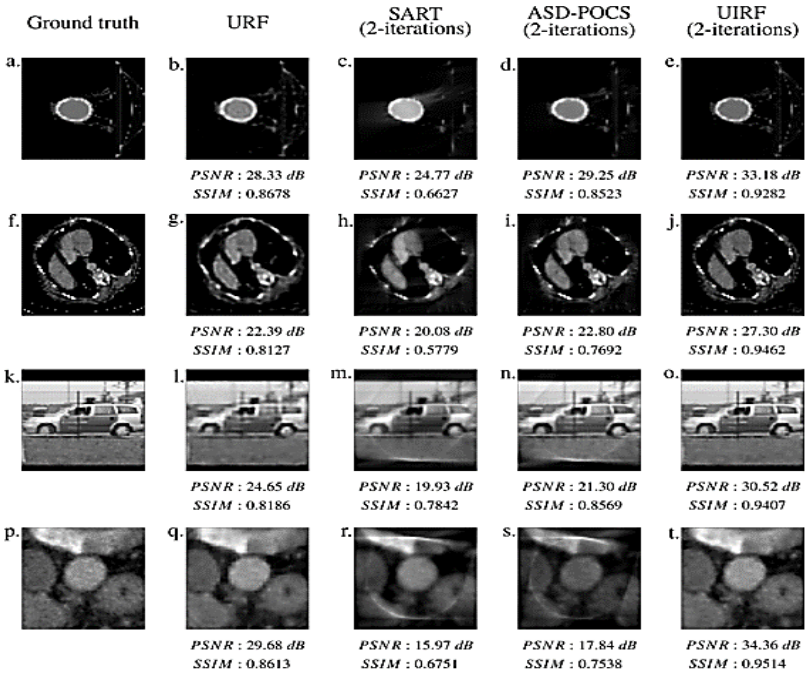

FIG.2: Illustrates Performance comparison between the URF, UIRF, & the other iterative techniques when evaluated on unknown test data with the ground truth images of size 64 × 64, wherein the UIRF uses X0 as the initial guess & other iterative techniques use Y0=0 as the initial guess.

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